How can an SME within the IT industry navigate greenwashing?

by

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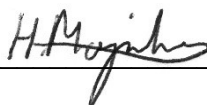
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Abstract

Despite raised awareness within society, greenwashing is increasing in both prevalence and sophistication. Within the IT sector, greenwashing can be seen emanating from IT technology manufacturers to electronic waste (e-waste) recyclers. Small and medium enterprises (SMEs) who are committed to demonstrating genuine environmental credentials are faced with significant challenges in clearly advertising the impact of their business when relying on third-party claims of green credentials which they may not have the expertise or resources to substantiate. With Rapid IT, a small IT recycling and refurbishment business as a case study, risk factors for greenwashing within the IT industry, more specifically for e-waste recycling, are investigated to establish how SMEs can avoid being unconsciously impacted by greenwashing.

To examine Rapid IT's dependence on downstream recycling partners for greenwashing risks, an anonymous questionnaire was designed and completed by 21 e-waste recycling and IT refurbishment businesses in the UK. Potential greenwashing factors were investigated through business responses on the calculation of carbon footprints and measures taken to reduce carbon emissions, the recycling practices used for e-waste and the questions that customers ask regarding sustainability.

Statistical analysis of the results found that the majority (85.7%) of the businesses focus on their environmental credentials within their marketing to customers, but 33.3% of businesses have no awareness of their carbon footprints. A wide variety of measures to reduce environmental impacts through waste disposal, recycling and operational emissions are employed by the businesses, but relatively few businesses have adopted externally verified carbon assessments (23.8%), despite the high occurrence of businesses with ISO 14001 environmental accreditation (66.7%). Similarly restricted uptake is seen for carbon plans for net-zero emissions by 2050 (42.9%) or emission-reduction measures such as biofuel use for transport (0%), on-site renewable electricity generation (33.3%) or energy management systems (9.5%). Additionally, customers ask insufficient questions on sustainability, particularly those relating to carbon emissions as opposed to the recycling process. The findings indicate a need for greater attention to carbon emission reductions from IT and e-waste recycling and refurbishment SMEs in order to claim sustainability with assurance and

avoid greenwashing. Recycling customers could reduce their risks of being misled through greenwashing by increasing active enquiries about the sustainability of recycling. Additionally, the average redistribution of e-waste to further recyclers is significant (46.4%), highlighting an area of greenwashing risk potential for downstream recyclers to invalidate the claims of zero waste-to-landfill made by businesses such as Rapid IT.

The findings from the questionnaire analysis were used to formulate a set of criteria that SMEs could use to reduce the risk of unconscious greenwashing from secondary exposure to downstream recycling or disposal partners.

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1   Introduction

1.1   Drivers for net-zero carbon emissions

The Intergovernmental Panel on Climate Change (IPCC) states that a failure to limit global warming to 1.5 $^{\circ}$C above pre-industrial levels could lead to runaway climate change through elevated greenhouse gas levels (Department for Business, Energy & Industrial Strategy, 2019). In 2019, the UK Government was the first major economy to announce a target of net-zero greenhouse gas emissions by 2050 (Department for Business, Energy & Industrial Strategy, 2019). The overall aim is to guide the shift from fossil fuels, to restore and protect the natural environment, to support and grow the markets for electric vehicles, renewable power and climate friendly heating while developing new innovations and positioning the UK as a leader in green industry and decarbonisation. Since the proposal of the government plans, the escalation of the energy crisis across Europe and the UK has bolstered the need to review and improve the ways energy is supplied and used (IEA, 2022). The Government has set the net-zero target for both residential and business sectors and in this research, Small to Medium Enterprises (SMEs) are being examined.

1.2   The state of e-waste recycling

The generation of electronic waste (e-waste), composed largely of broken or obsolete IT electronics and devices, is a well-studied area within literature. The production of electronics is one of the largest industries worldwide, with manufacture and e-waste quantities growing at a rapid pace (Abalansa et al., 2021; Clarke, Williams and Turner, 2019). Evidence suggests this trend will continue as the demand for new technology rises exponentially (Cucchiella et al., 2015). E-waste can contain up to 60 elements including valuable metals such as copper, gold, silver, palladium and platinum (Namias, 2013) or scarce metals such as europium and terbium (Magalini, Kuehr and Balde, 2015) and can become 40–50 times richer in these elements than natural deposits (Collins et al., 2012), which are rapidly being depleted by the electronic industry (Quariguasi-Frota-Neto et al., 2007).

Islam et al. (2020) report that 70% of hazardous substances present in the natural environment, including heavy metals such as cadmium, lead and mercury, polyvinyl chloride (PVC) plastics and brominated flame retardants (BFRs), are emitted from e-

waste. In 2019, the UK generated 23.9 kg of e-waste per capita, totalling in at 1598 kilotons according to the Global E-Waste Monitor 2020 report (Forti et al., 2020). The UK was predicted to become the largest producer of e-waste In Europe by 2023 (Malloy, 2021) and less than 20% of global e-waste is formally handled (Forti et al., 2020). With global estimates of up to 50 million tonnes of e-waste generated annually, this illustrates a need for further action (Wang, Zhang and Guan, 2016).

1.3   UK regulation on e-waste recycling

The Waste Electrical and Electronic Equipment (WEEE) Regulations 2013 and the Restriction of Hazardous Substances (RoHS) Regulations 2012 were implemented within the UK, requiring increased electronics manufacturer and importer responsibilities in the collection, recycling, treatment and disposal of products and to limit the presence of toxic substances in new products (Office for Product Safety and Standards, 2021; 2022). The UK is also party to the Basel Convention. This is an international convention aimed at mitigating e-waste exportation and associated environmental issues within developing countries (Ogunseitan, 2013).

Within the UK, the treatment and processing of WEEE must be performed by an authorised treatment facility (ATF) or an approved authorised treatment facility (AATF). Some exemptions are granted, such as for those who repair WEEE (Environment Agency, 2019). AATFs are able to provide evidence of the reuse, recovery and treatment of WEEE that they receive for electrical and producer compliance schemes (PCS), which electrical or electronic equipment (EEE) producers who place over 5 tonnes of EEE on the market annually are required to register with (Environment Agency, 2023). Additionally, AATFs are required to report quarterly on the tonnage of WEEE received for treatment, sent to a different facility for treatment (with details of the ATF or AATF distributed to) and delivered to an approved exporter (AE) for treatment and recovery or recycling outside the UK, along with evidence of reuse as a whole appliance (Environment Agency, 2019).

1.4   Landfilling and incineration of e-waste

Due to rapid development in the IT technology sector, and poor recycling systems globally for e-waste, a high proportion is still sent to landfill (Chen et al., 2019). This has significant and lasting environmental impacts, including the leaching of hazardous

compounds and heavy metals into groundwater and the environment (Akcil et al., 2015; Robinson, 2009). In 2017, only 44% of small e-waste was recycled through authorised routes, with the remaining mass unaccounted for (Greenaway, 2018).

Incineration is used as both a formal and informal treatment for e-waste globally. The combustion of e-waste can present significant harm to health, the environment, and further contribute to global warming through the gases and persistent organic pollutants (POPs) released (Robinson, 2009; Akcil et al., 2015). Advocates of incineration highlight the opportunity to reduce the volume of e-waste occupying landfill and subsequently urban land pressures, while also claiming its effectiveness as a waste-to-energy strategy (Rahman and Alam, 2020). However, the practice is widely considered to be a primitive processing method for e-waste which risks environmental pollution and ecological harm, even under controlled conditions (Nigam, Jha and Singh, 2021). The latest environment agency (EA) guidance states that all WEEE containing POPs above a particular threshold must be destroyed or irreversibly transformed rather than recycled, which facilities often perform through incineration (Environment Agency, 2022).

1.5   Overseas export of e-waste

Although it is illegal under the Basel Convention and contravenes the latest EA guidelines (Environment Agency, 2023), rich countries still export an unknown quantity of e-waste to poor countries, where ungoverned and potentially illegal recycling techniques include open-air burning and dissolution in strong acids, leading to environmental contamination and negative health effects (Abalansa et al., 2021; Murthy and Ramakrishna, 2022; Lee et al., 2018). Greenhouse gases and POPs are likely to be generated and released into the atmosphere in the absence of advanced flue gas cleaning systems (Robinson, 2009; Akcil et al., 2015), as these are not likely present in the incineration of e-waste in developing countries (Wäger, Hischier and Eugster, 2011).

1.6   Greenwashing

Greenwashing is a term environmentalist Jay Westerveld first used in 1986 to refer to organisations that invest more resources in marketing their environmentally friendly credentials, than in implementing these practices (de Freitas Netto et al., 2020).

Additionally, greenwashing is also defined as a combination of poor environmental action with positive communication about environmental action (Delmas and Burbano, 2011).

In 2007, The TerraChoice Group published "seven sins" to identify the ways in which companies greenwash product impacts. These "sins" include providing vague, false, irrelevant, or unproven claims (TerraChoice, 2007). Misguided corporate communications, deceptive positive environmental claims or greenwash noise composed of many unsubstantiated green claims are all examples of greenwashing (Horiuchi et al., 2009).

A review of 500 global websites led by the UK's Competition and Markets Authority (CMA) in 2021 concluded that greenwashing is increasing in prevalence. Of all the green marketing claims assessed, 40% were classified as greenwashing (Nemes et al., 2022). The CMA later published the "Green Claims Code", outlining 6 principles based on existing consumer law to help businesses to communicate and understand environmental claims. They also launched an investigation into misleading green claims in business (Competition and Markets Authority, 2022).

Research suggests numerous reasons for increased greenwashing. One explanation is that overall public awareness and concern around environmental issues has grown, putting pressure on businesses to make operations more sustainable and to reassure consumers with green public relations (PR) responses (Bowen, 2000). External drivers have been cited including limited disciplinary action due to location-based regulatory variations and increased demand from consumers, investors and market competition. Organisation-based causes of greenwashing can stem from a lack of understanding of what constitutes environmentally friendly behaviour, management changes or poor inter-communication. Research also acknowledges the contribution of individual behaviour traits in management state that greenwashing can lead to fines and damage to investor and consumer confidence when they are made aware of misinformation, which ultimately damages the market for environmentally friendly goods and services. They also highlight that misinformation may draw attention away from areas where environmental efforts are critically required (Delmas and Burbano, 2011).

Within the IT sector, greenwashing can be seen within multiple areas of literature focus. In 2019, Google was found to have made significant donations to groups denying climate change and actively lobbied against environmental regulations and climate legislation (Kirchgaessner, 2019). Google had previously signed the "We Are Still In" agreement following the U.S. withdrawal from the Paris Climate Accords (Hazel and Brittany, 2020). It is clear that Google's funding of climate change denial groups while claiming commitment to climate change interventions is direct, intentional greenwashing (Kirchgaessner, 2019).

1.7   Greenwashing within the IT industry

A significant contributor to e-waste is planned obsolescence within technology, an area of study receiving increased media and literature attention, mainly characterised by intentionally accelerated physical or functional deterioration of products and subsequently reduced lifecycles and durability (Makov and Fitzpatrick, 2021). Planned obsolescence of smartphones was exemplified in 2017 when Apple admitted to intentionally modifying their iOS operating system for older iPhones in order to slow them down. While Apple argued this was done to prolong battery life, many believe this was a deliberate attempt to boost upgrades to newer iPhone models (Fox, 2017). It is surmised that a major consequence of planned obsolescence in products is an increase in waste (Mellal, 2020), evidenced by research showing that smartphones now contribute to 12% of global e-waste (Joseph, 2021).

1.8   Greenwashing within IT recycling

Within the recycling industry, reports have shown that regulatory loopholes can be exploited at the cost of confidence in green integrity. While the export of e-waste from the EU to Nigeria is illegal, used electric and electronic equipment (UEEE), which often has a short lifespan or is only fit for disposal, can be exported from the EU freely, further damaging Nigeria's environment and raising questions about sustainability claims and regulations within the EU (Thapa et al., 2022). Some recycling companies adhere to material labelling systems solely to reduce pressure from non-government organisations (NGOs) such as Greenpeace, whilst others have allegedly acquired environmental certifications primarily to profit from certification status while not actually following the required standards, highlighting potential limitations of certification (Pickren, 2013).

1.9   Greenwashing through carbon emissions

Following publication of the UK government national net zero by 2050 roadmap, there was a call for smaller businesses to support the goals by pledging to cut their own emissions sufficiently by 2050 or sooner (Department for Business, Energy & Industrial Strategy et al., 2021). Many corporate net-zero emissions commitments have been targeted for 2050, but a substantial portion have been found to be poorly defined and there has been an evident lack of tangible reduction plans from companies to back their voiced commitments (In and Schumacher, 2021). Evidence from literature finds that climate change targets which are defined by ambitious, long-term, firm and committed reductions in emissions are effective (Dahlmann, Branicki and Brammer, 2019). Furthermore, many companies with high emissions have reportedly failed to align their future financial investment with their individual emission targets and with wider climate-change goals (Climate Action, 2021).

Research finds that an increasing share of companies are using voluntary carbon offsetting in order to appear to fulfil net-zero emission pledges and thus market environmental efforts publicly (Kathy Dhanda, 2014). However, evidence links excessive reliance on offsetting with greenwashing through legitimisation of existing practices, distraction from impactful emission reduction alternatives and shifting of responsibility for sustainable action to consumers (Christiansen et al., 2023). While many efforts appear to be genuine, a significant portion of communications about carbon offsets have been found to be misleading, with many claims of carbon neutrality either unsubstantiated or exaggerated (Guix, Ollé and Font, 2022; Kathy Dhanda, 2014).

Greenwashing through misleading or overly ambitious corporate communications on greenhouse gas emissions appears to be increasing in occurrence (In and Schumacher, 2021). Companies are selectively disclosing aspects of emissions, providing insufficient evidence, and do not appear to be prioritising accurate measurement, reporting and verification methods or concrete actions (Huang and Chen, 2015; In and Schumacher, 2021). Additionally, there is evidence to suggest that third-party emissions estimates from data providers are inadequate and that mandatory reporting of audited and verified emissions is necessary for sufficient transparency behind company environmental impacts (Kalesnik, 2021).

1.10   Greenwashing from energy suppliers

Consumers pursuing renewable electricity within the UK will find numerous green tariffs available from energy suppliers, with most claiming to provide a 100% renewable electricity supply. It is reasonably expected that this will be a genuine claim, with energy being sourced from a solar, wind or hydroelectric farm. However, not all green tariffs are equal. One of the primary sources of renewable electricity for the UK is provided through renewable energy guarantees of origin (REGO). The REGO scheme, which underpins 65% of green electricity tariffs (Andrews and Moss, 2023), uses certificates to indicate the proportion of electricity from an energy supplier that is generated from renewable sources (Ofgem, 2023). Consumers assessing green tariffs will likely encounter details of these certificates. However, there has been significant criticism and concern about the effectiveness and implementation of the system from both researchers and authoritative bodies (UKGBC, 2021; Delardas and Giannos, 2023; Hulshof, Jepma and Mulder, 2019).

REGO certificates purchased by electricity suppliers can be surrendered in the Fuel Mix Disclosure (FMD) process, indicating the sources of generated electricity which have been supplied to customers (Andrews and Moss, 2023). However, the REGO certificates alone carry the official renewable properties of electricity within the system and are traded on their own independent market, often being supplied without the renewable electricity they represent (Ofgem, 2023; Monyei and Jenkins, 2018). This makes it prohibitively difficult to determine whether a certificate is genuinely connected to a renewable energy supply upon purchase, or whether they have been purchased separately to account for the total non-renewable proportion of a supplier's electricity power mix, likely consisting of fossil fuel and nuclear sources (Martin, 2015; UKGBC, 2021).

Businesses are able to substantially reduce or offset their reported carbon emissions from purchased electricity backed by REGOs through the greenhouse gas (GHG) protocol reporting standard (Greenhouse Gas Protocol, 2015). It is now believed to be the norm for businesses to strategically use REGOs in this way, masking their actual emissions and warping estimates of progress towards climate-change goals (Bjørn et al., 2022). This highlights a potential for widespread greenwashing if REGOs cannot accurately represent the renewable status.

Additionality refers to investment in and development of new renewable generation sources, such as solar or wind farms. The UK Green Building Council (UKGBC) provides best-practice guidance that renewable electricity should create additional capacity in the grid (UKGBC, 2021). Most researchers agree that the current REGO scheme does not support additionality (Bjørn et al., 2022; Mulder and Zomer, 2016; Hamburger and Harangozó, 2018) and that suppliers do not agree to invest in new sources as part of use of their green tariff (Giuliani, 2022). Additionally, REGOs provide a very low proportion of the total revenue for renewable generators (Andrews and Moss, 2023).

The use of REGO certificates is also associated with a lack of granularity and traceability in the transmission of carbon and electricity data within the market (Keay-Bright et al., 2021; Delardas and Giannos, 2023). REGOs are intended to be retired from the market upon purchase or consumption by end users, however double-booking of REGO certificates is not an uncommon occurrence (Martin, 2015; Delardas and Giannos, 2023). Additional complications include inconsistencies in the definition of renewable energy sources between countries (Karakashev, Gorbunov and Keshav, 2020) and fraudulence within the issuing of REGO certificates (Martin, 2015).

Accusations and concerns of greenwashing within the REGO scheme, through misleading and vague claims and keywords such as '100% renewable' or 'green', have been raised by scholars, the media and even energy suppliers who have previously offered REGO-backed tariffs (Delardas and Giannos, 2023; Giuliani, 2022; George, 2023). The Government has published a 'Call for Evidence' report aiming to address the greenwashing associated with REGOs (Department for Energy Security and Net Zero and Department for Business, Energy & Industrial Strategy, 2021). Currently, there have been no significant changes to the way the REGO scheme operates. There are some green REGO-backed tariffs available from suppliers who purchase electricity only from 100% renewable sources (UKGBC, 2021). Additionally, ring-fenced REGOs, which are supplied alongside the associated electricity from the renewable generator, are available from a small number of suppliers, though these still do not generally provide additionality (Andrei, 2023).

1.10.1 Power Purchase Agreements (PPA)

A potential alternative to REGO-backed tariffs are power purchase agreements (PPA). These contracts operate directly between an electricity generator and the consumer, and unlike REGO-backed tariffs, there is often no energy supplier acting as an intermediary (Ghiassi-Farrokhfal, Ketter and Collins, 2021). Consequently, PPAs offer improved transparency for energy sourcing.

For PPAs, electricity can be sourced from either existing renewable energy sources or new renewable energy generation construction projects (Mendicino et al., 2019). PPA electricity is typically fed remotely through the grid or renewable generation technology is installed on the consumer's premises (Crown Commercial Service, 2020). In order for the source energy to be classed officially as renewable for annual fuel mix disclosures or GHG protocol emissions reporting, REGO certificates must still be supplied along with PPA contracts (Andrews and Moss, 2023). However, PPAs may ensure that any issued REGO certificates are directly transferred to the consumer (Mendicino et al., 2019), reducing concerns of possible greenwashing.

In addition to providing assured renewable energy, it is commonly agreed upon within literature that PPAs are capable of supporting high initial investment costs for renewable electricity farms and storage systems (Mendicino et al., 2019), with long-term agreements of 10-15 years improving the viability of renewable investments for producers (Brander, Gillenwater and Ascui, 2018; Delardas and Giannos, 2023), reducing the risks of new renewable projects through fixed project finance (Bjørn et al., 2022).

While PPAs offer significant advantages through transparency and lower, long-term fixed prices over REGO-backed tariffs (Climate Change Committee and Wills, 2020; Luther-Jones, 2019), complications include energy production uncertainty (Ghiassi-Farrokhfal, Ketter and Collins, 2021), lower flexibility, less choices and the complexity, commitment and resources required to finalise contracts (Delardas and Giannos, 2023; Climate Change Committee and Wills, 2020).

Corporate PPAs (CPPAs) are also available for larger businesses, which generally require even longer-term contracts of 15-20 years (Andrews and Moss, 2023). New options for PPAs through companies such as Ripple Energy have emerged to offer

simpler contracts to businesses and consumers. Ripple introduced the first consumer-owned wind farm to the UK in 2021 (Ripple Energy, 2023). As such, it can be seen that for providing higher confidence of a renewable electricity supply, PPAs are a more viable option.

1.11   Rapid IT

The Rapid IT case study meets the UK government definition of an SME having less than 250 employees, less than £50 million turnover and a balance sheet total of less than £43 million (Foreign, Commonwealth & Development Office, 2022).

Rapid IT is a small, forward-thinking IT and electronics refurbishment business in the North West region of the UK. The business primarily collects obsolete IT equipment from local businesses, schools and organisations and provides a comprehensive service which includes data destruction, inspection, testing and sorting equipment and parts for either refurbishment or disposal, based on functionality. Dismantling and sorting of equipment is performed manually. The refurbishment process often necessitates the purchase of replacement parts. Following repair and testing, refurbished equipment is sold on to traders and domestic customers. The business has implemented a zero waste-to-landfill policy with the aim to recycle and recover as much material value from non-functional e-waste as possible. In order to fulfil this, e-waste is separated, primarily manually, into material streams that can be collected by or delivered to a number of specialised recycling vendors.

Rapid IT markets its services as environmentally friendly, based on the website content viewed. The business shows a strong commitment to providing a secure and sustainable disposal service, holding verified environmental, quality and data security certifications and accreditations including ISO 9001, ISO 27001, BS EN 15713 and most notably, ISO 14001 for environmental management. The case study has invested substantially in its premises to lessen environmental impacts, such as through the installation of 100 solar panels on the site roof, acquiring an electric business van and charger and replacing the previous boiler, windows and insulation with energy-efficient counterparts. Internally, any paper and wood used is certified by the Forest Stewardship Council (FSC) and all lighting has been replaced with LEDs to reduce electricity consumption. In order to progress sustainability at Rapid IT, the business

sought assistance and collaboration with a Masters by Research student from the University of Central Lancashire through the ECO-I North West initiative. Rapid IT wants to better understand and advertise their business impact, and this research aims to explore the risks of greenwashing on the environmental integrity of their own internal processes and partners, and how SMEs can assure that their claims pass scrutiny.

1.12   Scope

Based on the review of greenwashing literature conducted, a comprehensive understanding of the proposed definitions, forms, impacts and solutions of greenwashing has been established. Furthermore, examples and discoveries of greenwashing behaviour in the IT industry are well-documented, with significant issues raised around the treatment of e-waste. However, the literature was found to contain inadequate industry-specific studies on combatting or navigating greenwashing, particularly lacking in studies pertaining to e-waste recycling. Additionally, it is unclear just how pervasive greenwashing is within this field and what the most significant contributory or risk factors are. More research is needed to answer these questions and this research attempts to investigate the latter query.

It is asserted that greenwashing may be a significant barrier to achieving a sustainable and effective e-waste recycling system within the UK. For SMEs such as Rapid IT, who refurbish IT equipment and attempt to recycle e-waste responsibly, there are significant challenges in clearly advertising the impact of their business when relying on third-party claims of green credentials from recyclers which they may not have the expertise or resources to substantiate.

It is also believed that many businesses which treat and recycle e-waste also refurbish equipment where possible. As a small business relying on numerous recycling vendors, Rapid IT is expected to send e-waste to recyclers who engage in both activities. As such, the scope of this study was focused primarily on the impacts and practices of e-waste recyclers and IT refurbishment businesses within the UK.

1.13 Aim and objectives

1.13.1 Aim

The aim of this research is to evaluate the risks of unconscious greenwashing within the IT recycling sector, using Rapid IT as a case study.

1.13.2 Objectives

1. To establish the recycling practices in place at Rapid IT
2. To assess the recycling practices and sustainability credentials of e-waste recycling and IT refurbishment SMEs
3. Develop criteria for reducing the risk of both native and third-party greenwashing for IT refurbishment SMEs using identified recycling and sustainability practices

2   Literature review

2.1   Overview

This literature review aims to establish the existing material on greenwashing and specifically, any studies that investigate greenwashing within the IT and e-waste industry.

The first literature on greenwashing began to emerge from 1995-6 (Pendse, Nerlekar and Darda, 2023). There was an increased focus on greenwashing within studies rather than as a consequence of the studies of other subjects (Montero-Navarro et al., 2021). Lyon and Montgomery (2015) suggest that 1995-2004 was the first decade of academic research in this area, with the quality of research improving during this period. Additionally, they found a notable increase in the number of empirical and conceptual studies involving greenwashing, such as drivers, guilty parties and consequences, from 2010 onwards. However, they highlighted a dearth of empirical papers with sufficiently large data sets, particularly concerning greenwashing impacts.

Much of the available literature shows that studies tend to focus on product or service-level claim greenwashing (de Freitas Netto et al., 2020), business ethics, sustainability, corporate social responsibility (CSR), production and operations, environmental communication, and green marketing (Pendse, Nerlekar and Darda, 2023). Researchers have explored numerous areas, including the impacts of greenwashing on consumers and businesses, the connection between regulations and environmental disclosures and the organisational conditions that allow and encourage greenwashing behaviour (Gatti, Seele and Rademacher, 2019).

A significant number of influential authors agree that growing societal concern and awareness around sustainability has accelerated the progression of academic research into greenwashing and its use to manipulate brand, product or service reputation (Mateo-Márquez, González-González & Zamora-Ramírez, 2022). Pendse, Nerlekar and Darda (2023) also attribute growth in this area partially to the evolution of research conducted on sustainable development after 1987.

Several authors emphasise the need to identify and measure greenwashing objectively, seeking to establish more empirical analysis and evidence of the drivers,

as well as the impacts and deterrents of greenwashing (Lyon and Montgomery, 2015), more extensive and rigorous research on the evolution of greenwashing methods such as executional greenwashing (Pendse, Nerlekar and Darda, 2023; de Freitas Netto et al., 2020) and a further increase in interdisciplinary dialogue to encourage the production of new and original insights (Gatti, Seele and Rademacher, 2019).

2.2   Definitions

Existing literature shows that there have been numerous attempts to clearly define greenwashing and its evolving scope. The multidisciplinary nature of greenwashing phenomenon and the consequent lack of a universally accepted definition is widely acknowledged (de Freitas Netto *et al.,* 2020; Lyon and Montgomery, 2015; Gatti, Seele and Rademacher, 2019).

One commonly cited definition of greenwashing within the literature is the Oxford English Dictionary definition (de Freitas Netto et al., 2020), which is "to mislead (the public) or counter (public or media concerns) by falsely representing a person, company, product, etc., as being environmentally responsible." (Oxford, 2023). This definition outlines the intentional and deliberate aspect as a critical component in the act of greenwashing (de Freitas Netto et al., 2020; Nyilasy, Gangadharbatla and Paladino, 2014). Not all researchers agree that greenwashing behaviour is exclusively deliberate, suggesting that interpretation of environmental communication and advertising is filtered by the insights of those receiving it, allowing for unrealistic expectations (Lyon and Montgomery, 2015).

Delmas and Burbano (2011) categorise firms with poor environmental performance as 'brown'. These firms can stay silent about their performance or may provide communication of a positive nature or of a high standard (Contreras-Pacheco and Claasen, 2017). This divergence between environmental communication or claims and environmental performance is a common theme in definitions for greenwashing (Ruiz-Blanco, Romero and Fernandez-Feijoo, 2022).

Forbes and Jermier (2012) assert that organisations can be evaluated by their material and symbolic components and that greenwashing is a sophisticated form of symbolic management, where "highly visible green criteria" may be focused on without necessarily addressing environmental performance. Another view put forward by

Seele and Gatti (2017) is that an accusation of greenwashing from an external party is a critical component of the behaviour, "regardless of the level of falsehood of corporate CSR communication".

A number of definitions of greenwashing emphasise selective disclosure as a key characteristic (Mitchell and Ramey, 2011). Lyon and Maxwell (2011) define this behaviour as providing "positive information about a company's environmental or social performance, without full disclosure of negative information on these dimensions, so as to create an overly positive corporate image". Gatti, Seele and Rademacher (2019) refer to definitions that regard greenwashing to be false advertising in the absence of verified or evidenced claims.

There is a notable disparity within the literature in the issues encompassed within greenwashing. Gatti, Seele and Rademacher (2019) found that 61.6% of scholars greenwashing included behaviours related solely to environmental issues, while 38.4% of researchers included both environmental and social issues. Some academics utilise alternate terms to categorise issues beyond environmental sustainability, such as "bluewashing" which relates to social issues (Sailer, Wilfing and Straus, 2022). Ruiz-Blanco, Romero and Feijoo designate "blackwashing" as a term for the differences between communication and behaviour on economic issues linked to sustainability (Ruiz-Blanco, Romero and Fernandez-Feijoo, 2022). Kim and Lyon (2015) refer to "brownwashing" as a strategic act of undue modesty on environmental performance by companies.

2.3   Forms of greenwashing

Current literature refers to numerous forms of greenwashing forms. As the ways in which greenwashing is manifested has evolved there has been a corresponding growth in research into this area.

TerraChoice (2007) offered the seven sins defined for product-based greenwashing exhibited by companies. Other researchers have proposed new greenwashing sins of "false hopes, fearmongering, broken promises, injustice, hazardous consequences, and profits over people and the environment" (Scanlan, 2017) as well as "dirty business; ad bluster, political spin and fuzzy reporting" (Contreras-Pacheco and Claasen, 2017).

The seven following classifications of greenwashing behaviour have been identified (Lyon and Montgomery, 2015).

2.3.1 Selective disclosure

This form of greenwashing involves companies publicly disclosing positive environmental efforts while failing to disclose or downplaying any negative environmental impacts, which positively distorts external views of their environmental performance (Tateishi, 2018; Lyon and Maxwell, 2011). Marquis, Toffel and Zhou (2016) describe this as a symbolic strategy for maintaining legitimacy. Lyon and Montgomery (2015) propose this is possibly the most widely studied form of greenwash.

2.3.2 Decoupling

Decoupling refers to "the combination of promising policy statements and poor implementation of programs and impact" (Graafland and Smid, 2016). Motives may be the pursuit of legitimacy, meeting external expectations from stakeholders without changing existing practices and alleviating external pressure (Siano et al., 2017; Yang *et al.,* 2020). It may be undertaken to avoid the financial burden of implementing changes or when companies lack the sufficient resources to meet the scale of their environmental commitments (Boxenbaum and Jonsson, 2017; Yang *et al.,* 2020). Some authors describe decoupling as symbolic greenwashing behaviour (Lyon and Montgomery, 2015).

2.3.3 Misleading communication

Greenwashing can occur when companies intentionally use deceptive manipulation of sustainable communication of their practices to create an environmentally conscious image for their products, services or brand (Siano *et al.,* 2017). This tactic is often employed to influence consumers while avoiding accusations of greenwashing (Mason and Mason, 2012)**.**

2.3.4 Attention deflection

This is a strategy where symbolic actions are deliberately made visible in order to deflect stakeholder and external attention away from poor environmental performance (Marquis and Toffel, 2012). This strategy can be comprised of multiple forms of greenwashing (Lyon and Montgomery, 2015; Yang *et al.,* 2020).

2.3.5   Environmental certifications

Lyon and Montgomery (2015) highlight that greenwashing can be presented through misuse of certifications designed to prevent this behaviour. The use of environmental certifications across sectors, particularly ISO 14001, is extensive, with numerous reported reputational and competitive benefits within markets (Petros Sebhatu and Enquist, 2007). Studies have associated adopting third-party certifications with significant improvements to a company's environmental performance. However, evidence on the environmental benefits of adoption is highly mixed, with some using certification status primarily for marketing and competitive advantages, while neglecting to improve their environmental impacts (Petros Sebhatu and Enquist, 2007; Testa, Boiral and Iraldo, 2018). While not conclusive, evidence has also associated adoption of ISO 14001 certification with lower environmental performance (King, Lenox and Terlaak, 2005). Additional studies provide evidence of companies preferring unsubstantiated claims related to eco-labels (Stephenson, Doukas and Shaw, 2012).

2.3.6   Voluntary schemes

Smith and Font (2014) and Kim and Lyon (2011) criticise participation in voluntary environmental schemes, such as voluntary tourism projects, DOE's Voluntary Greenhouse Gas Registry etc., stating that explanations of how environmental goals are reached are not clear or provided and often participation does not lead to environmental gains. Lyon and Montgomery (2015) also identify partnerships between NGOs to be at risk of aiding greenwashing activity or of being co-opted by greenwashing businesses.

2.3.7   Executional greenwashing

This form is characterised by the use of imagery to evoke nature e.g., using natural colours, sounds or landscapes, images of renewable energy sources and endangered animal species rather than questionable claims, according to Parguel, Benoit-Moreau and Russell (2015). In their study, they found empirical evidence of a misleading effect from nature evoking executional elements on a fictitious website. Additionally, they highlighted that there is insufficient research on this expanding form of greenwashing and its implications. Thomas (2014) found evidence of corporate reports providing vague disclosures, displayed with abstract images, which may be misleading. It was

noted by de Freitas Netto et al. (2020) that "these nature-evoking elements, intentionally or not, may induce false perceptions of the brand's greenness".

2.4　Drivers

The literature documents numerous drivers of greenwashing (Gatti, Seele and Rademacher, 2019). Increased environmental awareness and concern within society and media are believed to have led to a corresponding increase in demand for green products. Pressure on businesses from activists, consumers, investors and competitors to be environmentally conscious is a recognised driver (Bowen and Aragón-Correa, 2014).

Delmas and Burbano (2011) outline key external, organisational and individual drivers in their highly cited study, including characteristics of companies such as their size, culture, structure, communication efficiency and organisational inertia (the delay in action caused by management or directional changes). Additionally, they discuss characteristics of management individuals such as optimistic bias of capabilities and narrow decision framing. Most crucially, a lax and uncertain regulatory environment or disciplinary actions is highlighted as a key external driver.

Kim and Lyon (2011) found that pressure from environmental activists discouraged participation in voluntary schemes that could be viewed as greenwashing. However, studies have shown that increased institutional pressures to report environmental impacts or regulatory pressures on large companies may lead to increased selective disclosure, but that this is mitigated by scrutiny from society (Marquis and Toffel, 2012). Delmas and Montes-Sancho (2010) report that weak political pressure is also a driver. While external pressure from shareholders and suppliers was shown to encourage environmental improvements, pressure from customers and industry associations led companies to greenwash (Testa, Boiral and Iraldo, 2018). Growing companies which are likely to face increased stakeholder and regulatory pressure in the future are also more likely to greenwash pre-emptively (Kim and Lyon, 2015).

Literature suggests that companies with lower visibility are more likely to greenwash, particularly through selective disclosure (Delmas and Montes-Sancho, 2010; Wu, Zhang and Xie, 2020), and that companies in countries weakly connected to the global economic system tend to greenwash more (Marquis, Toffel and Zhou, 2016).

However, conflicting results suggest that close stakeholder proximity and high visibility act as greenwashing drivers, despite potentially higher risks (Ruiz-Blanco, Romero & Fernandez-Feijoo, 2022).

A study by conducted by Roulet and Touboul (2015) found that larger companies may be more likely to greenwash. This may be particularly so if the company is less risk-averse and experiencing less profit. Aragón-Correa, Marcus and Hurtado-Torres (2016) performed an international study involving the top 100 performing firms. They determined that these companies had the most effective environmental communication and the lowest relative environmental performance.

The industry in which a company is placed appears to have some impact on the propensity to greenwash. A number of studies have observed that companies in environmentally sensitive industries are less likely to greenwash (Ruiz-Blanco, Romero & Fernandez-Feijoo, 2022; Rankin, Windsor and Wahyuni, 2011; Walker and Wan, 2012). Research across specific industries, particularly the IT industry, is lacking, although one study by Ramus and Montiel (2005) reported that service industry companies were more likely to greenwash than those in manufacturing.

The opportunity to greenwash may be a sufficient driver, particularly for profit-driven firms (He *et al.,* 2022). However, greenwashing can also be driven by a lack of financial resources (Perez-Batres *et al.,* 2012; Zhang, 2022). Kim, Fairclough and Dibrell (2017) showed that non-family firms were more likely to greenwash, hypothesising that this is the result of having low environmental and long-term commitments, seeking to profit from greenwashing in the short term. The preservation of power and influence has been identified as a driver for greenwashing for both individuals and organisations (Jones, 2012; Lyon and Montgomery, 2015).

2.5   Impacts

Within the literature, numerous studies have investigated the impacts of greenwashing on stakeholders, including consumers, investors as well as on companies themselves and wider society. Multiple authors have outlined that corporate greenwashing generates confusion for consumers, particularly relating to an over-abundance of product choices and lack of clarity, detail and conciseness of environmental information (Vincent-Wayne, Walsh & Yamin, 2004). The association of this

greenwashing with major products leads to a higher perceived risk around purchasing green products which further contributes to consumer confusion and overwhelm as concern about choosing an environmentally damaging product increases (Chen and Chang, 2013; Parguel, Benoît-Moreau and Larceneux, 2011).

Kim and Lyon (2015) & Rahman, Park and Chi (2015) suggest that the rise in incidence of greenwashing and the increased awareness of it has led to lower trust and increased scepticism around environmental claims. This may in turn lead to a decrease in consumers' green purchase intentions (Nguyen *et al.,* 2019; Goh and Balaji, 2016). Furlow (2010) purports that this increased scepticism results in lower pay-off for environmental actions by companies, leading to companies being less motivated to be less environmentally harmful, therefore damaging the consumer, the company, as well as the environment.

There is a consensus that perceptions of greenwashing negatively influence consumer purchasing of green products and services and intentions to invest (Ahmad & Zhang, 2020; Sun and Shi, 2022), negatively impacting green brands (Pimonenko *et al.,* 2020; Szabo & Webster, 2021). Studies suggest that companies who greenwash in an attempt to maintain or gain legitimacy, suffer instead from damaged legitimacy, particularly in the presence of vigilant environmental NGOs, and negatively impacted financial performance (Berrone, Fosfuri & Gelabert, 2017; Wu and Shen, 2013). Greenwashing is also seen to pose a significant threat to the perceived integrity of businesses (de Jong, Huluba and Beldad, 2020). A recent study demonstrated that greenwashing from one brand has been shown to contribute to an impression of industry-wide greenwashing for consumers, negatively impacting their commitment to buying any green products, irrespective of the brand (Wang, Ma and Bai, 2019). The general conclusion in the literature is that greenwashing is negative for most parties involved. However, the impacts of greenwashing specifically within the IT industry and e-waste recycling, are not well-documented.

2.6   Solutions

2.6.1   Regulations

The role of regulation in mitigating and preventing greenwashing is widely debated. Many experts argue that stricter and higher levels of regulation is a critical factor in

reducing this behaviour and leads to a decrease in greenwashing activities from companies (Yu et al., 2020). Some authors point to the need for stricter monitoring of compliance and enforcement externally (Mateo-Márquez, González-González and Zamora-Ramírez, 2022).

Laufer (2003) argues for tripartism, with the introduction of an independent third party to regulate and monitor greenwashing. Delmas and Burbano (2011) expand on this, pushing for multistakeholder collaboration and increased communication between involved parties and stakeholders. Markham, Khare and Beckman (2014) also encourage collaboration with governments to collect and disseminate information on sustainable business practices and the environmental impact of goods and service production. Polonsky, Grau and Garma (2010) state that the involvement of international leadership in setting regulations and standards would reduce greenwashing.

Delmas and Montes-Sancho (2010) call for improved sanctioning mechanisms. There is evidence that increased punitive measures for non-compliant companies are highly effective in mitigating greenwashing (Sun and Zhang, 2019). There are a few findings indicating that, if the cost of CSR is too high, regulation does not deter greenwashing (Lee, Cruz & Shankar, 2018). Bowen and Aragón-Correa (2014) found that increased regulatory pressure to reduce carbon can lead companies to partially comply by releasing details of carbon emissions, without changing practices to bring emissions down. Garrido, Espínola-Arredondo and Munoz-Garcia (2020) support this and show that regulation requiring mandatory certification may impede accurate communications.

This diversity of views regarding regulation would suggest that further research is required, in particular large-scale empirical studies (Lyon and Montgomery, 2015; Mateo-Marquez, Zamora-Ramirez & Gonzalez-Gonzalez, 2022).

2.6.2 Mandatory or voluntary disclosures

Studies on CSR and within the environmental social and governance (ESG) field have found evidence for greenwashing in corporate sustainability reports (Arouri, El Ghoul and Gomes, 2021). There are differing views on solutions and the roles of voluntary reporting and regulations. Companies with higher environmental performance typically

have higher rates of environmental disclosures (Lu and Taylor, 2018) providing more environmental information (Tadros and Magnan, 2019) and a higher number of CSR reports published (Karaman et al., 2021). In contrast, Patten (2002) found a significant negative relationship between environmental performance and disclosure.

Bager and Lambin (2020) argue that mandatory disclosure alone would discourage greenwashing, while others consider mandatory disclosure requirements and voluntary sustainability reporting are necessary. Gatti, Seele and Rademacher (2019) favour "a paradigm shift integrating both the voluntary and mandatory dimensions of CSR". Cherry and Sneirson (2012) argue that CSR communication requires strong policing, with certifying organisations and watchdog groups implementing rules and regulating CSR. Standardisation of environmental disclosures would allow investors clarity into sustainability standards upheld by companies, which would benefit companies who meet and exceed these expectations (Pacces, 2021).

A number of studies have linked higher mandatory environmental regulation with higher levels of financial and non-financial environmental disclosure across multiple industries, particularly in companies with higher emissions (Liu and Guo, 2023; Perera, Jubb and Gopalan, 2019). Concerns have been raised about mandatory sustainability disclosures leading businesses to mismanage their resources invested into sustainability initiatives (Wang et al., 2016).

Gatti, Seele and Rademacher (2019) found little support for voluntary CSR as a form of genuine behaviour absent of greenwashing within the literature. They cited only Mahoney *et al.* (2013), who associate voluntary environmental disclosures with a higher standard of reporting. Studies on environmental voluntary agreements and programs have found no significant impact of participation on company carbon emission reductions over time (Delmas and Montes-Sancho, 2010; Kim and Lyon, 2011).

A criticism of voluntary disclosure is that inconsistent efforts will be made by businesses, with no ability to implement punitive measures for the businesses which may be performing or disclosing poorly (O'Neill, 2022). Additional criticisms include the potential lack of transparency and integrity in disclosures that could result from businesses being able to autonomously determine the content and extent of their

reporting (Lock and Seele, 2016; Gatti, Seele and Rademacher, 2019). There appears to be no consensus at this time regarding this debate, while CSR is continually being redefined.

2.6.3 Disclosure quality

There is a recognition of the poor quality and lack of clarity of sustainability disclosures and the need for widespread standards and regulation to underpin the quality and content of these disclosures in order to allow evaluation (De Silva Lokuwaduge and De Silva, 2022; Ruiz-Blanco, Romero and Fernandez-Feijoo, 2022). Hassan and Guo (2017) advocate the separation of environmental and financial reports, while Pimonenko *et al.* (2020) recommend standardisation of environmental information from companies through detailed official reports, environmental policies and achievements.

2.6.4 Ecolabelling and certification

There is wide agreement within the literature on the need for externally established environmental certification systems, performance ratings and ecolabels to deter greenwashing practices and encourage companies that maintain high standards (Parguel, Benoît-Moreau and Larceneux, 2011; Huang and Chen, 2015; Gosselt, van Rompay and Haske, 2019).

Gamper-Rabindran and Finger (2013) identified greenwashing of pollution levels in companies that self-regulate without third party certification. Other studies suggest that greenwashing can occur in the presence of certification (Mahenc, 2017; Little and Lucier, 2017) or through use of false certifications (Varela *et al.,* 2017). There is a risk of co-optation of third-party certifications and weakened standards when attempting to engage with corporations on sustainability (Jaffee, 2012). Without additional incentives and subsidies for adoption of certifications, there is evidence that they have limited positive environmental impacts (Zhu, Zhao and Wu, 2023). An association between self-declared ecolabels and greenwashing behaviour harmful to the value of these labels has been identified by Delmas and Gergaud (2021). Garrido, Espínola-Arredondo and Munoz-Garcia (2020) provide evidence that a requirement for mandatory certification can lead to deceptive behaviour from companies.

2.6.5 Monitoring

There is a significant amount of literature supporting monitoring and scrutiny from independent parties such as stakeholders, shareholders, directors as an effective solution in mitigating corporate greenwashing and ensuring environmental impacts are addressed (Yu, Luu and Chen, 2020). Many researchers refer to the strong influence of media, NGO and social media pressure in reducing greenwashing behaviour (Xu, Li and Xu, 2023; Yue and Li, 2023; Berrone, Fosfuri and Gelabert, 2017). An argument is put forward that monitoring is useful for detecting greenwashing, but also discourages some companies from disclosing information about their environmental performance out of fear of accusations of greenwashing (Lyon and Maxwell, 2011).

2.7 Gaps in the existing literature

From the literature, it appears that there is very little empirical research into how greenwashing from other businesses can be identified and combatted, particularly by SMEs. Nemes *et al*, (2022) only recently offered a framework designed to assess the quality and candour of 'green' and net-zero commitment claims. This study appears to be the first of its kind. However, the framework may not be easily applied practically by SMEs without significant time commitment and background knowledge of the external businesses being assessed or the use of tools such as life cycle assessments (LCA). Additionally, comparison of results for numerous assessed businesses may be challenging without the inclusion of a detailed scoring system. Overall, however, this is a promising development in the greenwashing field.

There are very few studies on greenwashing surrounding e-waste, despite the relative awareness of greenwashing cases within the IT and technology industries. This is somewhat surprising but is also mirrored by the general lack of development of literature for greenwashing in any specific industries. There is very little practical and empirical research within literature offering consumers a way to evaluate the environmental claims and better detect greenwashing. There are few studies or frameworks of this kind and those that do exist are more theoretical rather than empirical or practical in nature, currently untested on larger data sets and either too general or specific to limited industries. The information they provide may further the research field but does not necessarily aid SMEs and other interested parties in recognising, evaluating and avoiding greenwashing in industry. While there has

undoubtedly been growth in the field, it appears that more empirical studies are still needed (Lyon and Montgomery, 2015).

3 Methodology

The methodology for this research is to facilitate the evaluation of the greenwashing challenges facing the case study, Rapid IT, and investigating how these may be experienced more widely by other IT and e-waste recycling and refurbishment SMEs operating within the UK (the main aim of the study). To achieve the outlined objectives, the Rapid IT recycling practices were examined to understand the existing sustainability measures in place for the business. This insight allowed an assessment of the challenges involved in implementing these measures and the potential greenwashing risks. This allowed questions to be produced for an anonymous questionnaire distributed to businesses which recycle and refurbish IT equipment or e-waste. Finally, criteria for SMEs to assess the level of greenwashing risk from prospective e-waste recyclers was produced based on analysis of the questionnaire responses. This section will address the methodology used for each aspect of the study.

3.1 Objective 1 – To establish the recycling practices in place at Rapid IT

In order to address the 1st objective of the research, use of utilities at Rapid IT over 12 months through invoices and monitoring apps was analysed. Equivalent CO_2 emission values for the utilities used by the business over a 12-month period were calculated using the greenhouse gas (GHG) protocol and the UK government CO_2 conversion factors. Within scope 1, emissions from transport fuel and heating gas use were reviewed. Within scope 2, emissions from grid electricity were reviewed. Within scope 3, emissions from waste recycling, water supply and grid electricity transmission and distribution were reviewed. The performance of the solar panels was also evaluated. To maintain confidentiality, emissions values for the case study have not been included in this thesis, however, relative emission savings have been shown for the recycling process.

Following this, a site audit was conducted to establish specific details about insulation, heating and lighting efficiency, as well as operational behaviours that could contribute to higher carbon emissions or energy consumption. The audit itself is not within the scope of this thesis. From the combined results, a business report was produced that

summarized the findings and provided justified and costed recommendations for improvement.

The individual WEEE stream types accepted by Rapid IT for recycling were recorded, as well as the number of items and weights of WEEE accepted and forwarded to downstream recycling partners in 2022. The number of recycling partners in use was also recorded. The information collected on the case study here set the basis for further investigation through the 2nd objective.

3.2 Objective 2 - To assess the recycling practices and sustainability credentials of e-waste recycling and IT refurbishment SMEs

To address the 2nd objective of the research, it was decided that a questionnaire would be produced to be delivered to IT refurbishment and e-waste recycling businesses within the UK. In order to protect participating businesses, encourage participation and address the aim of evaluating unconscious greenwashing risks within the IT sector, the survey was devised to be anonymous and completed by 1 representative of each business.

A list of potential businesses to contact was created using search engines and terms such as "e-waste recycling" and "IT disposal". To achieve sufficient eventual responses, 129 UK businesses were shortlisted to account for a significant proportion choosing not to participate.

3.2.1 Questionnaire design

The questionnaire used a combination of unbiased questions in order to establish the greenwashing risk factors from the data provided by businesses. Questions were primarily closed-ended, with possible responses designed to be as comprehensive as possible within the context of this study. As the questionnaire was designed for one business representative to complete, open-ended questions were avoided to eliminate personal opinions from being collected and to focus on overall business practices. Some questions surveyed nominal variables such as WEEE treatment authorisation type (AATF, ATF or neither). There were a number of multiple-choice questions and questions using percentage scales or numerical inputs based on best-estimates. A small quantity featured text boxes for additional commentaries to closed-ended 'yes' or 'no' questions. Options for participants who were unsure of their response or

preferred not to answer were included in the vast majority of questions, both to increase the validity of collected responses and to encourage continued participation.

Questions were split into sections based on areas such as carbon emissions or WEEE recycling practices, with initial questions for business categorisation positioned at the start of the survey for logical flow. Where deemed necessary, technical terminology or question intentions were explained further in parentheses to ensure full understanding. Question wording was edited to make questions as concise, clear and widely comprehensible as possible. Questions with sub-parts (indicated by letters following question numbers, such as 'a)') were designed to appear only when a particular answer to the preceding question had been selected. As the questionnaire was compiled, it had many iterative test reviews by both the researcher and other parties in order to improve the useability and the quality of the data collected.

3.2.2 Justification for questions

The first step was to establish the areas of focus for the formulation of pertinent questions. The initial questions were prompted by the results of the literature review which showed that there was a notable lack of empirical studies within the greenwashing studies, particularly in practical frameworks for identifying, responding to and combating greenwashing behaviour. Specifically, as e-waste was found to be neglected within greenwashing literature, and the case study's process is heavily engaged with IT recycling and sending e-waste and IT equipment to downstream recyclers, this was an area that was considered critical to explore. It was decided that questions would be formulated to cover areas where greenwashing had been identified as a risk factor within industry and the literature review, tailoring questions to businesses within the IT recycling and refurbishment industry, to identify the possible presence of both conscious and unconscious forms of greenwashing.

The initial questions were formulated to identify the business demographic, including the size of business, policies in place, marketing strategy, material they accept and WEEE category, and e-waste processing capability. The particular areas of focus were carbon management, destinations of unrecycled e-waste and e-waste weights recycled. Other areas of interest were hazardous waste management, certifications of business and suppliers. Many of these question areas were also re-phrased to establish what information their customers request regarding sustainability before

doing business with the recycling companies, and what information on sustainability the recycling companies are willing to share with customers.

3.2.3 Carbon

The area of carbon footprint was a prime area of questioning focus as it is the centre of the Government target for net-neutrality by 2050. Along with establishing if adequate emission monitoring is implemented and how, it was decided to explore if and how businesses have responded to the call for support towards the UK government net-zero by 2050 roadmap through production of business carbon plans (Department for Business, Energy & Industrial Strategy et al., 2021). Accordingly, further questions requested information on carbon footprint calculations, audits, and related actions, net-neutrality plans and related actions, carbon emission monitoring software, energy management software, and the use of carbon offsetting initiatives.

3.2.4 Destinations

It was assessed that the amount and destination of e-waste passed on was a key area for investigation. To this end, questions were asked about the amount of e-waste being passed on to further recyclers, both to establish the extent and to indicate whether there was a traceability risk for e-waste that relates to greenwashing. Despite the high amounts of e-waste reported to be unaccounted for, or sent to landfill annually, many IT refurbishment and e-waste recycling businesses in the UK, including the case study, offer assurances of zero waste-to-landfill, raising questions about how this can be claimed, what is meant by this and what is actually occurring.

Based on the potential environmental harm, the extent of WEEE treatment by businesses occurring through landfilling and incineration was investigated to establish as much as possible the end destinations of WEEE as well as individual recycler attitudes to e-waste recycling, awareness of the impacts of these practices and any greenwashing risks that higher reliance on these strategies might indicate. Based on the known information on POPs and incineration, it was decided to investigate whether recyclers ask customers about the presence of POPs in their e-waste, which may indicate levels of awareness. A question was also devised for the proportion of WEEE exported overseas. While illegal exporting is not likely a practice that any businesses would admit to, the legal exceptions by which WEEE can be exported mean that ultimate control of the e-waste is lost, and therefore the risk of mismanagement

increases, meaning that even a well-intentioned business might be unknowingly greenwashing.

3.2.5 Certifications

Questions were also asked regarding the value of environmental certifications in the business and plans for new certifications. ISO 14001 was an initial certification shortlisted for investigation due to its industrial prevalence, but the use of certifications considered by Rapid IT such as B Corp and recycling-specific certifications such as e-Stewards were also investigated.

Responses were also requested for assessment of supply and distribution partners for appropriate accreditations, recorded weights of refurbished e-waste and whether the recycler was an Authorised Treatment Facility (ATF), or the more stringent Approved Authorised Treatment Facility (AATF), so that the result could be cross-tabulated with other responses.

3.2.6 Rapid IT (as a case study)

Rapid IT has implemented numerous sustainability measures in an attempt to target its emissions, including through improvements to insulation, installation of a more efficient boiler, solar panels and use of an electric van. However, the actual efficacy of these measures has previously gone unmeasured, leaving the business unaware of the scale of their sustainability impacts. In addition to the investigation into recycling practices at Rapid IT performed in relation to the 1st objective of this study, additional questions were devised for the 2nd objective based on these sustainability efforts and the resultant challenges faced in implementing them. Based on the widely established environmental benefits of renewable energy generation (Adamczyk and Graczyk, 2020) and the use of both solar panels and green tariffs at Rapid IT, the prevalence of SMEs using renewable energy resources, including renewable utility or energy tariffs, which may present greenwashing risks, was explored.

Other implementations that are currently in place or have previously been considered for use at Rapid IT were also selected for investigation, such as schemes and technologies which might be used to account for operational, business or employee emissions. This included cycle-to work schemes, combined heat and power systems (CHP) and electric business vehicle schemes among other options. These

implementations were expected to be less critical factors in relation to greenwashing, however might possibly have indicated levels of environmental commitment in the absence of other actions, or equally might have outlined a prevalence of low-effort environmental actions within the companies, providing supporting evidence for overarching conclusions about greenwashing risk factors. Similarly, the use of electric vehicles and other fuel sources for vehicles was also selected for investigation.

3.2.7 Questionnaire distribution

Following completion of the questionnaire preparation, participant consent forms and information sheets were produced, detailing for participants how the data collected would be used in the study and what consent to take part would involve. Companies were informed that the thesis containing analysis of the anonymous results would be available to read following submission.

The survey was distributed using the Qualtrics secure online survey platform, which was able to facilitate the anonymity required for the study. A link to the relevant information sheet and consent form on Qualtrics was sent via email to the supplied company representative or general enquiry email address. The information sheet detailed the purpose of the research, the questionnaire, the use of any data and the options for consent. It was made clear that no personal data would be collected or associated with the responses throughout this study. The companies were given 1 week to decide whether they would participate and sign the online consent form.

Companies that chose to participate followed the link and were given individually generated randomised numbers. The participant was requested keep a record of this number prior to completing the questionnaire and to provide it via email in the event that their company wanted to withdraw from the study. Withdrawal was possible up to 2 weeks after closure of the questionnaire, after which time the result would have been incorporated in the analysis.

3.2.8 Questionnaire data analysis

Following closure of the questionnaire period, responses were viewed on Qualtrics and any invalid responses which had been less than 50% completed were separated from the dataset. Basic results and statistical data were recorded before exporting data from Qualtrics into SPSS statistical software. This allowed for more complex

analysis and investigation of trends, primarily through the use of cross-tabulation and analysis and comparison of mean values for response data and assessment of response validity, such as 'unsure/prefer not to answer' responses.

The questionnaire data was analysed to establish a clearer picture of potential greenwashing in the IT industry and where it may originate from. The researcher investigated any key associations or correlations between business or recycling factors (such as the materials accepted for recycling) and levels of risk of greenwashing and whether there is any connection that could be drawn between questions frequently asked by customers and the environmental efforts made by clients or recyclers.

The analysis also established which areas of sustainability customers within the IT industry are most and least interested in, if they are at all concerned with sustainability, and what information on sustainability is typically made available to companies.

3.3   Objective 3 - Develop criteria for reducing the risk of both native and third-party greenwashing for IT refurbishment SMEs using identified recycling and sustainability practices

From the analysis of the questionnaire, questions and criteria which would assist companies such as Rapid IT in determining the environmental integrity of recyclers and avoiding greenwashing were constructed. This involved the production of suitable weighting factors for responses and question categories based on their importance and the level of greenwashing risk they may present. The criteria formulated for assessing greenwashing was tested extensively based on the responses received for the questionnaire. This was done to test that the basic premise worked, then tuned to ensure that the component criteria were sufficiently represented by use of the weighting factors. Maximum and minimum scores were produced along with representative poor and good example scores. This ensured both breadth and granularity in the marking scheme and demonstrated that for the selected weighting factors, the model was proven to be effective and would be applicable to potential e-waste recycling partners for SMEs.

4 Rapid IT's recycling practices

In order to achieve the 1st objective of this study, the waste recycling practices of Rapid IT were assessed as part of a carbon and energy audit conducted for the case study. Rapid IT classifies IT equipment into useable equipment and parts to be sold directly or refurbished for traders or customers. In 2022, the business processed over 87.82 tons of WEEE material, with over 10,952 assets tested and sent for recycling or resale. In total, over 34.81 tons of material was sent to be recycled by downstream recycling vendors. A wide variety of WEEE materials are collected for recycling, including:

Electrical equipment accepted by Rapid IT for recycling
Personal computers (PCs) and laptops
Motherboards, mixed boards and graphic cards
Power supplies (PSU)
Hard drives and RAM drives
Metal or WEEE scrap
TVs and monitors
CD-ROMs
Wires
Switches
Aluminium heatsinks
Server boards and scrap
Routers
Printers and toners
Projectors
Speakers/amps
VHS/DVD players
Aluminium whiteboards
Smashed screens and monitors
Cathode-ray tubes (CRTs)
Pb, Li-ion, household batteries

Table 4.1 - Electrical equipment accepted by Rapid IT for recycling

Materials are separated into skips, with some smaller shipments such as lead or lithium-ion batteries being sent to recycling vendors directly, while other materials such as WEEE skips are collected periodically by vendors themselves. Approximately 10 vendors are in use, though this is a constantly evolving area for Rapid IT as the business grows and they attempt to work with the most environmentally responsible recyclers available to them.

To establish the associated carbon emissions for the recycling process, waste data over 12 months was analysed and assessed by each material. The following table provides a detailed breakdown of the quantities of materials distributed to recyclers over 2022 as well as the carbon impact for each category, measured in equivalent tonnes of carbon dioxide (CO_2e).

Waste Type	Total Weight (tonnes)
Mixed WEEE scrap	6.83
Cathode-ray tubes	2.58
Batteries (lead-acid)	0.12
Batteries (alkaline)	0.27
Batteries (lithium-ion)	0.11
Mixed metals	17.46
Rolled aluminium	0.44
Cardboard	4.56
General waste	0.78
Glass/plastic	0.52
Polystyrene	1.12
Total	**34.81**

Table 4.2 - Breakdown of the quantities of material distributed to recyclers in 2022

Significant carbon savings are achieved by diverting these materials away from landfill. It was found that there was a calculated 86% reduction in equivalent carbon emissions (tCO_2e) by recycling versus sending material to landfill over 2022 for the business.

5 Questionnaire results

In total, 21 businesses participated and completed the survey designed to complete the 2nd research objective. The results are presented in both tabular and graphical form below with analysis of any key correlations.

5.1.1 Q1) Please select the category which best describes your business.

Q1) Please select the category which best describes your business.			
	Answer	**%**	**Count**
1	Micro business (less than 10 employees and an annual turnover under €2 million)	23.81%	5
2	Small business (less than 50 employees and an annual turnover under €10 million)	61.90%	13
3	Medium business (less than 250 employees and an annual turnover under €50 million)	9.52%	2
4	Large business (250 or more employees and an annual turnover over €50 million)	0.00%	0
5	Unsure/don't know	0.00%	0
6	Prefer not to answer	4.76%	1
	Total	**100%**	**21**
	- The majority of participating businesses were categorised as small businesses. - A smaller but significant number of businesses were micro businesses. - Only 2 medium businesses participated. - None of the large businesses that were contacted participated in the study.		

Table 5.1 - Q1) Please select the category which best describes your business – Results

Description of business category

4.8%
9.5%
23.8%
61.9%

■ Small business (less than 50 employees and an annual turnover under €10 million)

■ Micro business (less than 10 employees and an annual turnover under €2 million)

■ Medium business (less than 250 employees and an annual turnover under €50 million)

■ Prefer not to answer   ■ Large business (250 or more employees and an annual turnover over €50 million)

■ Unsure/don't know

Figure 5.1 - Q1) Please select the category which best describes your business – Chart results

5.1.2 Q2) Does your business have policies in place pertaining to environmental sustainability or carbon management?

	Q2) Does your business have policies in place pertaining to environmental sustainability or carbon management?		
	Answer	**%**	**Count**
1	No	0.00%	0
2	Yes	95.24%	20
3	Unsure/don't know	4.76%	1
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**
	- The majority of participants stated that their business had some form of environmental policies in place. - Only 1 participant was unsure if their business had policies in place.		

Table 5.2 - Q2) Does your business have policies in place pertaining to environmental sustainability or carbon management? - Results

5.1.3 Q3) Does your business marketing to customers focus on your company's environmental credentials?

	Q3) Does your business marketing to customers focus on your company's environmental credentials?		
	Answer	**%**	**Count**
1	No	14.29%	3
2	Yes	85.71%	18
3	Unsure/don't know	0.00%	0
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**
	- Most participants stated that their business' environmental credentials are a focus of its marketing. - The remaining three participants confirmed their business' marketing were not a focus of its marketing.		

Table 5.3 - Q3) Does your business marketing to customers focus on your company's environmental credentials? - Results

5.1.4 Q4) Please select which of the following IT e-waste materials/components your business accepts for recycling.

Q4) Please select which of the following IT e-waste materials/components your business accepts for recycling.		
Answer	**%**	**Count**
1 PCBs	85.71%	18
2 Hard drives	90.48%	19
3 LCD displays	85.71%	18
4 Plastic components	71.43%	15
5 Metal frames	80.95%	17
6 Wiring/cables	95.24%	20
7 Batteries	90.48%	19
8 Power supplies	95.24%	20
9 Switches	95.24%	20
10 Other	33.33%	7
11 Unsure/don't know	0.00%	0
12 Prefer not to answer	0.00%	0
Total	**100%**	**21**
- All the specific components listed were selected by a high frequency of participants. - Plastic components were marginally lower in selection count, indicating less acceptance of plastic e-waste parts for recycling. - Only 7 participants selected 'other', suggesting the components list was relatively exhaustive. - There were no dominant components found that businesses accept substantially more than the rest.		

Table 5.4 - Q4) Please select which of the following IT e-waste materials/components your business accepts for recycling – Results
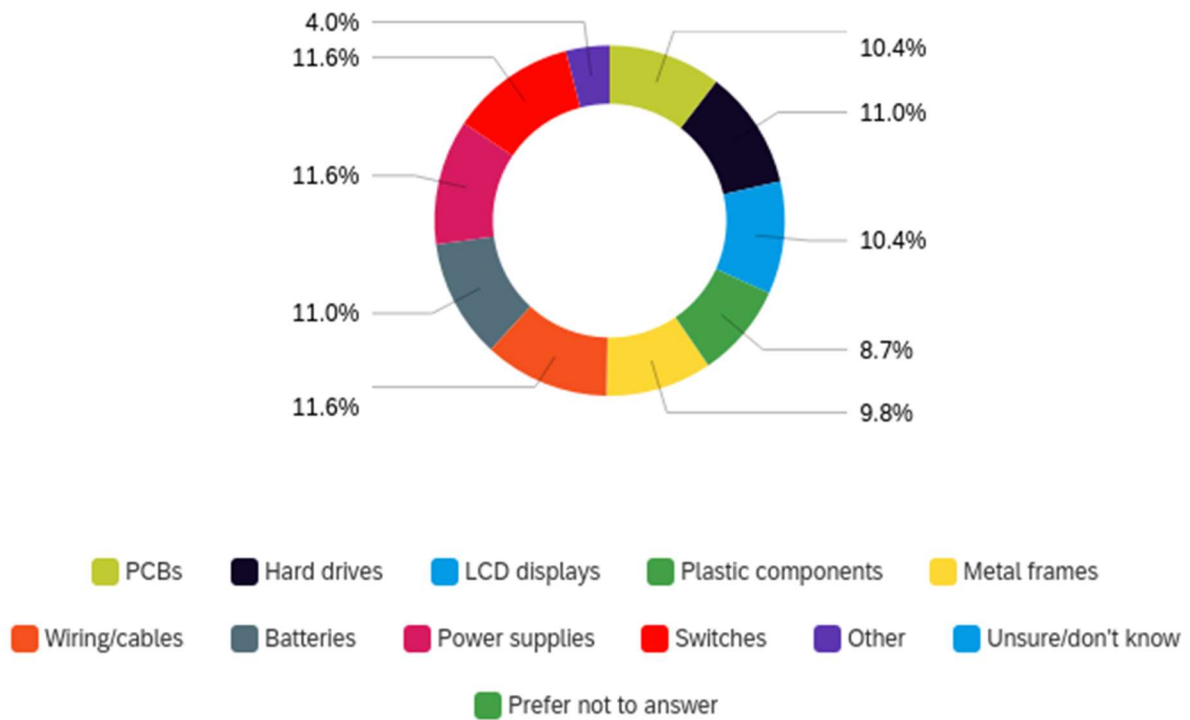
Figure 5.2 - Q4) Please select which of the following IT e-waste materials/components your business accepts for recycling - Histogram results

5.1.5 Q5) Please select which of the following the UK government defined WEEE categories your business accepts for recycling.

	Q5) Please select which of the following the UK government defined WEEE categories your business accepts for recycling.		
	Answer	**%**	**Count**
1	Category 1 - large household appliances	38.10%	8
2	Category 2 - small household appliances	42.86%	9
3	Category 3 - IT and telecommunications equipment	95.24%	20
4	Category 4 - consumer equipment	47.62%	10
5	Category 5 - lighting equipment	52.38%	11
6	Category 6 - electrical and electronic tools (except large scale stationary industrial tools)	47.62%	10
7	Category 7 - toys, leisure and sports equipment	38.10%	8
8	Category 8 - medical devices (except implanted and infected products)	33.33%	7
9	Category 9 - monitoring and control equipment	52.38%	11
10	Category 10 - automatic dispensers	38.10%	8
11	Category 11 - display equipment	47.62%	10
12	Category 12 - appliances containing refrigerants	28.57%	6
13	Category 13 - gas discharge lamps and light-emitting diode (LED) light sources	33.33%	7
14	Category 14 - PV panels (solar panels)	23.81%	5
15	Unsure/don't know	0.00%	0
16	Prefer not to answer	0.00%	0
	Total	**100%**	**21**
	- Category 3, IT and telecommunications equipment, was the most frequently selected category by a considerable amount. - Category 14, PV panels (solar panels), was the least-selected category with only five. - There was no observed trend in the selection of other categories. - The results suggest a specialism in the recycling of category 3 WEEE items for most businesses, but every other WEEE category has a non-zero frequency.		

Table 5.5 - Q5) Please select which of the following the UK government defined WEEE categories your business accepts for recycling – Results

UK government defined WEEE categories accepted

Category	Percentage
Category 1 - large household appliances	6.2%
Category 2 - small household appliances	6.9%
Category 3 - IT and telecommunications equipment	15.4%
Category 4 - consumer equipment	7.7%
Category 5 - lighting equipment	8.5%
Category 6 - electrical and electronic tools (except large scale stationary industrial tools)	7.7%
Category 7 - toys, leisure and sports equipment	6.2%
Category 8 - medical devices (except implanted and infected products)	5.4%
Category 9 - monitoring and control equipment	8.5%
Category 10 - automatic dispensers	6.2%
Category 11 - display equipment	7.7%
Category 12 - appliances containing refrigerants	4.6%
Category 13 - gas discharge lamps and light-emitting diode (LED) light sources	5.4%
Category 14 - PV panels (solar panels)	3.8%

Legend:
- Category 1 - large household appliances
- Category 2 - small household appliances
- Category 3 - IT and telecommunications equipment
- Category 4 - consumer equipment
- Category 5 - lighting equipment
- Category 6 - electrical and electronic tools (except large scale stationary industrial tools)
- Category 7 - toys, leisure and sports equipment
- Category 8 - medical devices (except implanted and infected products)
- Category 9 - monitoring and control equipment
- Category 10 - automatic dispensers
- Category 11 - display equipment
- Category 12 - appliances containing refrigerants
- Category 13 - gas discharge lamps and light-emitting diode (LED) light sources
- Category 14 - PV panels (solar panels)
- Unsure/don't know
- Prefer not to answer

Figure 5.3 - Q5) Please select which of the following the UK government-defined WEEE categories your business accepts for recycling - Histogram results

5.1.6 Q6) Is your process designed to deal specifically with e-waste or any specific components of e-waste (e.g., PCBs, batteries, hard drives, LCD displays, etc.)?

Q6) Is your process designed to deal specifically with e-waste or any specific components of e-waste (e.g., PCBs, batteries, hard drives, LCD displays, etc.)?		
Answer	**%**	**Count**
1	No	14.29%	3
2	Yes	85.71%	18
3	Unsure/don't know	0.00%	0
4	Prefer not to answer	0.00%	0
Total	**100%**	**21**

- Most participants stated that their business' process is specifically intended to deal with e-waste or components of it.
- The results are relatively consistent with those of Q5, which indicated a specialism in category 3 WEEE items, covering IT and telecommunications equipment.

Table 5.6 - Q6) Is your process designed to deal specifically with e-waste or any specific components of e-waste (e.g., PCBs, batteries, hard drives, LCD displays, etc.)? – Results

Q6 * Q1 (Please select the category that best describes your business)

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| | | Is your process designed to deal specifically with e-waste or any specific components of e-waste (e.g., PCBs, batteries, hard drives, LCD displays, etc.)? | | |
		No	Yes	Total
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)	40.0%	60.0%	100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)	7.7%	92.3%	100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)		100.0%	100.0%
	Prefer not to answer		100.0%	100.0%
Total		14.3%	85.7%	100.0%

- Cross-analysis with the government business categories highlighted that small businesses are potentially 32.3% more likely to have a process that is specifically dedicated to processing e-waste than micro businesses.
- The smaller sample size of micro businesses would necessitate further investigation.
- The small sample of medium businesses were excluded from this interpretation.

*Table 5.7 - Q6 * Q1 (Please select the category that best describes your business) - Crosstabulation*

5.1.7 Q7) Prior to processing, does your business ask customers (e.g., in tenders, or verbally) if their e-waste recycling material contains any hazardous substances (e.g., persistent organic pollutants (POPs))?

Q7) Prior to processing, does your business ask customers (e.g., in tenders, or verbally) if their e-waste recycling material contains any hazardous substances (e.g., persistent organic pollutants (POPs))?		
Answer	**%**	**Count**
1 No	19.05%	4
2 Yes	80.95%	17
3 Unsure/don't know	0.00%	0
4 Prefer not to answer	0.00%	0
Total	**100%**	**21**
- Most participants stated that their business asks customers about the presence of hazardous substances in their e-waste material prior to processing or recycling, indicating that this enquiry is common practice. - Just under 20% of businesses do not ask customers.		

Table 5.8 - Q7) Prior to processing, does your business ask customers (e.g., in tenders, or verbally) if their e-waste recycling material contains any hazardous substances (e.g., persistent organic pollutants (POPs))? - Results

5.1.8 Q8) Has your business had its carbon footprint calculated?

Q8) Has your business had its carbon footprint calculated?		
Answer	**%**	**Count**
1 No	33.33%	7
2 Yes, the carbon footprint was internally calculated	28.57%	6
3 Yes, the carbon footprint was externally verified	23.81%	5
4 Unsure/don't know	14.29%	3
5 Prefer not to answer	0.00%	0
Total	**100%**	**21**
- A small number of participants stated that they were unsure. - The rest were widely spread between internal, external and no carbon calculations performed. - While there was no clear trend, the data does indicate that a significant proportion of the businesses are not aware of their carbon footprint.		

Table 5.9 - Q8) Has your business had its carbon footprint calculated? - Results

Q8 * Q1 (Please select the category which best describes your business)						

SPSS Screenshot

		Has your business had its carbon footprint calculated?				
		No	Yes, the carbon footprint was internally calculated	Yes, the carbon footprint was externally verified	Unsure/don't know	Total
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)	60.0%		20.0%	20.0%	100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)	23.1%	46.2%	23.1%	7.7%	100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)			50.0%	50.0%	100.0%
	Prefer not to answer	100.0%				100.0%
Total		33.3%	28.6%	23.8%	14.3%	100.0%

- Cross-tabulation with government business categories demonstrated that small businesses were twice as likely to have had an internal carbon calculation versus an externally verified calculation.
- Almost 50% of all small businesses having opted for an internal calculation.
- Almost 25% of small businesses had an external audit.
- Approximately 25% of small businesses had not had any calculation of their carbon footprint whatsoever.
- While the sample set for medium businesses is too small to accurately assess, there appears to be a possible trend between micro and small businesses that the larger the business, the more likely to have had the carbon footprint calculated.

*Table 5.10 - Q8 * Q1 (Please select the category which best describes your business) – Crosstabulation*

Q8 * Q3 (Does your business marketing to customers focus on your company's environmental credentials?)

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		Has your business had its carbon footprint calculated?				
		No	Yes, the carbon footprint was internally calculated	Yes, the carbon footprint was externally verified	Unsure/don't know	Total
Does your business marketing to customers focus on your company's environmental credentials?	No	66.7%			33.3%	100.0%
	Yes	27.8%	33.3%	27.8%	11.1%	100.0%
Total		33.3%	28.6%	23.8%	14.3%	100.0%

- Further cross-analysis was performed with the proportion of businesses which did and did not have a focus on environmental credentials in their marketing. It was found that 27.8% of businesses with environmentally focused marketing had no awareness of their carbon footprint, and a further 11.1% were unsure, showing a high level of uncertainty.

*Table 5.11 - Q8 * Q3 (Does your business marketing to customers focus on your company's environmental credentials?) - Crosstabulation*

5.1.9 Q8a) How long ago were any carbon calculations or audits performed?

Q8a) How long ago were any carbon calculations or audits performed?		
Answer	**%**	**Count**
1 Within the last year	63.64%	7
2 1-3 years ago	36.36%	4
3 3-5 years	0.00%	0
4 5+ years ago	0.00%	0
5 Unsure/don't know	0.00%	0
6 Prefer not to answer	0.00%	0
Total	**100%**	**11**

- Of the businesses with a prior carbon footprint calculation, the majority stated this had been performed within the last year.
- No participants selected an option exceeding 3 years. This suggests all carbon footprint calculations could therefore be considered relatively recent.

Table 5.12 - Q8a) How long ago were any carbon calculations or audits performed? – Results

5.1.10 Q8b) How frequently have any carbon calculations or audits been performed?

	Q8b) How frequently have any carbon calculations or audits been performed?		
	Answer	**%**	**Count**
1	Once	0.00%	0
2	More than once a year	9.09%	1
3	Annually	54.55%	6
4	Up to every 2 years	0.00%	0
5	Up to every 3 years	9.09%	1
6	Less frequently than every 3 years	9.09%	1
7	Unsure/don't know	9.09%	1
8	Prefer not to answer	9.09%	1
	Total	**100%**	**11**

- Of the businesses with a prior carbon footprint calculation, a majority stated that carbon calculations are performed annually,
- The remainder of the responses were relatively widely distributed. However, none stated they had only one calculation performed.

Table 5.13 - Q8b) How frequently have any carbon calculations or audits been performed? - Results

	Q8 * Q8b (How frequently have any carbon calculations or audits been performed?)							

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		How frequently have any carbon calculations or audits been performed?						
		More than once a year	Annually	Up to every 3 years	Less frequently than every 3 years	Unsure/don't know	Prefer not to answer	Total
Has your business had its carbon footprint calculated?	Yes, the carbon footprint was internally calculated		83.3%				16.7%	100.0%
	Yes, the carbon footprint was externally verified	20.0%	20.0%	20.0%	20.0%	20.0%		100.0%
Total		9.1%	54.5%	9.1%	9.1%	9.1%	9.1%	100.0%

- Cross-analysis with the proportion of businesses which had a carbon footprint calculation revealed a much wider spread of frequency responses for those who had an external audit.
- In contrast, those with internal calculations showed very little variation in footprint frequency.

*Table 5.14 - Q8 * Q8b (How frequently have any carbon calculations or audits been performed?) – Crosstabulation*

5.1.11 Q8c) Has your business taken any actions yet based on any carbon calculations, energy consumption data or recommendations from any audits?

Q8c) Has your business taken any actions yet based on any carbon calculations, energy consumption data or recommendations from any audits?			
	Answer	**%**	**Count**
1	No	18.18%	2
2	Yes	72.73%	8
3	Unsure/don't know	9.09%	1
4	Prefer not to answer	0.00%	0
	Total	**100%**	**11**

- The majority of businesses with prior carbon calculations stated they had already taken actions based on the footprint calculated.

Table 5.15 - Q8c) Has your business taken any actions yet based on any carbon calculations, energy consumption data or recommendations from any audits? - Results

5.1.12 Q9) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) if your business has had its carbon footprint calculated?

Q9) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) if your business has had its carbon footprint calculated?																		
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Answer	0	0	0	0	0	0	0	0	1	1	3	5	20	26	30	30	30	35	45

Field	**Minimum**	**Maximum**	**Mean**	**Std Deviation**	**Variance**	**Count**
%	0	45	11.89	15.17	230.2	19

- This question was presented to all participants, irrespective of whether they have had a carbon footprint calculation.
- Of the 19 who provided an answer, the mean estimated proportion of customers who ask this question is low.
- The associated data suggests this question is very infrequently asked by customers, with 12 participants selecting 0-5% and a slight spike in those stating that around 30% ask.

Table 5.16 - Q9) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) if your business has had its carbon footprint calculated?

5.1.13 Q10) Have any customers asked for any of the results (e.g., carbon emissions, energy consumption or recommendations) of any carbon audits/calculations performed?

Q10) Have any customers asked for any of the results (e.g., carbon emissions, energy consumption or recommendations) of any carbon audits/calculations performed?		
Answer	**%**	**Count**
1 Yes (please state what information your business has provided to customers)	14.29%	3
2 No (please state what information your business would be willing to provide to customers)	57.14%	12
3 Unsure/don't know	23.81%	5
4 Prefer not to answer	4.76%	1
Total	**100%**	**21**
- A majority of participants stated that no customers have requested results. - A significant proportion were unsure whether customers have requested results. - Overall, the data indicates that this is an infrequent request.		

Table 5.17 - Q10) Have any customers asked for any of the results (e.g., carbon emissions, energy consumption or recommendations) of any carbon audits/calculations performed? - Results

Q10) 'Yes' field responses
Carbon emissions and energy consumption
Customers have asked the carbon offset by the equipment that has been reused.
carbon audits

Table 5.18 - Q10) 'Yes' field responses

Q10) 'No' field responses
We are happy to share our report
Scope 1, 2 and 3 emissions. Our Science based targets. Current footprint.
Anything we have.
The LCA Numbers on a cradle to gate analysis

Table 5.19 - Q10) 'No' field responses

5.1.14 Q11) Has your business created a plan to achieve carbon net neutrality by 2050?

	Q11) Has your business created a plan to achieve carbon net neutrality by 2050?		
	Answer	**%**	**Count**
1	No	47.62%	10
2	Yes	42.86%	9
3	Unsure/don't know	9.52%	2
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**
	- The results show significant numbers of businesses which have and have not created a carbon net-zero plan.		

Table 5.20 - Q11) Has your business created a plan to achieve carbon net neutrality by 2050? – Results

Q11 * Q8 (Has your business had its carbon footprint calculated?)				
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		Has your business created a plan to achieve carbon net neutrality by 2050?			
		No	Yes	Unsure/don't know	Total
Has your business had its carbon footprint calculated?	No	71.4%	14.3%	14.3%	100.0%
	Yes, the carbon footprint was internally calculated	33.3%	66.7%		100.0%
	Yes, the carbon footprint was externally verified	40.0%	60.0%		100.0%
	Unsure/don't know	33.3%	33.3%	33.3%	100.0%
Total		47.6%	42.9%	9.5%	100.0%

- Cross-analysis with the results of businesses who have had carbon footprint calculations points to a correlation, with any carbon calculation associated with a higher likelihood of a business having a carbon net-zero plan, by approximately 45-50%.
- The choice of an internal or external calculation did not appear to affect this substantially.

*Table 5.21 - Q11 * Q8 (Has your business had its carbon footprint calculated?) – Crosstabulation*

Q11 * Q1 (Please select the category which best describes your business)

<u>SPSS Screenshot</u>

		Has your business created a plan to achieve carbon net neutrality by 2050?			
		No	Yes	Unsure/don't know	Total
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)	80.0%		20.0%	100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)	38.5%	53.8%	7.7%	100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)		100.0%		100.0%
	Prefer not to answer	100.0%			100.0%
Total		47.6%	42.9%	9.5%	100.0%

- Further analysis against the government business categories identified micro businesses as the least likely to have a plan,
- Medium businesses were most likely to have a plan.
- While the sample sizes of micro and particularly medium businesses are smaller than for small businesses, there may be a potential trend of larger businesses having a higher likelihood of having a carbon plan in place.

*Table 5.22 - Q11 * Q1 (Please select the category which best describes your business) - Crosstabulation*

Q11 * Q3 (Does your business marketing to customers focus on your company's environmental credentials?)

<u>SPSS Screenshot</u>

		Has your business created a plan to achieve carbon net neutrality by 2050?			
		No	Yes	Unsure/don't know	Total
Does your business marketing to customers focus on your company's environmental credentials?	No	66.7%		33.3%	100.0%
	Yes	44.4%	50.0%	5.6%	100.0%
Total		47.6%	42.9%	9.5%	100.0%

- Additional analysis with businesses who environmentally-market themselves showed that almost 50% of the businesses who engage in this marketing have not created a carbon plan.

*Table 5.23 - Q11 * Q3 (Does your business marketing to customers focus on your company's environmental credentials?) - Crosstabulation*

5.1.15 Q12) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) whether your business has a plan or is on target to achieve carbon net neutrality by 2050?

Q12) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) whether your business has a plan or is on target to achieve carbon net neutrality by 2050?																				
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Answer	0	0	0	0	0	0	0	0	0	0	1	3	3	5	10	10	31	51	70	80

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	80	13.2	24.11	581.06	20

- The mean estimated proportion of customers who ask about carbon plans is low at 13.2%.
- The associated data is very widely distributed, but a high proportion estimated 0%, suggesting that this is generally an infrequent question for participating recyclers to receive from customers.

Table 5.24 - Q12) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) whether your business has a plan or is on target to achieve carbon net neutrality by 2050? - Results

5.1.16 Q13) Does your business use any carbon emissions monitoring software for its process or operations? If so, please list the software used.

Q13) Does your business use any carbon emissions monitoring software for its process or operations? If so, please list the software used.		
Answer	**%**	**Count**
1 No	85.71%	18
2 Yes	0.00%	0
3 Unsure/don't know	14.29%	3
4 Prefer not to answer	0.00%	0
Total	**100%**	**21**

- The majority of businesses stated they do not use any carbon emissions monitoring software.
- No participants confirming that their company used carbon emissions monitoring software.
- These results clearly indicate that use of emissions-tracking software is not a widely adopted practice by participating businesses.

Table 5.25 - Q13) Does your business use any carbon emissions monitoring software for its process or operations? If so, please list the software used – Results

Q13 * Q1 (Please select the category that best describes your business)				

SPSS Screenshot

		Does your business use any carbon emissions monitoring software for its process or operations? If so, please list the software used. - Selected Choice		
		No	Unsure/don't know	Total
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)	60.0%	40.0%	100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)	100.0%		100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)	50.0%	50.0%	100.0%
	Prefer not to answer	100.0%		100.0%
Total		85.7%	14.3%	100.0%

- Cross-tabulation of business categories with this question emphasises that small businesses are confidently not utilising any carbon monitoring software, despite displaying a high rate of internal carbon footprint calculation (Q8).
- The results for micro and medium businesses display more uncertainty from participants.

*Table 5.26 – Q13 * Q1 (Please select the category that best describes your business) – Crosstabulation*

5.1.17 Q14) Does your business use any energy-management tools, systems or software for its process or operations? If so, please list any used.

	Q14) Does your business use any energy-management tools, systems or software for its process or operations? If so, please list any used.		
	Answer	**%**	**Count**
1	No	66.67%	14
2	Yes	9.52%	2
3	Unsure/don't know	23.81%	5
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**

- A majority of participating businesses do not use any energy-management systems
- Unlike carbon monitoring software (Q13), a small number of companies do use energy-management systems
- A significant number of participants were unsure.

Table 5.27 - Q14) Does your business use any energy-management tools, systems or software for its process or operations? If so, please list any used – Results

5.1.18 Q15) Does your business use any carbon offsetting programs or initiatives for its process or operations? If so, please list any used.

Q15) Does your business use any carbon offsetting programs or initiatives for its process or operations? If so, please list any used.		
Answer	**%**	**Count**
1	No	61.90%	13
2	Yes	33.33%	7
3	Unsure/don't know	4.76%	1
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**

- There is less uncertainty here than for use of carbon monitoring or energy management software.
- A majority of businesses do not offset carbon emissions.
- A significant portion, at approximately one third, do offset carbon emissions.

Table 5.28 - Q15) Does your business use any carbon offsetting programs or initiatives for its process or operations? If so, please list any used. – Results

Q15) 'Yes' field responses
We are innately decarbonising anyway when listed next to the incumbent process
Tree planting initiative and Social Value Programme
IT Recycling
Ecologi
Calculation of carbon offset for reused devices based on the average carbon emissions to produce an equivalent new device.

Table 5.29 – Q15) 'Yes' field responses

Q15 * Q1 (Please select the category which best describes your business)

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		Does your business use any carbon offsetting programs or initiatives for its process or operations? If so, please list any used. - Selected Choice			
		No	Yes	Unsure/don't know	Total
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)	100.0%			100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)	46.2%	53.8%		100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)	50.0%		50.0%	100.0%
	Prefer not to answer	100.0%			100.0%
Total		61.9%	33.3%	4.8%	100.0%

- Further analysis through cross-tabulation with business categories showed that for small businesses, over 50% are using some form of carbon offsetting.
- For microbusinesses, none used any offsetting however the associated sample size was far lower.
- The sample size for medium businesses is too small to draw an individual conclusion.

*Table 5.30 – Q15 * Q1 (Please select the category which best describes your business) – Crosstabulation*

Q15 * Q8 (Has your business had its carbon footprint calculated?)

<u>SPSS Screenshot</u>

		Does your business use any carbon offsetting programs or initiatives for its process or operations? If so, please list any used. - Selected Choice			
		No	Yes	Unsure/don't know	Total
Has your business had its carbon footprint calculated?	No	85.7%	14.3%		100.0%
	Yes, the carbon footprint was internally calculated	33.3%	66.7%		100.0%
	Yes, the carbon footprint was externally verified	80.0%	20.0%		100.0%
	Unsure/don't know	33.3%	33.3%	33.3%	100.0%
Total		61.9%	33.3%	4.8%	100.0%

- Additionally, cross-analysis between those who have had a carbon footprint calculated and those who use carbon offsetting identifies significant differences between those who have internal or external carbon calculations, with a 46.7% increase in use of offsetting by those with internal calculations versus external.
- Furthermore, 14.3% of businesses who are unaware of their carbon footprint are offsetting carbon.

*Table 5.31 – Q15 * Q8 (Has your business had its carbon footprint calculated?) - Crosstabulation*

5.1.19 Q16) Is your business aware that carbon offsetting schemes have significant differences in their environmental impact and calculation techniques?

Q16) Is your business aware that carbon offsetting schemes have significant differences in their environmental impact and calculation techniques?

	Answer	%	Count
1	No	19.05%	4
2	Yes	61.90%	13
3	Unsure/don't know	19.05%	4
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**

- A majority of participants state their business is aware of carbon offsetting scheme differences.
- However significant proportions are either unaware or unsure whether their business is aware of carbon offsetting scheme differences.

Table 5.32 - Q16) Is your business aware that carbon offsetting schemes have significant differences in their environmental impact and calculation techniques? – Results

Q16 * Q15 (Does your business use any carbon offsetting programs or initiatives for its process or operations? If so, please list any used.)

SPSS Screenshot

		Is your business aware that carbon offsetting schemes have significant differences in their environmental impact and calculation techniques?			
		No	Yes	Unsure/don't know	Total
Does your business use any carbon offsetting programs or initiatives for its process or operations? If so, please list any used. - Selected Choice	No	23.1%	61.5%	15.4%	100.0%
	Yes	14.3%	57.1%	28.6%	100.0%
	Unsure/don't know		100.0%		100.0%
Total		19.0%	61.9%	19.0%	100.0%

- Cross-tabulation with the proportions of participants using carbon offsetting show that of those businesses that do offset carbon, a considerable proportion of 42.9% are either unaware or unsure of the differences in carbon offsetting scheme impacts and calculation methods.
- This share is larger than but paralleled by those who do not use carbon offsetting at all, with a total of 38.5% unaware or unsure in that case.

*Table 5.33 - Q16 * Q15 (Does your business use any carbon offsetting programs or initiatives for its process or operations? If so, please list any used.) - Crosstabulation*

5.1.20 Q17) Does your business currently take any other measures to address the carbon footprint from its process, operations or employees?

Q17) Does your business currently take any other measures to address the carbon footprint from its process, operations or employees?		
Answer	**%**	**Count**
1 Cycle-to-work scheme	38.10%	8
2 Electric business vehicle scheme	33.33%	7
3 Rainwater harvesting	4.76%	1
4 Car share scheme	19.05%	4
5 Combined heat and power	14.29%	3
6 Solar heating	9.52%	2
7 Heat pumps	0.00%	0
8 Renewable energy generation	33.33%	7
9 Other	14.29%	3
10 Unsure/don't know	23.81%	5
11 Prefer not to answer	0.00%	0
Total	**100%**	**21**

- Cycle-to-work schemes, electric business vehicle schemes and renewable energy generation appear to be adopted by a significant proportion of businesses.
- The remainder of additional measures are infrequently selected, and the uncertainty is relatively high for this question.

Table 5.34 - Q17) Does your business currently take any other measures to address the carbon footprint from its process, operations or employees? – Results

Q17) 'Other' field responses
Green only energy supply
Award tenders partially on carbon footprint scores
Awareness campaigns

Table 5.35 – Q17) 'Other' field responses
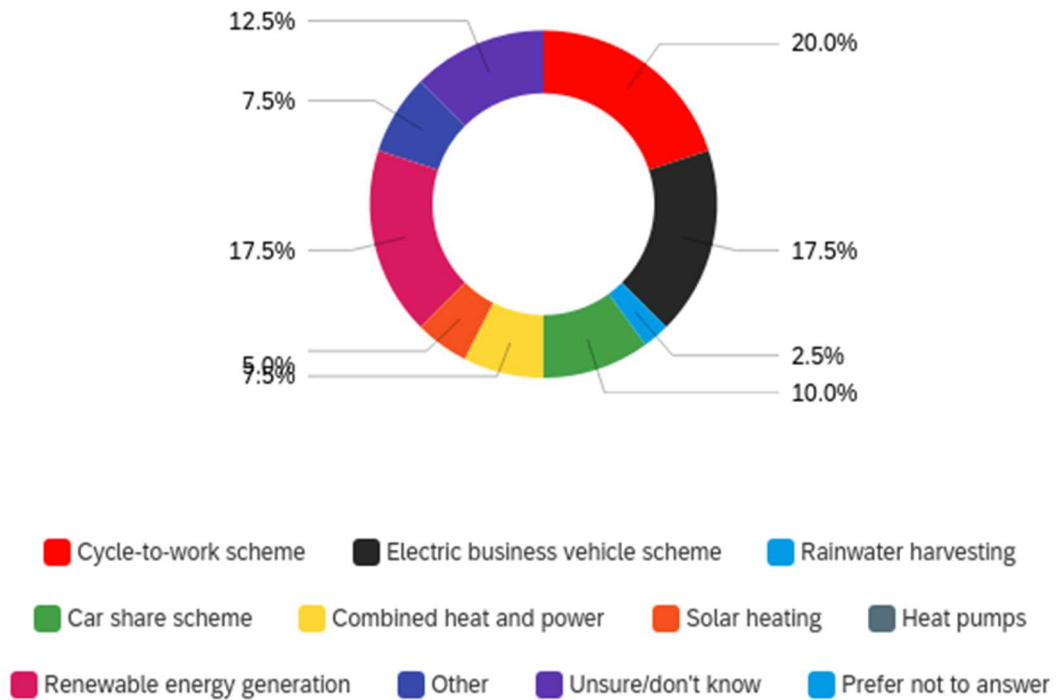
Figure 5.4 - Q17) Does your business currently take any other measures to address the carbon footprint from its process, operations or employees? - Histogram results

5.1.21 Q18) Have any customers asked (e.g., in tenders, or verbally) what your business has done to address the energy use and carbon footprint of its process or operations?

	Q18) Have any customers asked (e.g., in tenders, or verbally) what your business has done to address the energy use and carbon footprint of its process or operations?		
	Answer	**%**	**Count**
1	No (please state what information your business would be willing to provide to customers)	38.10%	8
2	Yes (please state what information your business has provided to customers)	33.33%	7
3	Unsure/don't know	28.57%	6
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**
	- The responses were mixed, showing a high degree of participants who were unsure and a significant number of businesses stating that customers do and do not ask this question.		

Table 5.36 - Q18) Have any customers asked (e.g., in tenders, or verbally) what your business has done to address the energy use and carbon footprint of its process or operations? - Results

Q18_1) 'No' field responses
We are completely transparent and willing to share all data
Any

Table 5.37 - Q18_1) 'No' field responses

Q18_2) 'Yes' field responses
Yes (please state what information your business has provided to customers) - Text
ISO certifications
Electric Vehicles, Bike2Work Schemes, going paperless with our consignments and invoices, changed lighting and heating etc.
LED lighting, driver training, route planning.
Energy use reduction measures
Asked about our energy usage, we have shown them our solar panel system

Table 5.38 - Q18_2) 'Yes' field responses

5.1.22 Q18a) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) what your business has done to address the energy use and carbon footprint of its process or operations?

Q18a) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) what your business has done to address the energy use and carbon footprint of its process or operations?							
Sample	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Answer	0	1	5	9	10	14	51

Field	**Minimum**	**Maximum**	**Mean**	**Std Deviation**	**Variance**	**Count**
%	0	51	12.86	16.24	263.84	7

- Seven businesses confirmed that customers have asked this question and gave a value of what percentage of customer ask.
- Of businesses who have been asked by customers, the mean estimated proportion of customers asking is low at 12.9%, with one potential outlier at 51%.

Table 5.39 - Q18a) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) what your business has done to address the energy use and carbon footprint of its process or operations? - Results

5.1.23 Q19) Does your business use grid-sourced electricity?

Q19) Does your business use grid-sourced electricity?		
Answer	**%**	**Count**
1 No	4.76%	1
2 Yes	80.95%	17
3 Unsure/don't know	14.29%	3
4 Prefer not to answer	0.00%	0
Total	**100%**	**21**

- The vast majority of businesses use some grid-sourced electricity, with a very small number who do not or are unsure.

Table 5.40 - Q19) Does your business use grid-sourced electricity? – Results

5.1.24 Q20) Does your business use any proportion of on-site renewable electricity generation?

	Q20) Does your business use any proportion of on-site renewable electricity generation?		
	Answer	**%**	**Count**
1	No	61.90%	13
2	Yes	33.33%	7
3	Unsure/don't know	4.76%	1
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**

- Approximately 60% of businesses do not use any on-site renewable electricity generation, but a significant portion do.

Table 5.41 - Q20) Does your business use any proportion of on-site renewable electricity generation? - Results

Q20 * Q1 (Please describe the category which best describes your business)

<u>SPSS Screenshot</u>

% within Please select the category which best describes your business:

		Does your business use any proportion of on-site renewable electricity generation?			
		No	Yes	Unsure/don't know	Total
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)	80.0%	20.0%		100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)	61.5%	38.5%		100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)	50.0%		50.0%	100.0%
	Prefer not to answer		100.0%		100.0%
Total		61.9%	33.3%	4.8%	100.0%

- Cross-tabulation with business categories showed a pronounced increase in likelihood for small businesses to adopt on-site renewable generation versus micro businesses, with 38.5% and 20% each using a proportion of it, respectively.
- The results for the 2 medium businesses would need a larger sample set for analysis.

*Table 5.42 – Q20 * Q1 (Please describe the category which best describes your business) – Crosstabulation*

Q20 * Q8 (Has your business had its carbon footprint calculated?)

<u>SPSS Screenshot</u>

		Does your business use any proportion of on-site renewable electricity generation?			
		No	Yes	Unsure/don't know	Total
Has your business had its carbon footprint calculated?	No	85.7%	14.3%		100.0%
	Yes, the carbon footprint was internally calculated	50.0%	50.0%		100.0%
	Yes, the carbon footprint was externally verified	60.0%	40.0%		100.0%
	Unsure/don't know	33.3%	33.3%	33.3%	100.0%
Total		61.9%	33.3%	4.8%	100.0%

- Further cross-analysis with proportions of businesses with carbon calculations performed revealed that having any carbon calculations was associated with a 25-35% higher likelihood of having on-site renewable electricity generation for businesses than those with no calculation.
- This trend was slightly more pronounced by 10% for those who had an internal calculation performed.

*Table 5.43 – Q20 * Q8 (Has your business had its carbon footprint calculated?) - Crosstabulation*

Q20 * Q14 (Has your business created a plan to achieve net neutrality by 2050?)

<u>SPSS Screenshot</u>

		Does your business use any proportion of on-site renewable electricity generation?			
		No	Yes	Unsure/don't know	Total
Has your business created a plan to achieve carbon net neutrality by 2050?	No	60.0%	40.0%		100.0%
	Yes	66.7%	22.2%	11.1%	100.0%
	Unsure/don't know	50.0%	50.0%		100.0%
Total		61.9%	33.3%	4.8%	100.0%

- Results of analysis against those who have a carbon plan in place suggest that those who do not have an almost 20% higher likelihood of having on-site renewable generation.

*Table 5.44 - Q20 * Q14 (Has your business created a plan to achieve net neutrality by 2050?) – Crosstabulation*

	Q21) Does your business use any green electricity tariffs, and/or any other renewably classified utilities? Please select as many as applicable.		
	Answer	**%**	**Count**
1	Electricity	42.86%	9
2	Water	9.52%	2
3	Gas	9.52%	2
4	Internet	9.52%	2
5	Unsure/don't know	52.38%	11
6	Prefer not to answer	4.76%	1
	Total	**100%**	**21**

- There was a high degree of uncertainty from participants for this question, but a significant proportion of businesses utilise a green electricity tariff.
- Renewable tariffs for water, gas and internet connectivity appear to be infrequently adopted.

Table 5.45 - Q21) Does your business use any green electricity tariffs, and/or any other renewably classified utilities? Please select as many as applicable. – Results
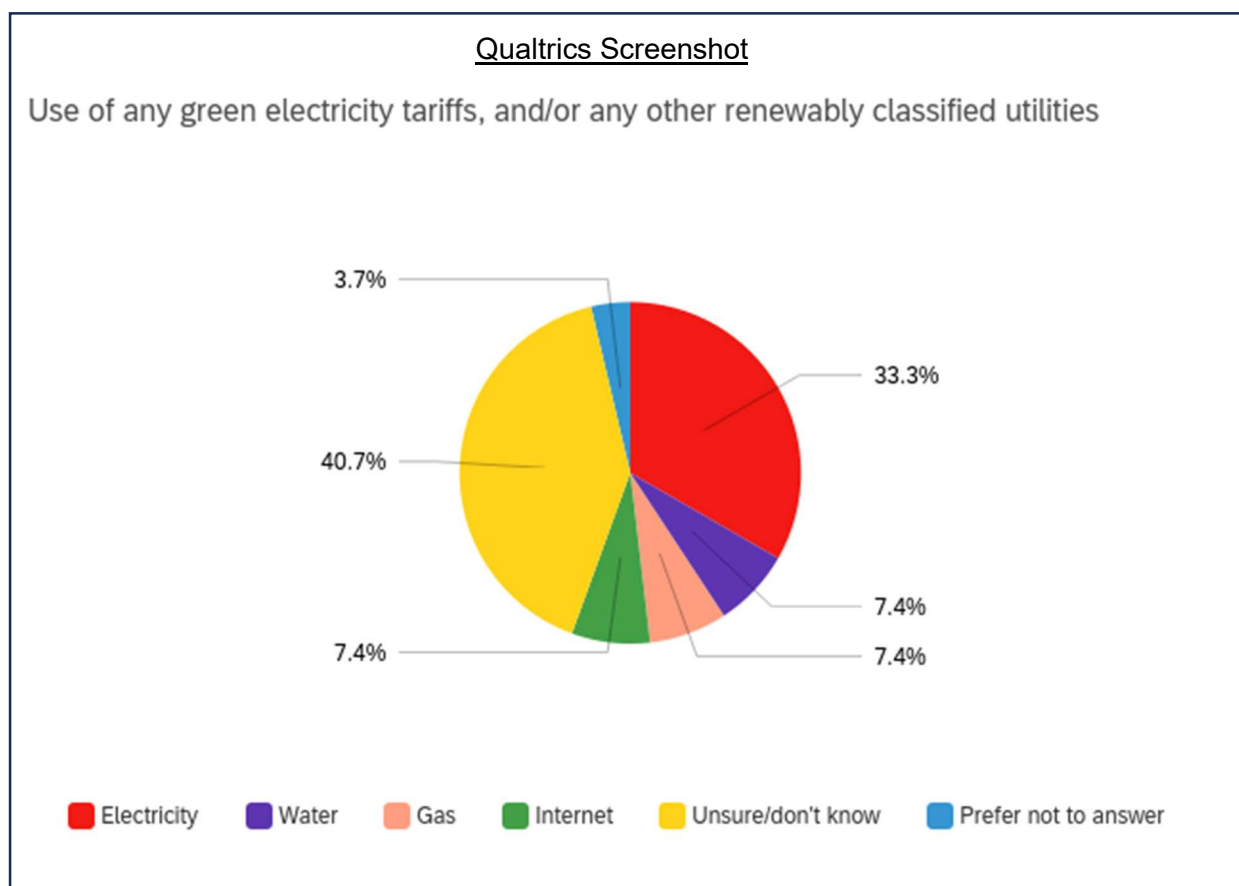
Figure 5.5 - Q21) Does your business use any green electricity tariffs, and/or any other renewably classified utilities? Please select as many as applicable. - Histogram results

5.1.26 Q22) Is your business aware of the use of REGO certificates by electricity suppliers?

Q22) Is your business aware of the use of REGO certificates by electricity suppliers?		
Answer	%	Count
1 Yes, the business knows about REGO certificates, and our electricity supplier uses them	9.52%	2
2 Yes, the business knows about REGO certificates, but our electricity supplier does not use them	9.52%	2
3 Our business is not aware of the use of REGO certificates	42.86%	9
4 Unsure/don't know	38.10%	8
5 Prefer not to answer	0.00%	0
Total	**100%**	**21**
- The responses were mixed, with a high degree of uncertainty from participants. - However, significant numbers of businesses are unaware of REGO certificate use, and very few businesses aware in total.		

Table 5.46 - Q22) Is your business aware of the use of REGO certificates by electricity suppliers? - Results

Q22 * Q21 (Does your business use any green electricity tariffs, and/or any other renewably classified utilities? Please select as many as applicable)

SPSS Screenshot

Is your business aware of the use of REGO certificates by electricity suppliers?

		Yes, the business knows about REGO certificates, and our electricity supplier uses them	Yes, the business knows about REGO certificates, but our electricity supplier does not use them	Our business is not aware of the use of REGO certificates	Unsure/don't know	Total
Does your business use any green electricity tariffs, and/or any other renewably classified utilities? Please select as many as applicable: Electricity	Electricity	22.2%	11.1%	44.4%	22.2%	100.0%
Total		22.2%	11.1%	44.4%	22.2%	100.0%

- Cross-analysis with only businesses which have a green electricity tariff identifies that over 66% are either unaware or unsure of the use of REGO certificates by electricity suppliers.

*Table 5.47 – Q22 * Q21 (Does your business use any green electricity tariffs, and/or any other renewably classified utilities? Please select as many as applicable) – Crosstabulation*

5.1.27 Q23) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) if/how much of your business' energy and utilities are from renewable or 'green' sources?

Q23) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) if/how much of your business' energy and utilities are from renewable or 'green' sources?																		
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Answer	0	0	0	0	0	0	0	0	0	0	0	1	1	4	5	6	6	60

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	60	4.61	13.61	185.13	18

- The mean estimated proportion of customers who ask about this is very low at 4.6%, with all estimates provided between 0-6% apart from an outlier at 60%.

Table 5.48 - Q23) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) if/how much of your business' energy and utilities are from renewable or 'green' sources? - Statistics

Q24) Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?

Q24) Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?		
Answer	**%**	**Count**
1 Authorised Treatment Facility (ATF)	9.52%	2
2 Approved Authorised Treatment Facility (AATF)	38.10%	8
3 Neither	42.86%	9
4 Unsure/don't know	9.52%	2
5 Prefer not to answer	0.00%	0
Total	**100%**	**21**
- Most businesses appear to be either AATFs or neither, with very few ATFs recorded.		

Table 5.49 - Q24) Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)? - Results

Q24 * Q8 (Has your business had its carbon footprint calculated?)					
SPSS Screenshot					

		Has your business had its carbon footprint calculated?				
		No	Yes, the carbon footprint was internally calculated	Yes, the carbon footprint was externally verified	Unsure/don't know	Total
Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?	Authorised Treatment Facility (ATF)		100.0%			100.0%
	Approved Authorised Treatment Facility (AATF)	37.5%	12.5%	37.5%	12.5%	100.0%
	Neither	22.2%	33.3%	22.2%	22.2%	100.0%
	Unsure/don't know	100.0%				100.0%
Total		33.3%	28.6%	23.8%	14.3%	100.0%

- The results of cross-tabulation with carbon footprint calculations show a marginally higher probability of non-authorised ('neither' category) businesses having had a calculation performed than for AATFs, though the results are similar.
- AATFs have a higher probability of having had an externally verified calculation performed.
- Conversely, non-authorised businesses have a higher probability of internally calculating carbon footprints.

*Table 5.50 - Q24 * Q8 (Has your business had its carbon footprint calculated?) - Crosstabulation*

Q24 * Q11 (Has your business created a plan to achieve carbon net neutrality by 2050?)

SPSS Screenshot

		Has your business created a plan to achieve carbon net neutrality by 2050?			
		No	Yes	Unsure/don't know	Total
Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?	Authorised Treatment Facility (ATF)	50.0%	50.0%		100.0%
	Approved Authorised Treatment Facility (AATF)	37.5%	62.5%		100.0%
	Neither	55.6%	33.3%	11.1%	100.0%
	Unsure/don't know	50.0%		50.0%	100.0%
Total		47.6%	42.9%	9.5%	100.0%

- Further cross-analysis with businesses that have created carbon plans shows a significantly higher percentage of AATFs having a plan in place than non-authorised businesses.

*Table 5.51 - Q24 * Q14 (Has your business created a plan to achieve carbon net neutrality by 2050?) - Crosstabulation*

Q24 * Q20 (Does your business use any proportion of on-site renewable electricity generation?)

SPSS Screenshot

		Does your business use any proportion of on-site renewable electricity generation?			
		No	Yes	Unsure/don't know	Total
Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?	Authorised Treatment Facility (ATF)		100.0%		100.0%
	Approved Authorised Treatment Facility (AATF)	50.0%	37.5%	12.5%	100.0%
	Neither	77.8%	22.2%		100.0%
	Unsure/don't know	100.0%			100.0%
Total		61.9%	33.3%	4.8%	100.0%

- Cross-tabulation with businesses with on-site renewable technology shows a higher percentage of AATFs having renewable generation on-site than non-authorised businesses.

*Table 5.52 - Q24 * Q20 (Does your business use any proportion of on-site renewable electricity generation?) - Crosstabulation*

Q24 * Q36 (Please estimate the proportion by weight of your business' input e-waste that has been passed on to further recyclers in the last 12 months)

SPSS Screenshot

Please estimate the proportion by weight of your business' input e-waste that has been passed on to further recyclers in the last 12 months: - %

		.00	5.00	14.00	20.00	24.00	25.00	35.00	50.00	52.00	59.00	70.00	100.00	Total
Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?	Authorised Treatment Facility (ATF)			100.0%										100.0%
	Approved Authorised Treatment Facility (AATF)	16.7%			16.7%	16.7%		16.7%				16.7%	16.7%	100.0%
	Neither		12.5%				12.5%	12.5%	12.5%	12.5%	12.5%		25.0%	100.0%
	Unsure/don't know	50.0%											50.0%	100.0%
Total		11.8%	5.9%	5.9%	5.9%	5.9%	5.9%	11.8%	5.9%	5.9%	5.9%	5.9%	23.5%	100.0%

- Cross-analysis results show a higher mean estimated percentage sent to further recyclers from non-authorised businesses than AATFs of 53.3% and 41.6%, respectively.
- However, some AATFs estimate the majority of their WEEE is passed on, with very few stating 0%.

*Table 5.53 - Q24 * Q36 (Please estimate the proportion by weight of your business' input e-waste that has been passed on to further recyclers in the last 12 months) - Crosstabulation*

Q24 * Q38 (Please estimate the proportion by weight of your business input e-waste that has been sent to landfill in the last 12 months)

SPSS Screenshot

Please estimate the proportion by weight of your business' input e-waste that has been sent to landfill in the last 12 months. - %

		.00	1.00	2.00	7.00	Total
Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?	Authorised Treatment Facility (ATF)		100.0%			100.0%
	Approved Authorised Treatment Facility (AATF)	83.3%	16.7%			100.0%
	Neither	50.0%	25.0%	12.5%	12.5%	100.0%
	Unsure/don't know	100.0%				100.0%
Total		64.7%	23.5%	5.9%	5.9%	100.0%

- The results of cross-analysis for estimates of WEEE landfilled show a wider range and marginally higher overall mean percentage for non-authorised businesses than AATFs of 1.4% and 0.2% respectively

*Table 5.54 - Q24 * Q38 (Please estimate the proportion by weight of your business input e-waste that has been sent to landfill in the last 12 months) - Crosstabulation*

Q24 * Q40 (Please estimate the proportion by weight of your business input e-waste that has been sent to incineration processes in the last 12 months)

<u>SPSS Screenshot</u>

Please estimate the proportion by weight of your business' input e-waste that has been sent to incineration processes in the last 12 months - %

		.00	1.00	3.00	5.00	10.00	12.00	17.00	20.00	30.00	34.00	81.00	Total
Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?	Authorised Treatment Facility (ATF)										100.0%		100.0%
	Approved Authorised Treatment Facility (AATF)	57.1%	14.3%			14.3%						14.3%	100.0%
	Neither	14.3%			14.3%		14.3%	14.3%	28.6%	14.3%			100.0%
	Unsure/don't know	50.0%		50.0%									100.0%
Total		35.3%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	11.8%	5.9%	5.9%	5.9%	100.0%

- Cross-analysis with estimates of WEEE incinerated show similar mean percentages for AATFs and non-authorised businesses of 13.2% and 12.0%, respectively.
- However, an estimate of 81% from one AATF is potentially an outlier, with the resultant mean for AATFs far lower at 1.6% when excluding it.
- Generally, the non-authorised businesses estimated higher proportions of incinerated WEEE.

*Table 5.55 - Q24 * Q40 (Please estimate the proportion by weight of your business input e-waste that has been sent to incineration processes in the last 12 months) – Crosstabulation*

Q24 * Q42 (Please estimate the proportion by weight of your business input e-waste that has been exported overseas for further processing in the last 12 months)

<u>SPSS Screenshot</u>

Please estimate the proportion by weight of your business' input e-waste that has been exported overseas for further processing in the last 12 months. - %

		.00	1.00	2.00	5.00	35.00	40.00	46.00	Total
Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?	Authorised Treatment Facility (ATF)		100.0%						100.0%
	Approved Authorised Treatment Facility (AATF)	57.1%				14.3%	14.3%	14.3%	100.0%
	Neither	75.0%		12.5%	12.5%				100.0%
	Unsure/don't know	100.0%							100.0%
Total		64.7%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	100.0%

- Cross-analysis with estimates of WEEE exported overseas shows mean percentages for AATFs and non-authorised businesses of 17.3% and 0.9%, respectively.
- AATFs were responsible for the highest 3 estimates provided, however significant portions of both groups stated 0% is exported.

*Table 5.56 - Q24 * Q42 (Please estimate the proportion by weight of your business input e-waste that has been exported overseas for further processing in the last 12 months) - Crosstabulation*

5.1.29 Q24a) As an ATF, does your business record the weight (e.g., in tenders, or verbally) of WEEE that is:

Q24a) As an ATF, does your business record the weight (e.g., in tenders, or verbally) of WEEE that is:					
Question	**No**	**Yes**	**Unsure/ don't know**	**Prefer not to answer**	**Total**
Received for treatment	0	2	0	0	2
Sent to landfill	0	2	0	0	2
Sent to different facilities for treatment	0	2	0	0	2
Sent to incineration processes	0	1	1	0	2
Delivered to an approved exporter for treatment and recovery or recycling outside the UK	0	2	0	0	2
Successfully refurbished	1	1	0	0	2
- Of the 2 businesses with ATF status, both record a significant amount of information that AATFs are required to record, but one does not record refurbished WEEE weights and one was unsure about the records for WEEE sent to incineration.					

Table 5.57 - Q24a) As an ATF, does your business record the weight (e.g., in tenders, or verbally) of WEEE that is: - Results

5.1.30 Q25) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste is successfully refurbished?

Q25) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste is successfully refurbished?																					
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Answer	0	0	0	1	4	5	20	20	20	39	45	47	47	50	50	50	51	62	75	80	85

Field	**Minimum**	**Maximum**	**Mean**	**Std Deviation**	**Variance**	**Count**
%	0	85	35.76	27.21	740.18	21
- The mean estimated proportion of customers who ask about this is 35.8%.						
- Although the responses are widely distributed, the majority fall within 0-50, suggesting a moderate frequency of customers who enquire.						

Table 5.58 - Q25) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste is successfully refurbished? - Statistics

5.1.31 Q26) Within your business' records, which of these separate categories are recorded by weight?

	Q26) Within your business' records, which of these separate categories are recorded by weight?		
	Answer	**%**	**Count**
1	Ferrous metals	57.14%	12
2	Non-ferrous metals	66.67%	14
3	Plastics	52.38%	11
4	Residual material	52.38%	11
5	Unsure/don't know	28.57%	6
6	Prefer not to answer	0.00%	0
	Total	**100%**	**21**

- Uncertainty from participants was relatively high.
- A majority of businesses record metals, with only marginally less which record plastics and residual material.

Table 5.59 - Q26) Within your business' records, which of these separate categories are recorded by weight? – Results

5.1.32 Q27) Have customers requested evidence of the end-destination of all materials collected and recycled by your business?

	Q27) Have customers requested evidence of the end-destination of all materials collected and recycled by your business?		
	Answer	**%**	**Count**
1	If yes, please state what information your business has provided to	57.14%	12
2	If no, please state what information your business would be willing to provide to customers	23.81%	5
3	Unsure/don't know	14.29%	3
4	Prefer not to answer	4.76%	1
	Total	**100%**	**21**

- A majority of businesses have been asked for evidence by customers.
- A relatively significant proportion have not been asked.

Table 5.60 - Q27) Have customers requested evidence of the end-destination of all materials collected and recycled by your business? - Results

Q27_1) 'Yes' field responses
all
All statutory paperwork, evidence notes, consignment notes, etc
Process flow diagram
All customers receive a waste transfer note with the destination marked
All our information of the final destination is on our website
Audit trail
WEEE waste tonnage annually
All.
Mass balance / yield tonnages
Have asked which refiners we send sorted material to.

Table 5.61 - Q27_1) 'Yes' field responses

Q27_2) 'No' field responses
Waste Transfer Notes

Table 5.62 - Q27_2) 'No' field responses

Q28) Please estimate the numbers of each of the following vehicle types that your business uses for business transport purposes, based on the fuel source that each uses.

	Cars					Vans					HGVs				
	Petrol or LPG	Diesel	Biofuel	Plug-in hybrid	Electric	Petrol or LPG	Diesel	Biofuel	Plug-in hybrid	Electric	Petrol or LPG	Diesel	Biofuel	Plug-in hybrid	Electric
1							1			1					
2	1					2					3				
3							1								
4		2					1					1			
5							3								
6		2					8								
7					3		14								
8		1					9								
9						1									
10							2					3			
11							2		1						
12							5					2			
13	2														
14							2								
15				1	4		5					3			
16		2													
17				1	2		2								
18															
19															
20															
21															
Totals	3	7	0	2	9	3	55	0	1	1	3	9	0	0	0

- Of businesses who answered this question, three have some quantity of electric or hybrid cars, with a significant total of these in use.
- Diesel vans make up the majority of all vehicles used by businesses, with only 2 businesses using either a hybrid or electric van.
- Diesel use is predominant for HGVs with no electric or hybrid options.
- No businesses use any form of biofuels for vehicles.

Table 5.63 - Q28) Please estimate the numbers of each of the following vehicle types that your business uses for business transport purposes, based on the fuel source that each uses. - Results

5.1.34 Q29) Does your business have any environmental, waste management or recycling certifications or accreditations? Please select any that are applicable.

	Q29) Does your business have any environmental, waste management or recycling certifications or accreditations? Please select any that are applicable.		
	Answer	**%**	**Count**
1	WEEE compliance	66.67%	14
2	ISO 14001	76.19%	16
3	ISO 50001	4.76%	1
4	e-Stewards	0.00%	0
5	Responsible Recycling (R2) Standard	4.76%	1
6	B Corp	0.00%	0
7	Other	38.10%	8
8	Unsure/don't know	0.00%	0
9	Prefer not to answer	0.00%	0
	Total	**100%**	**21**
	- The most commonly achieved accreditation is ISO 14001 followed by WEEE compliance. - Other listed certifications were infrequently selected or not at all. - Eight respondents included other certifications in written statements. - One was attempting "EcoVadis", and another pursuing R2 and ISO 14001.		

Table 5.64 - Q29) Does your business have any environmental, waste management or recycling certifications or accreditations? Please select any that are applicable. – Results

Q29_7) 'Other' field responses
EcoVadis
ISO 9001
Carriers Licence, CPC, DGSA
450001 & 90001, carriers license, AATF
ISO9001, BSEN15713
9001
ISO9001 ISO27001
Just setting up - on the way to R2 / ISO 14001

Table 5.65 - Q29_7) 'Other' field responses
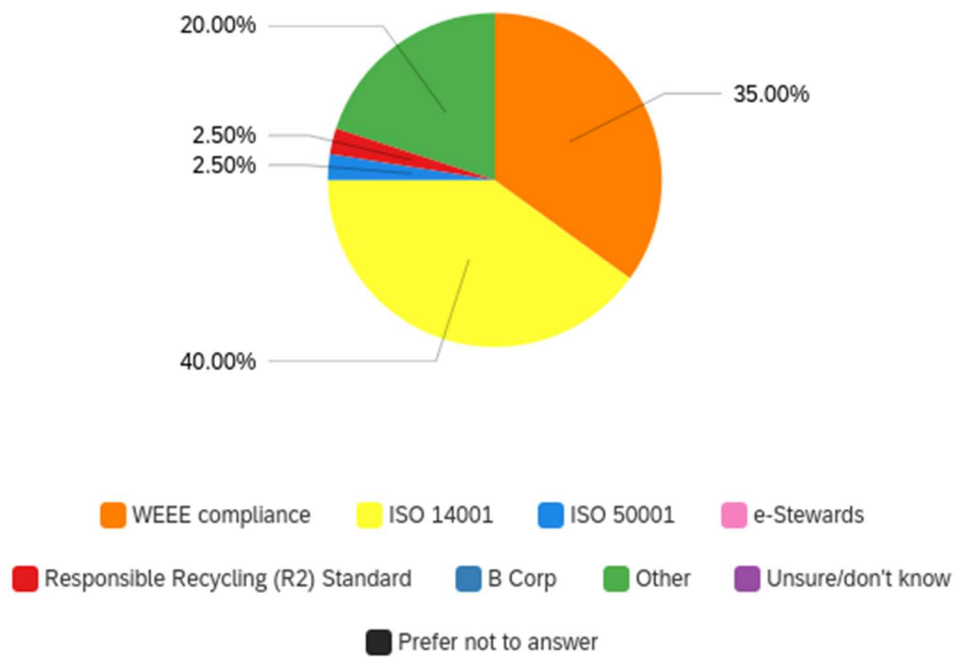
Figure 5.6 - Q29) Does your business have any environmental, waste management or recycling certifications or accreditations? Please select any that are applicable. – Histogram results

Q29 * Q8 (Has your business had its carbon footprint calculated?)

SPSS Screenshot

		Does your business have any environmental, waste management or recycling certifications or accreditations? Please select any that are applicable. - Selected Choice ISO 14001	
		ISO 14001	Total
Has your business had its carbon footprint calculated?	No	31.3%	31.3%
	Yes, the carbon footprint was internally calculated	31.3%	31.3%
	Yes, the carbon footprint was externally verified	25.0%	25.0%
	Unsure/don't know	12.5%	12.5%
Total		100.0%	100.0%

- Cross-analysis between businesses that have ISO 14001 accreditation and the proportion of businesses that had their carbon footprint calculated reveals that almost one third of businesses without any carbon calculations have this accreditation.

*Table 5.66 - Q29 * Q8 (Has your business had its carbon footprint calculated?) – Crosstabulation*

5.1.35 Q30) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) what environmental or 'eco' certifications your business has?

Q30) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) what environmental or 'eco' certifications your business has?																		
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Answer	0	0	0	1	14	30	30	50	55	57	70	80	87	90	92	92	95	96	100

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	100	54.68	37.06	1373.27	19

- The responses were highly variable for this question.
- Answers ranged from 0% to 100%, with a moderate mean estimate of 54.7% and very high variance.
- A slight peak is observed for estimates of 0%, but the frequency of customers asking this question is difficult to verify.

Table 5.67 - Q30) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) what environmental or 'eco' certifications your business has? - Results

5.1.36 Q31) Have any customers requested to view the responses to any accreditation assessments?

	Q31) Have any customers requested to view the responses to any accreditation assessments?		
	Answer	**%**	**Count**
1	If yes, please state what information your business provided to customers	28.57%	6
2	If no, please state what information your business would be willing to provide to customers	38.10%	8
3	Unsure/don't know	33.33%	7
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**
	- A third of those responded were unsure whether any customers requested to view the responses to any accreditation assessments. - The remaining two thirds were split no to yes in approximately a 57:43 ratio.		

Table 5.68 - Q31) Have any customers requested to view the responses to any accreditation assessments? - Results

Q31_1) 'Yes' field responses
ISO audit assessments
Yes but only for ISO27001
certs

Table 5.69 - Q31_1) 'Yes' field responses

Q31_2) 'No' field responses
Any
All

Table 5.70 - Q31_2) 'No' field responses

5.1.37 Q32) Does your business assess the companies within its supply and distribution networks based on their sustainability?

	Q32) Does your business assess the companies within its supply and distribution networks based on their sustainability?		
	Answer	**%**	**Count**
1	Yes, through environmental certifications	36.67%	11
2	Yes, through marketing	3.33%	1
3	Yes, through questioning	36.67%	11
4	No	13.33%	4
5	Unsure/don't know	10.00%	3
6	Prefer not to answer	0.00%	0
	Total	**100%**	**30**
	- Over two thirds of businesses assess other companies environmentally based on certifications and questioning. - A moderate proportion do not assess companies environmentally at all and almost none use marketing.		

Table 5.71 - Q32) Does your business assess the companies within its supply and distribution networks based on their sustainability? - Results

5.1.38 Q33) Does your business have any plans to gain any new environmental certifications within the next 3 years, excluding any re-certifications?

	Q33) Does your business have any plans to gain any new environmental certifications within the next 3 years, excluding any re-certifications?		
	Answer	%	Count
1	No	9.52%	2
2	Yes	52.38%	11
3	Unsure/don't know	38.10%	8
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**
	- A majority of businesses claim to be pursuing environmental certifications in the next 3 years. - There was a high degree of uncertainty within the remaining participants.		

Table 5.72 - Q33) Does your business have any plans to gain any new environmental certifications within the next 3 years, excluding any re-certifications? – Results

5.1.39 Q34) Have any customers requested further information on any plans your business has to improve the environmental impacts of its process/operations within the next 3 years?

	Q34) Have any customers requested further information on any plans your business has to improve the environmental impacts of its process/operations within the next 3 years?		
	Answer	**%**	**Count**
1	If yes, please state what information your business provided to customers	14.29%	3
2	If no, please state what information your business would be willing to provide to customers	52.38%	11
3	Unsure/don't know	33.33%	7
4	Prefer not to answer	0.00%	0
	Total	**100%**	**21**

- A majority of businesses have not been asked for further details.
- Participant uncertainty was higher than those who confirmed they had been asked for further information.

Table 5.73 - Q34) Have any customers requested further information on any plans your business has to improve the environmental impacts of its process/operations within the next 3 years? - Results

Q34_1 'Yes' field responses
Sustainability plan
Water Use / Energy Use project info

Table 5.74 - Q34_1 'Yes' field responses

Q34_2 'No' field responses
Willing to provide full details on our processes and operations
All

Table 5.75 - Q34_2 'No' field responses

Q35) Please estimate the composition of your input e-waste stream as a percentage in the last 12 months.

SPSS Screenshot

Raw data

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Ferrous metals	0	0	10	20	0	0	15	0	40	0	15	0	0	0	25	0	5	20	2	0	0
Non-ferrous metals	0	0	30	10	0	0	10	40	10	0	30	0	0	0	25	0	0	35	8	0	0
Plastics	0	0	60	10	0	0	55	20	0	0	20	0	0	0	25	0	5	40	10	0	0
Residual material	0	0	0	0	0	30	20	40	0	0	15	0	0	0	25	0	0	5	80	0	0
Total	0	0	100	40	0	30	100	100	50	0	80	0	0	0	100	0	10	100	100	0	0

Raw data plus adjusted residual (in red)

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Ferrous metals	0	0	10	20	0	0	15	0	40	0	15	0	0	0	25	0	5	20	2	0	0
Non-ferrous metals	0	0	30	10	0	0	10	40	10	0	30	0	0	0	25	0	0	35	8	0	0
Plastics	0	0	60	10	0	0	55	20	0	0	20	0	0	0	25	0	5	40	10	0	0
Residual material	0	0	0	60	0	30	20	40	50	0	35	0	0	0	25	0	90	5	80	0	0
Total	0	0	100	100	0	30	100	100	100	0	100	0	0	0	100	0	100	100	100	0	0

Raw data plus adjusted residual with incomplete data excluded

Sample (filtered)		1	2			3	4	5		6				7		8	9	10			Mean
Ferrous metals		10	20			15	0	40		15				25		5	20	2			15.2
Non-ferrous metals		30	10			10	40	10		30				25		0	35	8			19.8
Plastics		60	10			55	20	0		20				25		5	40	10			24.5
Residual material		0	60			20	40	50		35				25		90	5	80			40.5
Total		100	100			100	100	100		100				100		100	100	100			100

- A significant proportion of respondents did not answer this question.
- However, many of the estimates provided for input e-waste composition did not add up to 100% (this question format did not allow for Qualtrics software to automatically require or adjust totals to add to 100%), so an additional adjustment was made, and incomplete data was excluded.
- This suggests an estimated prevalence of residual materials and plastics in e-waste, with metals considered to be in a slight minority.

Table 5.76 - Q35) Please estimate the composition of your input e-waste stream as a percentage in the last 12 months - Results
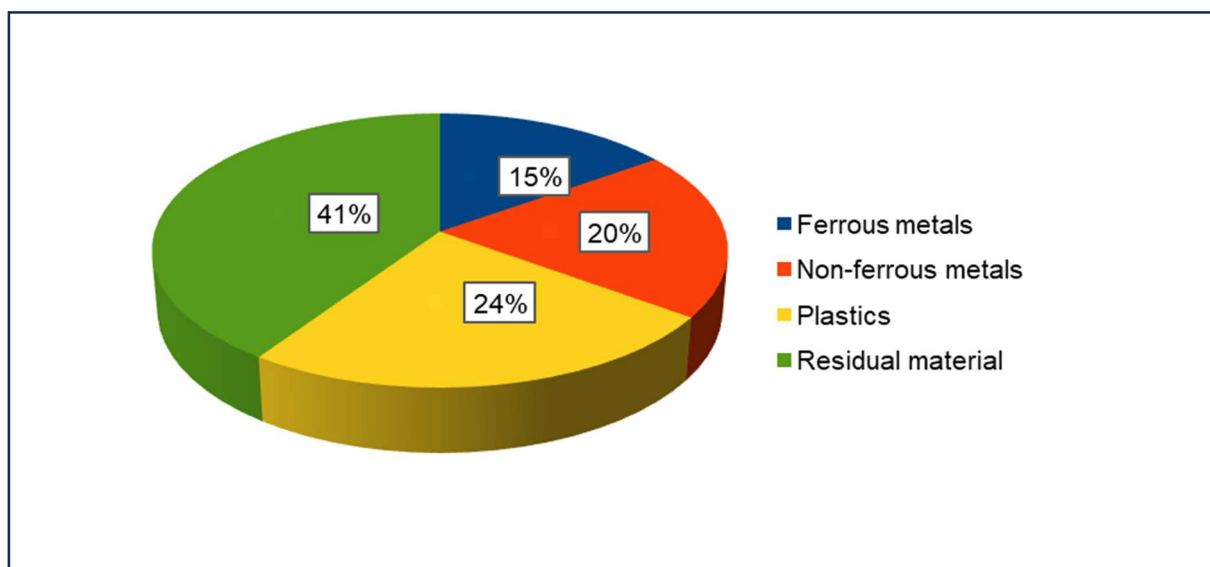
Figure 5.7 - Q35) Please estimate the composition of your input e-waste stream as a percentage in the last 12 months. – chart of results

5.1.41 Q36) Please estimate the proportion by weight of your business' input e-waste that has been passed on to further recyclers in the last 12 months.

Q36) Please estimate the proportion by weight of your business' input e-waste that has been passed on to further recyclers in the last 12 months.
SPSS Screenshot

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Answer	100	100	100	100	70	59	52	50	35	35	25	24	20	14	5	0	0

- Seventeen participants answered this question, with results showing significant variance and estimates from 0-100%.
- The mean estimated percentage was moderate at 46.4%.

Table 5.77 - Q36) Please estimate the proportion by weight of your business' input e-waste that has been passed on to further recyclers in the last 12 months. – Results

Q36 * Q1 (Please select the category which best describes your business)

SPSS Screenshot

Please select the category which best describes your business: * Please estimate the proportion by weight of your business' input e-waste that has been passed on to further recyclers in the last 12 months: - % Crosstabulation

% within Please select the category which best describes your business:

		Please estimate the proportion by weight of your business' input e-waste that has been passed on to further recyclers in the last 12 months: - %												Total
		.00	5.00	14.00	20.00	24.00	25.00	35.00	50.00	52.00	59.00	70.00	100.00	
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)	25.0%				25.0%		25.0%					25.0%	100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)		8.3%	8.3%	8.3%		8.3%	8.3%	8.3%	8.3%	8.3%	8.3%	25.0%	100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)	100.0%												100.0%
Total		11.8%	5.9%	5.9%	5.9%	5.9%	5.9%	11.8%	5.9%	5.9%	5.9%	5.9%	23.5%	100.0%

- Analysis through cross-tabulation with business categories was performed. The results showed, particularly for small businesses, that there was a very high proportion of e-waste being passed on to further recyclers within the 12 months, with an individual mean percentage for this category of 52.4%.
- This trend is notably higher than the individual mean for micro businesses at 39.8%.

*Table 5.78 - Q36 * Q1 (Please select the category which best describes your business) – Crosstabulation*

5.1.42 Q37) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output is passed on to further recyclers?

Q37) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output is passed on to further recyclers?

Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Answer	0	0	0	3	3	4	5	6	8	10	10	10	20	24	36	50	70	72	90

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	90	22.16	27.23	741.4	19

- Results for this question showed significant variance but a relatively low mean estimated percentage of customers who enquire at 22.2%, suggesting it is an infrequently asked question.

Table 5.79 - Q37) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output is passed on to further recyclers? - Results

5.1.43 Q38) Please estimate the proportion by weight of your business' input e-waste that has been sent to landfill in the last 12 months.

Q38) Please estimate the proportion by weight of your business' input e-waste that has been sent to landfill in the last 12 months.																	
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Answer	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	2	7

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	7	0.76	1.66	2.77	17

- The variance in results for this question was very low, accompanied by a very low mean estimated percentage of e-waste going to landfill at 0.8%.
- No business had an estimate higher than 7%, with the majority estimating 0%.

Table 5.80 - Q38) Please estimate the proportion by weight of your business' input e-waste that has been sent to landfill in the last 12 months. - Results

Q38 * Q1 (Please select the category which best describes your business)
SPSS Screenshot

Please select the category which best describes your business: * Please estimate the proportion by weight of your business' input e-waste that has been sent to landfill in the last 12 months. - % Crosstabulation

% within Please select the category which best describes your business:

		Please estimate the proportion by weight of your business' input e-waste that has been sent to landfill in the last 12 months. - %				Total
		.00	1.00	2.00	7.00	
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)	100.0%				100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)	50.0%	33.3%	8.3%	8.3%	100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)	100.0%				100.0%
Total		64.7%	23.5%	5.9%	5.9%	100.0%

- From cross-tabulation with business categories, all micro and medium businesses were found to send no e-waste to landfill.
- However, the majority of small businesses still state very low percentage estimates for this, with a maximum of 7%.

*Table 5.81 - Q38 * Q1 (Please select the category which best describes your business) - Crosstabulation*

5.1.44 Q39) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output goes to landfill?

Q39) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output goes to landfill?																			
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Answer	0	0	0	0	2	5	7	12	19	20	23	44	49	50	63	80	85	85	90	100

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	100	36.7	34.88	1216.51	20

- Variance in responses to this question was very high, with a moderate mean estimated proportion of customers who ask at 36.7%, and estimates ranging from 0-100%. This appears to be a moderately frequently asked question by customers.

Table 5.82 - Q39) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output goes to landfill? – Results

5.1.45 Q40) Please estimate the proportion by weight of your business' input e-waste that has been sent to incineration processes in the last 12 months.

Q40) Please estimate the proportion by weight of your business' input e-waste that has been sent to incineration processes in the last 12 months.																	
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Answers	0	0	0	0	0	0	1	3	5	10	12	17	20	20	30	34	81

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	81	13.71	19.99	399.5	17

- The mean estimated percentage is relatively low at 13.7% being sent for incineration.
- Most estimates were between 0-34% apart from an outlier at 81%.

Table 5.83 - Q40) Please estimate the proportion by weight of your business' input e-waste that has been sent to incineration processes in the last 12 months. - Results

Q40 * Q1 (Please select the business category which best describes your business)

SPSS Screenshot

		Please estimate the proportion by weight of your business' input e-waste that has been sent to incineration processes in the last 12 months - %											Total
		.00	1.00	3.00	5.00	10.00	12.00	17.00	20.00	30.00	34.00	81.00	
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)			25.0%					25.0%	25.0%		25.0%	100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)	45.5%	9.1%		9.1%		9.1%	9.1%	9.1%		9.1%		100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)					100.0%							100.0%
	Prefer not to answer	100.0%											100.0%
Total		35.3%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	11.8%	5.9%	5.9%	5.9%	100.0%

- Analysis through cross-tabulation with business categories suggests that micro businesses send a considerable proportion by weight of e-waste to incineration processes, with an individual mean estimate of 33.5%.
- For small businesses, almost 50% suggested none of their e-waste was sent to incineration, while the individual range of results for the small business category showed a lower proportion incinerated than for micro businesses, with an individual mean estimate of 8.1%.

*Table 5.84 - Q40 * Q1 (Please select the business category which best describes your business) – Crosstabulation*

5.1.46 Q41) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much of your e-waste output goes to incineration processes?

Q41) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much of your e-waste output goes to incineration processes?																		
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Answer	0	0	0	0	0	0	0	0	0	1	2	4	4	5	5	40	49	67

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	67	9.83	19.49	379.81	18

- The mean estimated percentage is low at 9.8%, and the majority of estimates falling between 0-5%, apart from 3 participants estimating between 40-67%.
- Overall, this appears to be an infrequently asked question by customers.

Table 5.85 - Q41) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much of your e-waste output goes to incineration processes? - Statistics

5.1.47 Q42) - Please estimate the proportion by weight of your business' input e-waste that has been exported overseas for further processing in the last 12 months.

Q42) - Please estimate the proportion by weight of your business' input e-waste that has been exported overseas for further processing in the last 12 months.																	
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Answer	0	0	0	0	0	0	0	0	0	0	0	1	2	5	35	40	46

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	46	7.59	15.32	234.83	17

- Variance here was relatively low, with a low mean estimated percentage of 7.6% and the majority of estimates between 0-5%, with 3 estimates between 35-46%.

Table 5.86 - Q42) Please estimate the proportion by weight of your business' input e-waste that has been exported overseas for further processing in the last 12 months - Results

Q42 * Q1 (Please select the category which best describes your business)								
SPSS Screenshot								

Please estimate the proportion by weight of your business' input e-waste that has been exported overseas for further processing in the last 12 months. - %

		.00	1.00	2.00	5.00	35.00	40.00	46.00	Total
Please select the category which best describes your business:	Micro business (less than 10 employees and an annual turnover under €2 million)	75.0%						25.0%	100.0%
	Small business (less than 50 employees and an annual turnover under €10 million)	54.5%	9.1%	9.1%	9.1%	9.1%	9.1%		100.0%
	Medium business (less than 250 employees and an annual turnover under €50 million)	100.0%							100.0%
	Prefer not to answer	100.0%							100.0%
Total		64.7%	5.9%	5.9%	5.9%	5.9%	5.9%	5.9%	100.0%

- Analysis through cross tabulation with business categories established that at least micro and small businesses are both exporting some of their e-waste overseas for further processing, with individual mean estimates of 11.5% and 7.6%, respectively.
- The sample size is too small to assess medium businesses.

*Table 5.87 - Q42 * Q1 (Please select the category which best describes your business) - Crosstabulation*

5.1.48 Q43) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output is exported overseas?

Q43) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output is exported overseas?																
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Answer	0	0	0	0	0	0	0	0	1	2	5	6	10	17	18	48	67

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	67	10.24	18.46	340.65	17

- The mean estimated percentage is low at 10.2% and most estimates are between 0-18%, with outliers at 48% and 67%. Overall, this appears to be an infrequently asked question by customers.

Table 5.88 - Q43) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output is exported overseas? - Results

5.1.49 Q44) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how your business handles hazardous waste materials?

Q44) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how your business handles hazardous waste materials?																		
Sample	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Answer	0	0	5	5	9	15	19	20	35	41	46	50	50	50	55	67	76	81	98

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
%	0	98	38	28.71	824.11	19

- The responses show high variance but there was a relatively high mean estimated percentage of 38%, with estimates ranging 0-98%.

Table 5.89 - Q44) Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how your business handles hazardous waste materials? - Results

5.1.50 Q45) Have any customers requested the weights of e-waste output sent to landfill, further recyclers, incineration and overseas?

Q45) Have any customers requested the weights of e-waste output sent to landfill, further recyclers, incineration and overseas?		
Answer	**%**	**Count**
1	Yes (please state what data your business provided to customers)	35.00%	7
2	No (please state what data you would be willing to provide to any customers)	35.00%	7
3	Unsure/don't know	30.00%	6
4	Prefer not to answer	0.00%	0
Total	**100%**	**20**

- Six participants were unsure, creating some uncertainty, with an equal proportion of businesses stating that customers had and had not asked for specific weights of e-waste going to these areas.

Table 5.90 - Q45) Have any customers requested the weights of e-waste output sent to landfill, further recyclers, incineration and overseas? - Results

Q45_1) 'Yes' field responses
%'s
Mass balance downstream info
certs

Table 5.91 - Q45_1) 'Yes' field responses

Q45_2) 'No' field responses
Data available and full details on website
All data collected

Table 5.92 - Q45_2) 'No' field responses

6   Discussion

Of 129 businesses approached, 21 businesses in total who refurbish and recycle IT equipment chose to participate in the study and complete the survey. The survey was designed to establish the areas for concern around greenwashing for IT refurbishment and recycling businesses.

6.1   Study demographic

The general demographic of the participating businesses was found to be primarily small IT refurbishment and recycling businesses with less than 50 employees and an annual turnover under €10 million. As such, the majority of them may share similar experiences and challenges as the case study. Equally, the information gathered from this study may be applicable to SMEs within e-waste recycling or refurbishment specifically as well as those within other sectors of the IT industry.

While there were a significant number of micro businesses participating in the study, very few medium and no large businesses took part. This could suggest IT recycling within the UK is dominated by, or more accessible by, smaller businesses and that there are fewer larger-scale e-waste processing facilities available. However, many large businesses contacted did not respond or chose not to participate in the study, affecting the overall spread. It may be that the sheer scale, reduced ease of information transmission and level of activity at larger companies contributed to this absence. Some large businesses specifically stated that they did not participate in research, instead pointing to their own annual reports or other published data for researchers to use. There is also a possibility that SMEs, particularly small businesses, have more of a genuine vested interest in sustainability or alternatively that they rely more on visible sustainable action as an external measure of their performance. However, the overall proportion of businesses approached which participated is low (16.3%), suggesting a possible reluctance to or lack of prioritisation of providing information on sustainability.

6.1.1 Environmental marketing

As anticipated, of the businesses participating, the vast majority (95.2%) have policies relating to environmental sustainability in place. This does not indicate the stringency of any policies, the motives for their implementation or whether they are mandatory

through regulations or voluntary. Most businesses (85.7%) have made their environmental credentials a focus of their marketing to customers. Drivers for this may be the pursuit of a competitive edge, pressure to act sustainably from society and media, as well as the government call for SMEs to work towards net-zero emissions (Department for Business, Energy & Industrial Strategy et al., 2021). Also, as environmental impact is arguably a critical measure of performance for recyclers, businesses may be responding to this external expectation and pressure for high sustainability standards to be upheld. The case study shows a strong commitment to sustainability but also uses environmental marketing for a competitive edge. However, environmental marketing opens the potential for greenwashing, so any claims made need to be evidenced carefully. Relatively few businesses stated that their marketing was not focused on environmental credentials, which could indicate low priority given to sustainability. However, the fear of appearing to be greenwashing or a reticence to falsely overemphasise these credentials are possible explanations. Additionally, as some businesses may focus more on refurbishment than recycling, they may instead have a higher focus on the marketing of the refurbished products they sell and their disposal and data security capabilities.

6.1.2 WEEE intake

Most businesses claimed to have a process dedicated to e-waste processing or recycling, which was also backed up by the high selection of WEEE category 3 (IT equipment) and indicates an absence of multi-purpose general recyclers participating. However, other WEEE categories were selected with no apparent trend, suggesting many businesses apply their processes to more than just IT-specific WEEE. These findings were reflected in the wide intake of WEEE items accepted by the case study, Rapid IT. For many businesses, diversification of WEEE intake may be necessary to remain competitive.

6.2 Recycling

6.2.1 Further recyclers

Some significant findings came out of the results within the e-waste recycling section. The first is that a substantial proportion of the e-waste that businesses collect on average is passed on to further recyclers (46.4%), particularly in the case of small businesses, with an individual mean percentage for this category of 52.4%. Rapid IT

distributes a significant proportion of e-waste components to approximately 10 further recycling vendors. This is necessary due to the complexity and variety of materials present in IT equipment alone which requires specialist processing for effective recovery and potentially many further recycling stages. However, passing e-waste on brings a risk potential for greenwashing, as traceability at the next recycling stage may be impaired, leaving doubt about the treatment and end-destinations of materials by downstream recyclers and the presence of greenwashing. The lack of a guarantee of sustainable practice could result in unknown quantities of material being incinerated, exported, potentially illegally where it may not be recovered, or reaching landfill sites. This is not to suggest that the businesses which pass on recycling material are complicit in greenwashing, however, the nature of this system makes it liable to the risk of greenwashing through unverifiable claims or through poor environmental impacts from downstream recyclers.

6.2.2 Landfill

Rapid IT, along with many of the businesses initially approached, claim to uphold zero waste-to-landfill policies on their websites. Participant estimates of e-waste being sent to landfill were found to be very low on average at 0.8%. which is consistent with this. Small businesses were responsible for all non-zero percentages going to landfill. While small businesses estimate minimal landfilling, the fact that non-zero data has been input suggests that some acknowledge that their process may not be entirely zero waste-to-landfill. This is a substantial finding that highlights a disparity with the results that approximately 50% of e-waste is estimated to be sent to further recyclers. This confidence from most businesses that less than 1% of e-waste is sent to landfill does not appear to be well-founded. While the businesses may believe this to be true because they do not directly landfill e-waste themselves, there is a strong possibility for downstream recyclers to send unknown quantities of e-waste to landfill, potentially greenwashing upstream recycling customers such as Rapid IT through deception about these quantities. This may negate the validity of any zero waste-to-landfill claims and so full verification of landfilled e-waste quantities is needed for customer assurance.

6.2.3 Overseas export

A similar trend was found with the WEEE percentages by weight exported overseas for further processing with a low estimated mean of 7.6%. It is assumed here that businesses are exporting WEEE or EEE through legal routes, however it is known that illegal export is taking place on a large scale (Malloi, 2021). The results suggest that businesses are confident that while overseas export does occur, at higher levels than landfilling, the quantities of e-waste exported are minimal.

Low levels of exportation can be viewed positively, as once e-waste has been exported overseas, traceability is reduced, potentially more so than in the case of UK-domestic further recyclers. However, this finding highlights the disparity between estimates of low exportation and high distribution to further recyclers of e-waste. Potential greenwashing issues arise if traceability from downstream recyclers is low. They may end up exporting a significant proportion of e-waste internationally to further processing facilities at best, and at worst, to landfill and rudimentary incineration sites, causing harm to the environment and health of the local population. As such, claims of ethical exportation of repairable e-waste need to be backed up with full evidence of end-destinations in order to reduce the risks of greenwashing.

It is unclear what necessitates this export of e-waste, and questions are raised, such as the reasons that this material is not being processed in the UK and whether or not the UK has the necessary processing facilities to effectively deal with this e-waste. The question also arises as to what the specific components or materials being exported are. The case study business encountered some difficulties when attempting to establish which of its prospective downstream recyclers keep e-waste and metals within the UK, suggesting that this information is not necessarily readily available from recyclers within the industry, even for other recyclers, along with domestic customers.

6.2.4 Incineration

Participant estimates of e-waste sent to incineration were slightly higher than for landfill or exportation at 13.7% on average. Although destruction, often through incineration, is mandated for e-waste containing persistent organic pollutants (POPs), one business estimated as high as 81% of their input e-waste going to incineration, which is not considered representative of the study group, but does indicate that some businesses are incinerating a considerable quantity of their input stream. Rapid IT, like

many participating businesses, do not appear to have any publicly stated policies on incineration.

While under strictly controlled conditions, incineration may divert WEEE from landfill and generate energy, overall, it can be considered an inferior option to recycling and recovery of materials and so should be minimised wherever possible. It is possible that more than just e-waste containing POPs is being incinerated by the businesses. Furthermore, the high proportion of e-waste sent to downstream recyclers means that even if these businesses are not directly sending substantial e-waste quantities to incineration, there is significant ambiguity around the quantities sent to incineration by downstream recyclers, which could involve multiple stages of recyclers. Additional unnecessary incineration may be performed at any stage to reduce the financial burden of processing e-waste and dispose of it more efficiently. It remains unclear if participating businesses have established the quantities of e-waste that downstream recyclers send for incineration, which is information that should be available to all customers. Without this information, the true quantity of e-waste reaching incineration may be unknown and unverifiable and greenwashing from any recyclers who unknowingly under-report in good faith the amount being eventually incinerated is a risk.

6.2.5 Summary of findings from end-destinations for e-waste

As noted previously, the evidence of e-waste being exported, sent to landfill or incineration does not directly equate to any greenwashing, as there are known limitations to the processing available for e-waste. However, it is noteworthy that many businesses have confidence that minimal e-waste is being sent to any of these destinations when a significant quantity of their e-waste output is being sent to further recyclers, where traceability is at risk of being diminished through greenwashing. Additionally, if recyclers at any processing stage send even small quantities to these destinations, whether this is disclosed or not, the total adds up considerably. As a result, refurbishment businesses may put themselves at a risk for indirect greenwashing if their claims cannot truly be verified as genuine.

Based on this, selecting a recycler with minimal e-waste sent to landfill, incineration or overseas export is advisable for the best environmental impact. However, in order to minimise greenwashing risks, the infrastructure is required for businesses to

confidently back claims of low outputs to landfill sites, overseas and incineration with end-to-end traceability of downstream recycling destinations and recoveries wherever possible. Realistically, this may require full end-to-end tracking of all e-waste in one integrated system that has the capability to eliminate greenwashing discrepancies in quantities.

6.2.6 Authorisation to treat e-waste

Notable findings came out of the results and cross-tabulation analysis for businesses which are AATFs, ATFs or neither. The initial finding was that only 9.5% of businesses were confirmed to be ATFs, with the remainder relatively evenly split between AATFs (38.1%) and those businesses which were neither (42.9%). The prevalence of businesses without AATF or ATF status could suggest that many may be performing no treatment of WEEE whatsoever. Cross-analysis was focused on the differences between AATFs and those with no authorised status. AATFs were found to be 30% more likely than non-authorised businesses to have produced a net-zero carbon plan for 2050, and while the proportions of both which have had any type of carbon footprint calculation performed was approximately the same, AATFs were more likely to have had an external audit done versus non-authorised businesses, which showed a higher probability of internal calculations. However, it was found that 37.5% of AATFs had not had a carbon footprint calculated, with the same proportion who had not produced a carbon plan. Bearing in mind their relatively high level of environmental authorisation, this is a somewhat surprising result.

In terms of recycling practices, AATFs had lower average proportions of e-waste sent to further recyclers than non-authorised businesses (41.6% and 53.3% respectively), but some AATFs still estimated as much as 70% and 100% being sent to further recyclers. However, when assessing proportions of e-waste sent to landfill, the vast majority of AATFs stated 0% while non-authorised businesses stated a wider range of estimates from 0-7%, which possibly indicates more uncertainty in the end-destinations of WEEE for this group. Excluding an outlier estimating 81%, AATFs generally estimated a much lower proportion of WEEE sent to incineration processes than non-authorised businesses, with 57.1% of AATFs stating 0%. Non-authorised businesses displayed a wider range of estimates, further supporting the idea of higher uncertainty in WEEE end-destinations from this group. The findings for proportions of

WEEE exported overseas show a marked contrast, with some AATFs estimating export of as much as 46%, versus a maximum of 5% for non-authorised businesses. 75% of this group stated that 0% was exported versus 57.1% of AATFs, suggesting that while many businesses in general do not export, some do, particularly AATFs who appear to rely on exportation more heavily. This raises questions about this disparity and the reasoning behind it.

6.3   Carbon

6.3.1   Footprint calculation

There were several key findings around business attitudes to carbon management. Despite the expectation that recyclers are forward-thinking companies committed to sustainability, the initial finding was that 33.3% of the businesses have no awareness of their carbon footprint, with an additional 14.3% who were unsure. Further analysis showed that 27.8% of businesses which have environmentally focused marketing also have not had any carbon footprint calculations. Having some form of carbon emissions measurement is arguably a critical first step in addressing sustainability within business. The results could be attributed to a lack of prioritisation of substantive sustainability despite the use of environmental marketing. However, it is possible that businesses believe the process of recycling and reusing IT equipment is sufficient to warrant marketing of an overall positive environmental impact.

6.3.2   Internal or external calculation

Of the participant study group, 28.6% had carbon emissions calculated internally while 23.8% had their footprint externally calculated and verified by a third party. Further analysis against business categories demonstrated that small businesses were twice as likely to have had an internal carbon calculation in comparison to an externally verified calculation, with 46.2%, of all small businesses having opted for an internal calculation. Almost a quarter of small businesses had an external audit, but the same proportion had not had any calculation of their carbon footprint whatsoever. While the sample set for medium businesses is too small to accurately assess, there appears to be a possible trend between micro and small businesses that the larger the business,

the more likely to have had the carbon footprint calculated, however this would need to be verified with a larger sample of micro businesses.

The effectiveness and quality of an internal calculation could be considered to be largely dependent on its rigour, assumptions made and boundaries of emissions scopes. If these are not approached responsibly, greenwashing could occur. The frequency of internal carbon calculations performed was found to be more consistent and regular than for external calculations, with 83% of internal calculations performed annually versus 20% annually for external calculations and a wide spread of other frequency results from more than once a year to less frequently than 3 years. This may be explained by the higher costs of an externally verified footprint, which may necessitate less frequent audits for some businesses. In contrast, internal calculations may consume some time from an employee, but will likely involve lower costs. However, these results could also reflect the quality and thoroughness of carbon measurements made, with external calculations requiring more resources and dedication to complete. An externally verified calculation is performed through a standardised method by a trained, qualified professional and approved through a third party, providing additional assurance. In this way, the likelihood of greenwashing may be significantly lower, providing that the auditing authority and auditor are performing their roles properly.

However, while an externally verified footprint provides additional assurance, it may also highlight issues that businesses do not want to address. Conversely, internal calculations could allow businesses some degree of control and influence over the final results through manipulation of scopes and boundaries. While internal calculation may arguably be considered better than no calculation, the lack of supporting information to establish how and to what extent the calculations were performed raises the risk of greenwashing, along with the lack of oversight and external verification from a trusted third party. In addition, the training and knowledge of those conducting internal audits for their business may not be possible to establish, with the potential for unintentional greenwashing to occur as a consequence of inexperience.

The costs of an external calculation may be off-putting for some businesses. Businesses may also have a qualified auditor, sustainability consultant or other environmental person employed who can competently perform this task, so internal

calculations do not necessarily reflect any lower quality of audit, but they do create more uncertainty around the potential for greenwashing.

Overall, evidence of any carbon footprint measurement may be considered a positive sign of engagement, but the quality of the audit should be investigated in order to verify this. As a high-level study evaluating greenwashing risk factors and criteria, this would be a recommended area of future studies. Rapid IT has had external carbon assessments performed and could therefore be seen to be in a minority of businesses which perform more responsibly.

6.3.3 Carbon plan implementation

The results show that 42.9% of participating businesses have created a carbon net-zero plan for 2050. Given the recognised importance of a plan for emissions reduction containing concretely defined and time-focused targets, it is commendable that many businesses have already adopted goals for net neutrality. These results may indicate that some businesses are attempting to go to additional lengths to ensure their commitment to sustainability, as well as to demonstrate this visibly to customers and stakeholders. However, this is still not a majority which might give cause for concern. A carbon plan can be seen as an effective way to drive and demonstrate improved sustainability, but only if the business engages with it. Otherwise, it is merely environmental communication without substantive actions behind it.

For businesses without a plan, this may be indicative of a lack of priority given to emissions reduction or sustainability in general. However, awareness about government and international climate-change initiatives or their applicability to SMEs may be lacking in these businesses. Secondly, an awareness of how to produce or implement a plan may be lacking, or businesses may find the concept overwhelming, particularly if they are conscious of avoiding greenwashing accusations. An initial carbon plan has been produced for Rapid IT. However, the complexities of determining which measures will create a meaningful impact and in making predictions about future growth are challenges that the business face, particularly given the available resources as a small business.

Concerningly, it was found that 44.4% of businesses which engage in environmental marketing have not created a carbon plan. For these businesses, there are more

substantial concerns about the potential for greenwashing. For the businesses which have both environmental marketing and a carbon plan, further investigation would be required to assess the veracity of their plans.

An additional finding was that larger businesses may be more likely to have created a carbon plan. No micro businesses reported having a plan in place, while 53.8% and 100% of small and medium businesses did, respectively. While larger sample sizes would need to be researched for confirmation, this could indicate that smaller businesses have insufficient resources to allocate to additional, non- 'work' activities, such as production of a plan. Alternatively, larger businesses may experience more external pressure or have more awareness of climate-change initiatives and the importance of emissions reduction.

A significant disadvantage of businesses not having a carbon plan in place is that customers have limited ability to assess and monitor the progress towards reduced carbon emissions over time. It was found that businesses who have had carbon footprints calculated had a 45-50% (depending on the emission calculation method used) higher likelihood of having already created an action plan for the goal of net-zero carbon emissions by 2050, in line with government targets. It is apparent that without some measure of a baseline carbon impact, goals for reducing emissions to neutrality cannot be developed, so this is expected. However, it may suggest that having a carbon footprint calculated could encourage businesses to take additional actions and create a plan to deal with carbon, rather than leave an established emissions value unaddressed.

6.4   Renewable electricity use

It was found that having any form of carbon calculation was associated with a 25-35% higher probability of also having adopted on-site renewable energy generation. As IT refurbishment involves the regular use and soak testing of IT equipment, it is likely that electricity consumption could be relatively high among these businesses. As a result, renewable electricity generation may be an advantageous consideration for any which are looking to reduce carbon emissions, with the added advantage of a potential long-term saving over grid electricity costs. This combination of environmental and financial benefits could explain renewable technology adoption, which was found to be one of

the more common measures taken to counter energy use and emissions, selected by a third of the businesses. The case study business installed solar panels based on the recommendations of a previous audit conducted for them. The business found that their large roof-area, unobstructed sky and low electricity requirements made this a viable option for emission reductions.

However, having a carbon plan in place resulted in approximately 20% lower probability of having on-site renewable generation for participating businesses. It may be that the initial capital costs of installation along with the physical space requirements are barriers which may present many SMEs, particularly small and micro businesses with some logistical issues. It may also be that businesses which create carbon plans have assessed these factors and determined that renewable generation is not feasible for them or would not offer the most substantial carbon reduction for the investment required currently. Alternatively, lack of adoption could be interpreted as apathy towards or a lack of prioritisation of emissions reduction.

6.4.1 Renewable electricity tariffs

In the absence of renewable generation, it would be important to see other alternatives evaluated or implemented by a business. One such alternative is renewable grid electricity supplied through a green tariff used by 42.9% of businesses. Implications of using different renewable electricity supplies has already been discussed within this thesis. A significant proportion of businesses at 52.4% were unsure of how renewable their utilities are. More concerningly, over 80.9% of businesses were unaware or unsure of the use of REGO certificates in electricity supplies and of businesses that have a green electricity tariff, this proportion was still over 66%. The case study is among businesses that were not aware of the use of REGO certificates despite using a REGO-backed green electricity tariff. This points to a widespread lack of awareness in this cross section that warrants a need for further research. While potentially less substantial in impact at 9.5%, other forms of renewable utility tariffs show very weak adoption, which may be explained by the sheer number of options available for green electricity.

The implications of this are that the uptake of renewable energy generation as well as the awareness of alternative options could be improved. Care needs to be taken in

verifying the source of electricity as well as use of it in order to prevent greenwashing through claims of use of renewable electricity.

6.5 Business vehicles

While many businesses did not provide data on the vehicles they use, the businesses which did indicate a relatively low uptake of electric or hybrid cars. The 14.3% of businesses who claimed to have some quantity of electric or hybrid cars did have a significant total of these in use. However, diesel vans make up the majority of all vehicles used by businesses, with only 9.5% of businesses using either a hybrid or electric van. Diesel use is predominant for HGVs with no electric or hybrid options. This may be due to the high availability and versatility of diesel vans. Electric vehicles are a constantly developing technology with complications to consider and there are considerably less options for larger electric vehicles, especially HGVs. No businesses use any form of biofuels for vehicles. This may be due to the requirement for delivery and storage of many biofuels. The case study is among a very small proportion of businesses which own and use an electric van, and are also exploring the use of biofuels, which is not seen to be adopted within the study results.

6.6 Carbon monitoring

Other areas where businesses might be addressing their energy consumption and carbon emissions were explored in the study. Carbon emissions monitoring software was not confirmed to be used by any of the businesses, despite the high rate of internal carbon footprint calculations performed (Question 8), suggesting that they may do manual and non-continuous calculations more periodically. It is possible that businesses are not aware of the availability of basic carbon-tracking tools. Despite not being a panacea due to the inability to account for more difficult emission sources, having some form of basic emission tracking software may provide at least a low-level of assurance that emissions are within a targeted level, and allow recyclers to both set and monitor the progress of any goals to reducing these emissions. However, as with internal audits, use of emissions monitoring software could be open to greenwashing through manipulation if results are not verifiable and published transparently.

6.7   Energy management

Energy management systems were only confirmed to be adopted by 9.5% of businesses. However, there is some engagement with this measure unlike carbon monitoring software. This could be due to the fact that lower energy consumption is not only associated with reduced carbon emissions, but also with lower energy costs, making this financially advantageous for some companies. However, the number who have these features implemented is very low and the case study is among businesses which do not use any energy management systems currently. Many smaller businesses may not require energy management systems in order to reduce their energy use, due to smaller, simpler buildings that could be managed more efficiently through behavioural modifications.

6.8   Carbon offsetting

The use of carbon offsetting was anticipated to be similar to that of energy management systems and carbon monitoring. Carbon monitoring and energy management tools potentially allow for businesses to take actions towards emission reduction, rather than passively offset existing emissions. However, offsetting was found to be significantly more popular with 33.3% of participating businesses reporting use (though this was even higher for solely small businesses at over 50%). Despite 61.9% not using any, this remains a significant finding. An explanation for their higher popularity may be that offsetting could be seen as a quick, easy option which can be dealt with by software or an external organisation. However, without any guarantee of the success of offsetting programs, use may put businesses at risk of greenwashing, and ultimately not being responsible for their own emissions. As previously highlighted, there is uncertainty around the efficacy of offsetting and the practice cannot necessarily remove or negate emissions, so should not be used to justify emissions staying the same or allowing for even higher emissions.

However, most businesses surveyed overall still do not appear to use offsetting. This may be partially due to a lack of awareness of the schemes, as of those that do not use any, 38% do not know or are unsure of differences in offsetting impacts and techniques. Of the approximately 60% that do not use the schemes but are aware of differences, this may suggest that they have concerns about offsetting efficacies, greenwashing or accusations of it. An alternate explanation is that as refurbishment

and recycling businesses, they already view their operations as inherently providing an offset to any carbon emissions they produce, due to the diversion of e-waste from landfill that they deliver. This theory is partially supported by additional written statements provided regarding offsetting, which asserted "We are innately decarbonising anyway when listed next to the incumbent process" and "Calculation of carbon offset for reused devices based on the average carbon emissions to produce an equivalent new device.", implying a belief that offsetting should be based solely on the recycling of IT equipment or e-waste itself, rather than any additional carbon emitted during processing of e-waste.

6.8.1 Awareness of offsetting impacts

A significant finding about the use of offsetting was that of those businesses that do offset their carbon, a considerable total of 42.9% are either unaware or unsure of the differences in carbon offsetting scheme impacts and calculation methods. It might be expected that businesses using offsetting would typically be more aware of the differences in schemes, particularly when there are associated costs to consider. This may raise an increased risk of greenwashing for unaware users, as without suitably assessing the criteria on which each offsetting program is based and verifying that initiatives are successful, there may be no guarantee that emissions are genuinely being offset.

6.8.2 Carbon offsetting and footprint calculation

Crucially, additional analysis shows a 46.7% increase in use of carbon offsetting by those who internally calculated their carbon footprint versus those who had it calculated externally. This connection may support a theory that some businesses group these activities together, as actions which can be taken independently of external audits and approvals and allow businesses to take control of carbon management easily and internally, using invoices, minimal supply chain details and other relatively accessible data. More cynically, this could allow some businesses to exploit the less-verifiable nature of internally calculated carbon emissions, choosing the boundaries of their measurements, with offsetting providing a low-effort, low-cost response to the pressure to reduce emissions.

A final finding is that 14.3% of businesses offset their carbon despite having not had a carbon calculation and thus not being aware of their business carbon footprint. One

explanation for this may be that these are the minority of participants who wrote statements suggesting that carbon offsetting is inherently built into IT recycling and refurbishment. However, this does raise concerns and risks of greenwashing for a minority of businesses if there is any marketing of offsetting efforts.

The case study has utilised and relied on carbon offsetting to calculate emissions and believes that by offsetting, its impact could be considered effectively 'net-negative', with more emissions offset than are being released. If any claim of this belief were made to customers, it could be considered greenwashing, especially when considering the lack of evidence for successful offsetting to have occurred through the scheme used.

From this analysis of carbon offsetting activity, carbon offsetting can be seen to have potential merits for combatting and encouraging a reduction in carbon emissions. However, the risks of greenwashing through reliance on vaguely defined or poorly-performing offsetting schemes require that details of schemes and initiatives be made available and verified independently in order to evaluate the effectiveness of efforts and any specific risk factors for greenwashing.

6.9   Customer questions

Some of the most important findings came from the questions that customers of recycling businesses are found to ask most and least frequently. Generally, the results showed that on average, no more than 40-50% of customers over all of the customer response questions listed, supporting the idea that further awareness and responsibility from customers is needed in order to demand details and encourage change. One explanation for a lack of customers asking may be that depending on the business, some of the required information may have already been displayed on their website or media outlets. However, it is possible that customers assume that recyclers must be 'experts' when it comes to environmental considerations and put sufficient trust in them to not ask questions. Additionally, some customers may assume that environmental certifications must mean that all impacts have been assessed and approved by an independent authority, so must be legitimate. Another consideration is that businesses which are willing to answer these questions are more expensive, so customers looking for an environmentally conscious recycler will compromise and

accept whatever environmental certifications or 'stamps-of-approval' that come with the most economical recyclers. Potentially, the majority of customers are not invested in sustainability or are not drawn to particular recyclers based on it.

The most frequently asked questions were basic enquiries about recycling and refurbishment, such as how the business handles hazardous waste materials which is asked by an estimated mean of 38% customers, how much e-waste output goes to landfill at 36.7% and how much e-waste is successfully refurbished at 35.8%. Enquiries about hazardous waste were anticipated to be relatively common and should arguably be the focus of any responsible customer.

6.9.1 Enquiries regarding WEEE end-destinations

Enquiries about the amount of e-waste refurbished were one of the more frequently asked questions by an average of 35.8% customers. This makes sense as a more primary focus of customers, with refurbishment metrics serving as an indicator of both business and sustainability performance simultaneously. It is also potentially a simple measure of impact for customers to assess on a surface basis, as the numbers required to understand it are limited, often measured in the number of computers or devices refurbished or the effective carbon saving of refurbishing a certain quantity of computers versus building an equivalent quantity of new equipment. 57.1% of participating businesses also stated that customers have requested evidence of the end-destination of all materials collected and recycled by them. This could likely be for environmental reasons as the end destination is a measure of the overall process sustainability. However, greenwashing from downstream recyclers may pose a threat to the reliability of this information.

Landfilling appears to be a similarly important consideration for customers on average, with a mean of 36.7% customers enquiring. This is further validated by 35% of businesses stating that customers have requested the weights of e-waste output sent to landfill, incineration or exported at some point. However, the proportion of customers who ask specifically about incineration and overseas export of e-waste was found to be significantly lower, with estimated means of 9.8% and 10.2%, respectively. It may be that customers are more aware of landfilling practices than incineration and export, considering landfilling has historically been the default disposal practice.

Additionally, the WEEE regulations are particularly focused on minimising landfilled e-waste.

In order to comply with WEEE regulations and demonstrate themselves as committed to sustainable practices, it is both necessary and desirable for customers of recyclers, particularly other businesses and organisations, to be able to claim that the obsolete IT equipment and e-waste they dispose of is being recycled as much as practicable rather than landfilled. This may explain an additional pressure for recyclers to implement policies for and claim zero waste-to-landfill.

For overseas export, the practice is legal and approved through UK WEEE regulations as long as the waste material is destined to be repaired (Environment Agency, 2023). In this sense, this practice may be relatively familiar to customers and considered integral to recycling, causing them to ask less frequently. However, the decreased traceability of overseas export presents increased greenwashing potential and risks, and this can become an issue of greenwashing when customers do not request sufficient information about how e-waste is being treated. A final possibility is that customers assume export or incineration does not take place.

The results showed that customers ask slightly more frequently about whether e-waste is passed on to further recyclers, with an estimated mean of 22.2% of customers, however it is evidently not a common question. As discussed previously, the practice is necessary and not inherently associated with greenwashing, but the fact that more customers are not asking about it suggests that they may be unaware of the greenwashing potential from downstream recycling.

6.9.2 Enquiries regarding carbon

Questions from customers relating to the carbon emissions and energy consumption of recycling businesses were found to be some of the least frequently asked, with enquires about the renewable status of business energy and utilities only being asked by an average of 4.6%, of customers. This is a relatively basic question to ask of a prospective recycler during assessment, and one that provides a concrete example of a recycler attempting to reduce their impact, even with the challenges of uncertainty and greenwashing from green utilities.

It was found that a third of participating businesses had been asked at some point about what they have done to address the energy use and carbon footprint of their process or operations. However, a differently phrased question found that only 12.9% of customers on average ask this question. This was expected to be a regular request from customers. It may be that customers view recycling as sufficient in countering energy use and carbon emissions. A possibility is that customers do not in fact prioritise carbon reduction.

When asking businesses how many customers enquire about carbon footprint calculations, only 11.9% on average of customers were estimated to ask. Similarly, when asked if any customers had requested the results of any carbon calculations, only 14.3% of businesses said that customers had. It might be expected that a prospective customer company would be interested in assessing recycler emissions, a recycler's openness to providing this sort of information, or in using this information for calculation of their own scope 3 emissions. The results imply that customers may not be focused on carbon emissions or in a recycler's response to emissions.

Similar estimates were gathered for the proportion of customers who ask whether businesses have carbon plans for net-neutrality by 2050 (13.2%) or about any plans the businesses have to improve the operational environmental impacts within the next 3 years (14.3%). Of businesses which have implemented carbon plans, some may already have marketed this so that customers do not need to ask. It was expected to see higher percentages here due to the government push behind the net-zero by 2050 initiative for SMEs (Department for Business, Energy & Industrial Strategy et al., 2021). It is possible that customers are not looking for a long-term business relationship and are therefore not concerned with future business initiatives, just the current state of operations, however results for customer enquiries about carbon emissions overall suggest a general lack of awareness or disinterest.

6.9.3 Enquiries regarding certification

There was a notable increase in the estimated proportion of customers who request to view the responses to any accreditation assessments held by businesses, with a mean of 28.6%. While still not asked by a majority, some customers appear to value sustainability certification assessments substantially more than emissions-based performance measures. Being able to view the specific details of these assessments

would provide additional assurance to customers. It may be that accreditations and certifications are considered an easier way of measuring each business' environmental standards or that third-party assurance of environmental standards is something some customers value highly in order to ensure reliable standards and reduce the risk of greenwashing.

From the data available, questions that relate more directly to the reduction of carbon emissions from the businesses appear to be less-frequently considered and posed to recycling businesses by customers, suggesting a lack of awareness and focus in this area.

6.10 Certifications

The most significant finding from the investigation of environmental certifications held by participating businesses was that two thirds (14) hold ISO 14001, making it significantly more popular than any other environmentally related accreditation. The case study holds ISO 14001 as its only environmental certification currently. With evidence linking its use with limited environmental improvement or in some cases greenwashing (Testa, Boiral and Iraldo, 2018), this is of some interest. It was also discovered that businesses which had no carbon footprint calculation were equally as likely to have the accreditation, meaning that over a third of businesses who have ISO 14001 do not have any idea of their carbon footprint. This raises concerns for a risk of greenwashing, or at least a lack of environmental awareness.

Other possible options were the WEEE-specific recycling certifications 'Responsible Recycling (R2) Standard', selected once and 'e-Stewards', which no businesses selected. It was expected to see more uptake of these certifications, raising questions as to why they are not more widely adopted. The case study is currently pursuing an e-waste recycling certification, which could distinguish it within the UK WEEE industry. It may be that most businesses are unaware of the existence of these certifications. It may be that the associated costs and additional work and stringency of the certifications are off-putting, especially for businesses with existing certifications to maintain. Alternatively, it may be that due to being relatively less well-known than accreditations like ISO 14001, businesses do not believe attaining these certifications will have any benefit in terms of influencing customers. ISO 50001, an energy

management accreditation, was only selected once, which again, may be due to the relative popularity of ISO 14001, which is also more of a general environmental accreditation.

6.11 Criteria for assessing greenwashing risks from WEEE recyclers

Based on the original areas under investigation and the responses and extrapolated results gathered from IT recycling and refurbishment businesses, a framework of criteria has been produced for customers, traders and smaller refurbishment businesses such as Rapid IT who may need to use the services of another recycler. The questions within the framework can be filled out by prospective recyclers and a total score is produced from the answers provided, indicating a level of confidence that can be ascertained in a recycler's sustainability efforts. Each question was weighted from 0-6, with 0 being least favourable and 6 being most favourable in terms of reducing greenwashing risks. Similarly, the answer was rated on a similar scale of 0-3 with the intent that the multiplication of these two factors would allow a substantially wide variation of overall scores to distinguish recycler's greenwashing risk levels. This was tested on different theoretical sample responses based on the questionnaire results.

The example representative scores can be seen within the criteria framework in table 93. Examples of 'good' and 'mediocre' example responses are included along with the best and worst possible scores. A lower total score indicates a higher potential greenwashing risk, with a possible score range from 0-83 (with the example weightings). The weighting of scoring for each question is based on both the considered importance of each topic and the level of confidence provided by given answers. While this framework has been developed specifically for e-waste recyclers, the criteria could be modified and re-applied to businesses within the IT industry more generally as well as those in other sectors. The weighting factors may be tailored to the specific focuses of individual businesses looking to assess greenwashing risks from other companies and recyclers.

Criteria	Answer weighting	Question weighting	Total score	Good example score	Mediocre example score	Best possible score	Worst possible score
1) Is environmental sustainability a priority for your company?							
Yes	1	4	4	4	4	4	
No	0	4	0				0
2) Has your business had its carbon footprint measured in the last 3 years?							
Yes, via an externally-verified audit from a third party	3	4	12	12		12	
Yes, we calculated it internally	2	4	8				
Yes, we calculated it using carbon monitoring software /internally	2	4	8				
Yes, we calculated it through carbon offsetting software /internally	1	4	4		4		
No	0	4	0				0
3) Are you willing to share your carbon footprint calculation if it exists?							
Yes	1	4	4	4	4	4	
No	0	4	0				0
4) Are you willing to share any recommendations made ?							
Yes	1	3	3	3	3	3	
No	0	3	0				0
5) Are you willing to share any actions you have taken in response to the audit?							
Yes	1	3	3	3		3	
No	0	3	0		0		0
6) Does your business have a carbon plan?							
Yes, I'm willing to provide	1	3	3	3		3	
Yes, but not willing to provide	0	3	0				
No	0	3	0		0		0
7) Does your business use any renewable electricity?							
Yes, we have on-site renewable generation	1	5	5			5	
No we don't	0	5	0	0	0		0
8) Does your business use any green grid electricity?							
Yes, we have a power purchase agreement with a renewable electricity generator	2	2	4	4		4	
Yes, we use a green electricity tariff matched to ringfenced REGO certificates from an electricity generator	2	2	4				
Yes, we use a green electricity tariff covered/backed by REGO certificates, but they are not matched to the source	1	2	2		2		
Don't know	0	2	0				
No	0	2	0				0
9) Does your business use any renewable gas?							
Yes	1	2	2			2	
No	0	2	0	0	0		0
10) Does your business hold ISO 14001 accreditation?							
Yes, willing to provide assessment notes	1	1	1	1	1	1	
Yes, not willing	0	1	0				
No	0	1	0				0
11) Does your business hold ISO 50001 accreditation?							
Yes, willing to provide assessment notes	1	2	2			2	
Yes, not willing	0	2	0				
No	0	2	0	0	0		0
12) Does your business offset carbon?							
Yes	0	2	0	0	0		0
No	1	2	2			2	
13) Do you have either Responsible Recycling (R2) Standard or e-Stewards Certification?							
Yes, willing to provide assessment notes	1	2	2			2	
Yes, not willing	0	2	0				
No	0	2	0	0	0		0
14) Are you an ATF, AATF or neither?							
AATF	2	3	6			6	
ATF	1	3	3	3			
Neither	0	3	0				0
15) How much if any e-waste (by weight) is sent to further recyclers/details?							
Over 70%	0	4	0				0
More than 35, less than or equal to 70%	1	4	4	4	4		
35% or less	2	4	8			8	
16) How much e-waste (by weight) is sent to landfill/details?							
Above 10%	0	4	0		0		0
Above 0, up to 10%	1	4	4	4			
0%	2	4	8			8	
17) How much e-waste (by weight) do you export overseas?							
Above 10%	0	4	0				0
Above 0, up to 10%	1	4	4	4	4		
0%	2	4	8			8	
18) Do you have verifiable evidence that you can provide of the end destination of all materials sent to further recyclers, landfill, incineration and export?							
Yes	1	6	6			6	
No	0	6	0	0	0		0
Totals				49	26	83	0

Table 6.1 - Criteria for assessing greenwashing risks from WEEE recyclers

6.12   Recommendations to recyclers

Based on the findings, it is evident that customers, which may include smaller refurbishment and recycling businesses, may not be asking for sufficient details or asking the right questions in order to minimise the uncertainty around greenwashing from the suppliers and recyclers that they use. However, there are also takeaways for refurbishment and recycling companies who are committed to sustainability and have the desire to reflect their environmental efforts more effectively and transparently without the impression of greenwashing. A higher emphasis on carbon measurement and management needs to be seen within recycling firms. While recycling of IT and e-waste can be seen to inherently offset emissions from the production of new equipment, the carbon emissions from businesses who recycle and refurbish e-waste still produce an additional environmental strain. Consequently, reducing these operational emissions can effectively enhance the positive impact of e-waste recycling.

As SMEs, recycling and refurbishment businesses are a critical contributor to the UK's goal to reach net-zero emissions by 2050. In order to achieve this, greater transparency and care is required when making sustainability claims. Information on the recycling process, such as end-destinations for materials, its overall impacts and its current limitations should be provided wherever possible to provide customers with a balanced view to evaluate sustainability. Recyclers should also evaluate their awareness of their use of energy and utilities, as well as the renewability of their sources. A pro-active attitude towards genuine sustainability means continuous evaluation of what can be reasonably optimised, and it is not only reasonable to justify where certain changes are not yet feasible, but signals to customers that efforts are genuine, motivated, and without greenwashing. For this reason, measurement of the carbon footprint and having a rational and achievable carbon plan in place, even initially for the short-term, is considered crucial. Full transparency about the process fulfils a responsibility from recyclers, and leaves customers only with their responsibility of supporting sustainability. The criteria produced for SMEs and refurbishment and recycling businesses like Rapid IT is largely applicable and could be used by other businesses when assessing their current or prospective partnerships.

6.13   Recommendations to policy makers

The research conducted within this study has identified greenwashing risks from the transfer of e-waste to further recyclers. As discussed, there is uncertainty in the end-destinations of e-waste going to further recyclers, with this uncertainty increasing with each additional stage of recyclers. It may be difficult to ascertain how much e-waste from a customer eventually ends up being exported, sent to landfill or incineration. The current tracking systems in place are considered to be fragmented and comprising mostly paper-based data, which is not believed to provide sufficient granularity on the movement of waste (Hatchett, 2022). Therefore, it is suggested that a digital tracking system is implemented, which provides end-to-end information on the treatment and distribution of e-waste throughout the UK recycling system. A reliable and transparent third-party organisation would need to be in place to govern the treatment of e-waste through this new digital system. This information would be unified digitally and available to customers in a real-time and granular form, allowing for confidence in how e-waste is handled by recyclers and a greatly reduced risk of greenwashing.

In addition, it is proposed that recyclers are required to publish standardised information on their environmental performance, which should be regularly updated and audited by an independent body. This information would include details of how waste is being treated, evidence of maintenance of standards for environmental certifications and the carbon emissions from operation of the business. In order to improve recycling within the UK, manufacturers need to take increased responsibility and involvement in the recycling of their products, such as through take-back schemes for products. There needs to be a collaborative, knowledge-sharing process between manufacturers and recyclers in order to identify and reduce the impacts of materials found within e-waste, as well as cater the recycling systems better to the materials being used. Finally, there is a need for dedicated governmental research within this area, with criteria and frameworks centred around greenwashing developed officially for the public to use. This would raise awareness of the challenges of greenwashing and guide customers in avoiding behaviours which put them a risk of committing or experiencing third-party greenwashing. Ultimately, this will place a pressure on businesses and recyclers to adopt the highest sustainability standards with transparency.

6.14 Study limitations

This was a broad and high-level study to identify potential greenwashing risk factors. Many elements were considered, which placed a certain limit on depth in any given area. Further research could focus on selected factors in greater levels of detail. Additionally, 129 businesses were contacted, but only 21 participated in the questionnaire. This left a smaller sample size than desired and made it difficult to validate certain findings, particularly those for micro and medium businesses, which were in a minority. Further research in this area could help to corroborate the findings and conclusions presented. Finally, empirical research into greenwashing is difficult, particularly when surveying businesses, due to the deceptive nature of greenwashing. Therefore, it is possible that participants were not entirely accurate or candid with their questionnaire responses, potentially skewing the results collected. Further investigation through alternative means would reduce the limitations of particular data collection methods such as surveys.

7   Conclusion

In this thesis, a study of the factors that may present risks of greenwashing for SMEs within the IT industry was conducted. Specifically, there was a focus on green claims within IT refurbishment and e-waste recycling. A group of 21 UK IT refurbishment and recycling businesses were anonymously assessed to identify their levels of attention to sustainability and establish the questions and requests they receive from customers regarding their sustainability.

IT refurbishment businesses estimate sending minimal quantities by weight of e-waste to landfill (0.8%), incineration (13.7%) or overseas (7.6%). However, a large proportion of e-waste is estimated to be sent to further recyclers (46.4%), where end-to-end traceability may not currently be sufficient to verify that IT equipment taken from customers is being handled ethically and without greenwashing. An end-to-end digital tracking system has been proposed for e-waste movements in order to prevent e-waste being lost within the system or unaccounted for and to minimise the potential for greenwashing through deception on e-waste quantities being recycled. There may be a need to investigate the proportionally higher exportation of e-waste by AATFs in comparison to non-authorised businesses.

Overall, there was a weaker focus on carbon footprint calculation, monitoring and reduction within the businesses. The vast majority engage in environmental marketing, but 44.4% of those which market their environmental credentials have not created a carbon net-zero plan for 2050, and 27.8% have not had any calculation of their business carbon footprint. These results raise serious concerns of direct greenwashing. A similar proportion of internally calculated and externally verified carbon footprint calculations have been completed, however this leaves 44.6% either not calculating or being unsure of their carbon footprint. While no businesses use carbon emission monitoring software, one third use carbon offsetting and of this group, 42.9% are either unaware or unsure of the differences in impacts and calculation techniques between schemes. 66.7% of businesses hold ISO 14001, but of these, over a third have not had any calculation of their carbon footprint. These findings suggest a need for further research on greenwashing within the use of environmental certifications and more focus from SMEs on carbon emission reductions in order to avoid greenwashing through neglect of business emissions.

Results from businesses showed adoption of on-site renewable electricity generation by one third of businesses, with adoption associated with a higher likelihood of having had a carbon footprint calculation. Two thirds of businesses using green electricity tariffs were unaware or unsure of the use of REGO certificates by energy suppliers, raising risks of unconscious greenwashing through claims of low emissions or green electricity. There is a need for review of the current renewable electricity system and increased consciousness of alternatives which can be verified as sustainable and free of greenwashing claims.

Customers of IT refurbishment and recycling businesses were found to ask very few supplemental questions about sustainability, particularly lacking in enquiries about carbon emissions and business responses to them. Without asking more detailed questions, customers increase the risk that they will both experience and be complicit in greenwashing unconsciously, through inaccurate claims about sustainability and the proportions of e-waste being recycled.

Based on the findings presented, a scoring framework containing criteria for evaluating IT and e-waste recycling businesses was produced. For the case study and similar refurbishment businesses which rely on downstream recyclers to treat e-waste responsibly, assessment against this framework can provide a degree of confidence that sustainability is being approached as transparently as possible, allowing comparison between prospective partners, and reducing risks of exposure to greenwashing.

This thesis addresses the research aim by exploring and uncovering areas of risk for unconscious greenwashing through association with recycling vendors within the IT recycling sector. For an SME looking to navigate greenwashing within the IT industry, the framework developed through this research can serve as a guide to assess, benchmark and compare downstream suppliers and recycling vendors on their sustainability efforts. The framework can be built upon for future research and used to develop awareness and discussion of the potential pitfalls and complications in improving general sustainability and recycling effectiveness.

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9 Appendix

9.1 Original Consent Form

Welcome to the UCLan sustainability research study!

My name is Haaris Moynihan and I am a Masters student researching sustainability within the IT and e-waste industry. I have produced this anonymous questionnaire which should take no more than 5-10 minutes. The anonymous results and analysis may prove very useful to any IT or e-waste processing businesses in improving their environmental impacts and their communication of existing sustainability efforts. These results will be available to view by request from the 1st July 2023, upon submission of my thesis.

Your responses will be kept completely confidential. Your participation in this research is voluntary and you have the right to withdraw at any point while the questionnaire is still open for completion. Full details of the study and how the anonymous response data will be used can be found by clicking for more information below, along with contact details for the Principal Investigator of this study, Professor Karl Williams.

More information on the study

1. Title of Study: How can an SME within the IT sector navigate greenwashing? - A case study of Rapid IT.

2. Version Number and Date: Version 1 – dated 17/02/2022

3. Introduction: Your company is being invited to participate in a research study. Before you decide whether to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask us if you would like more information or if there is anything that you do not understand. We would like to stress that you do not have to accept this invitation and should only agree to take part if you want to. Thank you for reading this.

4. What is the purpose of the study? Rapid IT is an IT refurbishment and recycling SME (small-to-medium enterprise) based in Lancashire, selling refurbished products

such as laptops, desktops, and components. They have taken significant steps to reduce their environmental impact through changes to their operations and the installation of energy-efficient equipment and eco-innovations. such as the installation of 100 solar panels on their building as well as the use of electric business vehicles and FSC-certified wood, cardboard and paper within their operations and packaging. They are looking to further their commitment to sustainability and reducing their environmental impact and are well on their way to achieving net-zero carbon emissions by 2050, in line with the government national and industrial sector targets.

The researcher is a post-graduate Masters by Research student at the University of Central Lancashire (UCLan). They are working on the Eco-I North West Project, which is an initiative to support local businesses, such as Rapid IT, in reducing their carbon footprints. The aim of this research is to evaluate the information on sustainability available to SMEs within the IT sector, using Rapid IT as a case study. In particular for this aspect of the study, Rapid IT's recycling process for e-waste, waste consisting of consumed IT items, is a focus. Rapid IT currently aims to operate with a zero waste-to-landfill policy. As e-waste is a significant and rapidly growing contributor to global waste production, Rapid IT aims to ensure they are recycling their e-waste responsibly, while extracting the maximum resource value and minimising further greenhouse gas emissions.

This aspect of the research is focused solely on the second objective of this research - assessing the current partner recycling processes for Rapid IT and comparing with best practice. A questionnaire has been produced to gain insight into the types of questions that potential customers of e-waste recyclers might ask before committing to a recycling company and how frequently they are asked, as well as what information is readily available to customers from recyclers during the decision-making process. Questions will also look at the positive steps recycling companies are taking to address their own carbon footprint and how they can reflect these efforts more effectively to customers. The overall focus is on sustainability and the environmental impacts/considerations of e-waste recycling companies and their processes.

5. Why have I been invited to take part? Your recycling company was initially identified as a candidate for this study based on keyword searches for environmental terms relating to e-waste recycling in online search engines. In addition, due to the

nature of your recycling process, the components/products you accept and your location, your company is considered a good candidate for studying Rapid IT's internal recycling process. 45 e-waste recycling/processing companies situated primarily in the North West have been chosen to participate in this study, though this number may not reflect the final number of recycling companies who choose to participate.

6. Do I have to take part? Participation in this study through completion of the questionnaire is entirely optional. Participating companies may withdraw from the study until the closing time of the questionnaire, with no consequences or ramifications as a result, and without any explanation. It should also be noted that the questionnaire may be partially completed with no consequences as a result.

7. What will happen if I take part? Following signing of the consent form for the study, a link to the online questionnaire will be sent to each company representative via email. This questionnaire will be on a secure online platform and should take no more than 10-15 minutes. It is expected that the information provided by each company will be truthful, honest, and as accurate as possible to allow for valid conclusions to be drawn from any data and 1 week will be provided to complete and submit the online questionnaire. The researcher will process and analyse the questionnaire responses to establish:

1) The most effective questions for customers to ask regarding sustainability
2) Where information disclosure could be improved within the IT industry
3) What efforts are being undertaken by recyclers to address environmental impact
4) How customers can be more proactive in engaging with recyclers
5) How recyclers can better advertise their 'green' efforts
6) A list of criteria for Rapid IT to evaluate their own recycling process and move further towards net zero carbon emissions

Only the researcher will have access to the raw questionnaire responses from each company. The data collected will be anonymous from completion of the questionnaire and will remain anonymised for use in the researcher's thesis, with no questionnaire data associated with companies at any point. Each company will have access to the researcher's thesis upon request. This may provide useful insight to each company on

their environmental performance within the industry and how it could be improved. The thesis will be available from 1st July 2023, to be viewed. 8. How will my data be used? The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of 'public task', and in accordance with the University's purpose of "advancing education, learning and research for the public benefit". Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. The University privacy notice for research participants can be found on the attached link: https://www.uclan.ac.uk/data_protection/privacy-notice-research-participants.php

Further information on how your data will be used can be found below:

How will my data be collected? Your company responses will be collected through a secure and confidential online questionnaire form.

How will my data be stored? The collected data will temporarily be stored on the online questionnaire platform for initial analysis, but will be completely deleted from the survey platform account after storing on the researcher's secure, password-protected UCLan student OneDrive account for analysis. It will not be stored anywhere else. Once the thesis is submitted, the raw data will be deleted from the OneDrive account.

How long will my data be stored for? The collected data will be stored until analysis has been completed and the thesis has been submitted, which will be no later than 1st July 2023.

What measures are in place to protect the security and confidentiality of my data? The collected data will be stored in an encrypted, password-protected OneDrive account and will only be accessed through a secure, password-protected university laptop.

Will my data be anonymised? Yes, the data will be anonymised at the point of completion of the questionnaire and will remain anonymised for use in the thesis. Only the researcher will have access to the raw data at any time and it will not be shared anywhere.

How will my data be used? The data will highlight what sort of information recycling companies generally provide to customers or SMEs and what information about sustainability they generally request from companies such as yours, as well as some basic details about your recycling process and sustainability efforts. It will be used to create a list of criteria to give guidance to SMEs on creating the most environmentally-friendly recycling strategy. It will clarify what information customers should request from recyclers to make the most informed decisions. The research conclusions will be presented within the thesis.

Who will have access to my data? Only the researcher will have access to the raw anonymous data. Following analysis, it will be used and presented in the thesis.

Will my data be archived for use in other research projects in the future? The anonymised data within the thesis itself may be available for future viewing in UCLan's publication database.

How will my data be destroyed? The raw data will be destroyed and deleted from the secure OneDrive account through the business laptop after 1st July 2023, upon submission of the thesis. The anonymous data will only remain in the thesis.

9. Are there any risks in taking part? Following assessment, it has been deemed that there are no risks from being involved in this study.

10. Are there any benefits from taking part? There may be significant benefits to recycling companies participating in this study:

1) Recyclers will be able to gauge their relative risk factors for unconscious greenwashing by viewing the analysis of the anonymous data within the research thesis and comparing against their own responses (which they already know).

2) Participating recyclers will have a view of how other recyclers within the IT industry are performing and operating in terms of sustainability and informing customers of 'green' efforts.

11. Expenses and/or payments: There will be no associated expenses involved and the anonymised data will be made accessible to each company through the thesis upon request.

12. What will happen to the results of the study? The anonymised results of the study will be available within the thesis upon request after 1st July 2023. The thesis will also be found in the UCLan publication database at a later date.

13. What will happen if I want to stop taking part? If you/your company wish to withdraw from this study and have any data collected from your company destroyed, this can be requested up until the point of closure of the questionnaire, which will be open to complete for 1 week. An individual randomized number will be generated and assigned to each company representative through the online questionnaire link via email. The participant will be required to take note of this number and provide it via email if requesting withdrawal from the study. After the point of closure for the questionnaire, collected data will undergo analysis and it will not be possible to delete/destroy an individual company's data. Participation in this project is entirely voluntary, and you/your company can withdraw up until the closure of the questionnaire without giving a reason by contacting Professor Karl Williams (details below).

14. What if I am unhappy or if there is a problem? If you encounter any issues or are unhappy, please feel free to let us know by contacting Professor Karl Williams on +44 (0) 1772 893496 and we will try to help. If you remain unhappy, or have a complaint which you feel you cannot come to us with, then please contact the Ethics, Integrity and Governance Unit at OfficerForEthics@uclan.ac.uk. The University strives to maintain the highest standards of rigour in the processing of your data. However, if you have any concerns about the way in which the University processes your personal data, it is important that you are aware of your right to lodge a complaint with the Information Commissioner's Office by calling 0303 123 1113.

15. Who can I contact if I have further questions? For further questions, the Principal Investigator/Supervisor can be contacted: Professor Karl Williams, Director

for the Centre for Waste Management, School of Engineering Email address: kswilliams@uclan.ac.uk Address: University of Central Lancashire, Fylde Rd, Preston, PR1 2HE Contact details of Student Researcher/Investigator: Haaris Moynihan, MRes student, University of Central Lancashire Email address: hmoynihan@uclan.ac.uk

Full Consent Terms

1. I confirm that I have read and have understood the information sheet dated [17/02/2023] for the above study, or it has been read to me. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.

2. I understand that I will be representing my company's responses in this study and confirm that they are happy for me to do so.

3. I understand that taking part in the study involves the completion and submission of an online questionnaire form.

4. I understand that participation is voluntary and that myself and my company are free to stop taking part and can withdraw from the study at any time without giving any reason and without any rights being affected. In addition, I understand that I am free to decline to answer particular questions.

5. I understand that I/my company can withdraw from this study up until the closure of the questionnaire and that after this point, any data provided cannot be excluded from the study.

6. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Central Lancashire.

7. I understand that signed consent forms and questionnaires will be retained in the researcher's secure password-protected OneDrive account and accessed through a password-protected work laptop until submission of the thesis by 1st July 2023 when they will be deleted.

8. I understand that the researcher will respect company confidentiality and I give permission for them to have access to my responses to the questionnaire on behalf of my company.

9. I understand that any data collected will be presented anonymously in the thesis.

- Yes, I am happy to take part in the above study.

- No, I do not agree to take part.

Please enter your full name below as confirmation that you are representing your company (your name will not be shared or associated with any of the anonymous questionnaire responses). After entering this and pressing the blue arrow below, you will be redirected to the questionnaire.

E-waste Sustainability Questionnaire

Welcome to the UCLan sustainability questionnaire!

Most questions are multiple-choice and you may choose not to answer any particular question on behalf of your business. A small number include comment boxes which you are encouraged to fill with any relevant information that you think may be useful. Completion would be greatly appreciated and should take no more than 5-10 minutes.

Here is your random ID number: **${e://Field/Random%20ID}**

Please copy this ID number for your own records. In the event that you wish to withdraw from the study prior to the closing of the questionnaire completion period, you will need to provide this number. Once you have copied your ID, click the blue arrow to continue with the survey.

Q1 Please select the category which best describes your business:

◯ Micro business (less than 10 employees and an annual turnover under €2 million)

◯ Small business (less than 50 employees and an annual turnover under €10 million)

◯ Medium business (less than 250 employees and an annual turnover under €50 million)

◯ Large business (250 or more employees and an annual turnover over €50 million)

◯ Unsure/don't know

◯ Prefer not to answer

Q2 Does your business have policies in place pertaining to environmental sustainability or carbon management?

○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

Q3 Does your business marketing to customers focus on your company's environmental credentials?

○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

Q4 Please select which of the following IT e-waste materials/components your business accepts for recycling:

- ☐ PCBs

- ☐ Hard drives

- ☐ LCD displays

- ☐ Plastic components

- ☐ Metal frames

- ☐ Wiring/cables

- ☐ Batteries

- ☐ Power supplies

- ☐ Switches

- ☐ Other

- ☐ Unsure/don't know

- ☐ Prefer not to answer

Page Break ————————————————————————————

Q5 Please select which of the following the UK government-defined WEEE categories your business accepts for recycling:

☐   Category 1 - large household appliances

☐   Category 2 - small household appliances

☐   Category 3 - IT and telecommunications equipment

☐   Category 4 - consumer equipment

☐   Category 5 - lighting equipment

☐   Category 6 - electrical and electronic tools (except large scale stationary industrial tools)

☐   Category 7 - toys, leisure and sports equipment

☐   Category 8 - medical devices (except implanted and infected products)

☐   Category 9 - monitoring and control equipment

☐   Category 10 - automatic dispensers

☐   Category 11 - display equipment

☐   Category 12 - appliances containing refrigerants

☐   Category 13 - gas discharge lamps and light-emitting diode (LED) light sources

☐   Category 14 - PV panels (solar panels)

☐   Unsure/don't know

☐   Prefer not to answer

Page Break

Q6 Is your process designed to deal specifically with e-waste or any specific components of e-waste (e.g., PCBs, batteries, hard drives, LCD displays, etc.)?

○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

Q7 Prior to processing, does your business ask customers (e.g., in tenders, or verbally) if their e-waste recycling material contains any hazardous substances (e.g. persistent organic pollutants (POPs))?

○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

End of Block: Process

Start of Block: Carbon

Q8 Has your business had its carbon footprint calculated?

○ No

○ Yes, the carbon footprint was internally calculated

○ Yes, the carbon footprint was externally verified

○ Unsure/don't know

○ Prefer not to answer

Q8a How long ago were any carbon calculations or audits performed?

○ Within the last year

○ 1-3 years ago

○ 3-5 years

○ 5+ years ago

○ Unsure/don't know

○ Prefer not to answer

Page Break

Q8b How frequently have any carbon calculations or audits been performed?

○ Once

○ More than once a year

○ Annually

○ Up to every 2 years

○ Up to every 3 years

○ Less frequently than every 3 years

○ Unsure/don't know

○ Prefer not to answer

Page Break

Q8a How long ago were any carbon calculations or audits performed?

Q8c Has your business taken any actions yet based on any carbon calculations, energy consumption data or recommendations from any audits?
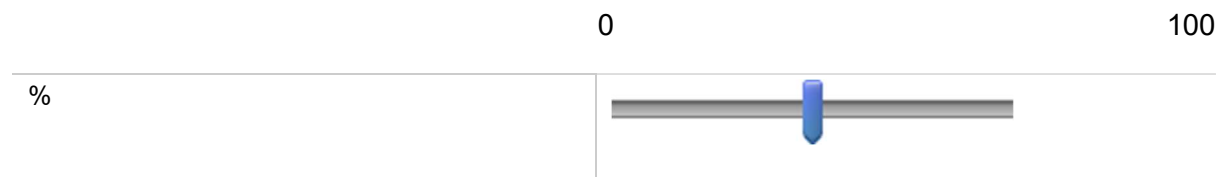
○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

Page Break ───

Q9 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) if your business has had its carbon footprint calculated?

○ Unsure/prefer not to answer

	0	100
%		

Page Break ───

Q10 Have any customers asked for any of the results (e.g. carbon emissions, energy consumption or recommendations) of any carbon audits/calculations performed?

○ Yes (please state what information your business has provided to customers)
_____

○ No (please state what information your business would be willing to provide to customers) _____
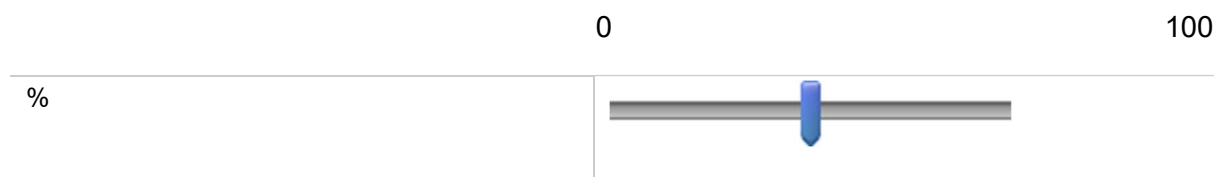
○ Unsure/don't know

○ Prefer not to answer

Q11 Has your business created a plan to achieve carbon net neutrality by 2050?

○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

Q12 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) whether your business has a plan or is on target to achieve carbon net neutrality by 2050?

○ Unsure/prefer not to answer

	0	100
%		

Q13 Does your business use any carbon emissions monitoring software for its process or operations? If so, please list the software used.

○ No

○ Yes _____

○ Unsure/don't know

○ Prefer not to answer

Q14 Does your business use any energy-management tools, systems or software for its process or operations? If so, please list any used.

○ No

○ Yes _____

○ Unsure/don't know

○ Prefer not to answer

Q15 Does your business use any carbon offsetting programs or initiatives for its process or operations? If so, please list any used.

○ No

○ Yes _____

○ Unsure/don't know

○ Prefer not to answer

Q16 Is your business aware that carbon offsetting schemes have significant differences in their environmental impact and calculation techniques?

○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

Q17 Does your business currently take any other measures to address the carbon footprint from its process, operations or employees?

☐   Cycle-to-work scheme

☐   Electric business vehicle scheme

☐   Rainwater harvesting

☐   Car share scheme

☐   Combined heat and power

☐   Solar heating

☐   Heat pumps

☐   Renewable energy generation

☐   Other _____

☐   Unsure/don't know

☐   Prefer not to answer

Page Break

Q18 Have any customers asked (e.g., in tenders, or verbally) what your business has done to address the energy use and carbon footprint of its process or operations?

○ No (please state what information your business would be willing to provide to customers) _____

○ Yes (please state what information your business has provided to customers)
_____

○ Unsure/don't know

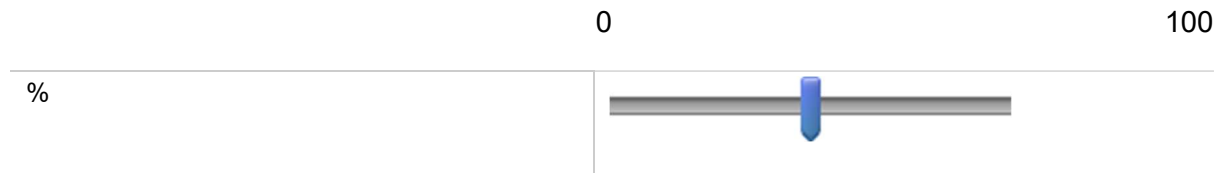○ Prefer not to answer

- -

Page Break ──

Q18a Approximately, what percentage of customers ask (e.g., in tenders, or verbally) what your business has done to address the energy use and carbon footprint of its process or operations?

○ Unsure/prefer not to answer

	0	100
%		

- -

Page Break ──

End of Block: Carbon

Start of Block: Logistics/site

Q19 Does your business use grid-sourced electricity?

○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

Q20 Does your business use any proportion of on-site renewable electricity generation?

○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

Q21 Does your business use any green electricity tariffs, and/or any other renewably classified utilities? Please select as many as applicable:

☐ Electricity

☐ Water

☐ Gas

☐ Internet

☐ Unsure/don't know

☐ Prefer not to answer

**Q22 Is your business aware of the use of REGO certificates by electricity suppliers?**

○ Yes, the business knows about REGO certificates, and our electricity supplier uses them

○ Yes, the business knows about REGO certificates, but our electricity supplier does not use them

○ Our business is not aware of the use of REGO certificates

○ Unsure/don't know

○ Prefer not to answer

- -

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Q23 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) if/how much of your business' energy and utilities are from renewable or 'green' sources?

○ Unsure/prefer not to answer

	0	100
%		

- -
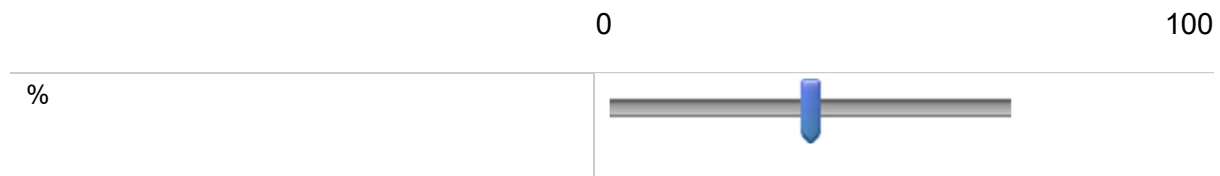
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Q24 Is your business an Authorised Treatment Facility (ATF) or an Approved Authorised Treatment Facility (AATF – able to provide evidence notes for WEEE producer compliance schemes)?

○ Authorised Treatment Facility (ATF)

○ Approved Authorised Treatment Facility (AATF)

○ Neither

○ Unsure/don't know
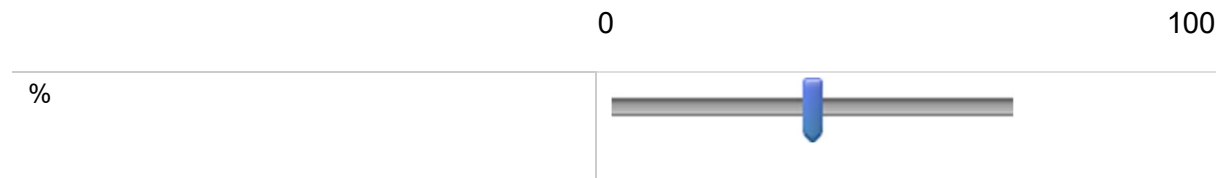
○ Prefer not to answer

154

Q24a As an ATF, does your business record the weight (e.g., in tenders, or verbally) of WEEE that is:

	No	Yes	Unsure/don't know	Prefer not to answer
Received for treatment	○	○	○	○
Sent to landfill	○	○	○	○
Sent to different facilities for treatment	○	○	○	○
Sent to incineration processes	○	○	○	○
Delivered to an approved exporter for treatment and recovery or recycling outside the UK	○	○	○	○
Successfully refurbished	○	○	○	○

Q25 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste is successfully refurbished?

○ Unsure/prefer not to answer

	0	100
%		

Page Break —————————————————————————————————————

Q26 Within your business' records, which of these separate categories are recorded by weight?

☐ Ferrous metals

☐ Non-ferrous metals

☐ Plastics

☐ Residual material

☐ Unsure/don't know

☐ Prefer not to answer

Page Break —————————————————————————————————————

Q27 Have customers requested evidence of the end-destination of all materials collected and recycled by your business?

○ If yes, please state what information your business has provided to customers
_____

○ If no, please state what information your business would be willing to provide to customers _____

○ Unsure/don't know

○ Prefer not to answer

Q28 Please estimate the numbers of each of the following vehicle types that your business uses for business transport purposes, based on the fuel source that each uses.

	Petrol or LPG	Diesel	Biofuel	Plug-in hybrid	Electric
Cars					
Vans					
HGVs					

End of Block: Logistics/site

Start of Block: Environmental policies, schemes and future plans

Q29 Does your business have any environmental, waste management or recycling certifications or accreditations? Please select any that are applicable.
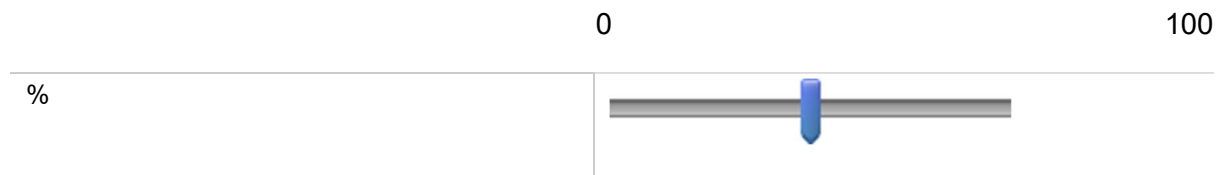
☐ WEEE compliance

☐ ISO 14001

☐ ISO 50001

☐ e-Stewards

☐ Responsible Recycling (R2) Standard

☐ B Corp

☐ Other _____

☐ Unsure/don't know

☐ Prefer not to answer

Page Break ——

Q30 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) what environmental or 'eco' certifications your business has?

◯ Unsure/prefer not to answer

	0	100
%		

Page Break ——

Q31 Have any customers requested to view the responses to any accreditation assessments?

○ If yes, please state what information your business provided to customers
_____

○ If no, please state what information your business would be willing to provide to customers _____

○ Unsure/don't know

○ Prefer not to answer

Q32 Does your business assess the companies within its supply and distribution networks based on their sustainability?

☐ Yes, through environmental certifications

☐ Yes, through marketing

☐ Yes, through questioning

☐ No

☐ Unsure/don't know

☐ Prefer not to answer

Q33 Does your business have any plans to gain any new environmental certifications within the next 3 years, excluding any re-certifications?

○ No

○ Yes

○ Unsure/don't know

○ Prefer not to answer

Q34 Have any customers requested further information on any plans your business has to improve the environmental impacts of its process/operations within the next 3 years?

○ If yes, please state what information your business provided to customers

_____

○ If no, please state what information your business would be willing to provide to customers _____

○ Unsure/don't know

○ Prefer not to answer

End of Block: Environmental policies, schemes and future plans

Start of Block: Waste management

Q35 Please estimate the composition of your input e-waste stream as a percentage in the last 12 months:

Ferrous metals : _____
Non-ferrous metals : _____
Plastics : _____
Residual material : _____

Total : _____

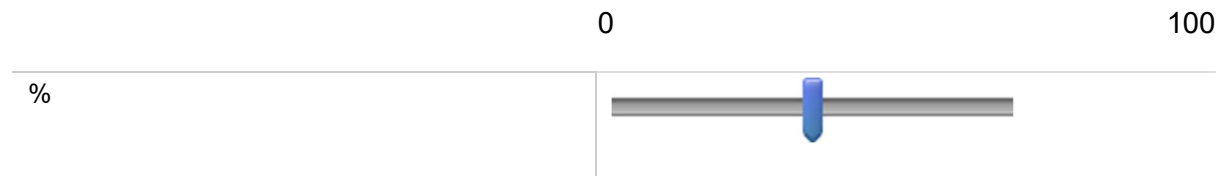--

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Q36 Please estimate the proportion by weight of your business' input e-waste that has been passed on to further recyclers in the last 12 months:
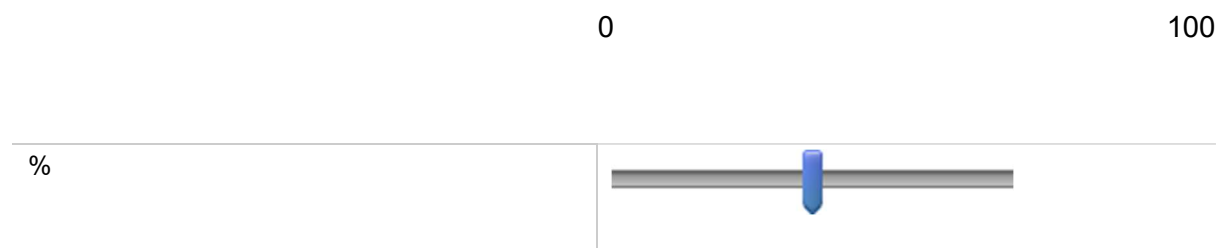
○ Unsure/prefer not to answer

0   100

%

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Q37 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output is passed on to further recyclers?
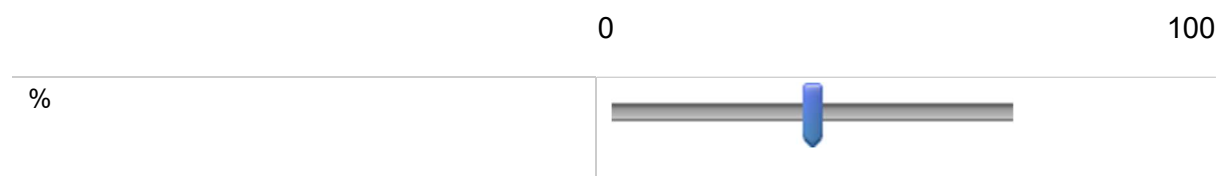
○ Unsure/prefer not to answer

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Q38 Please estimate the proportion by weight of your business' input e-waste that has been sent to landfill in the last 12 months.

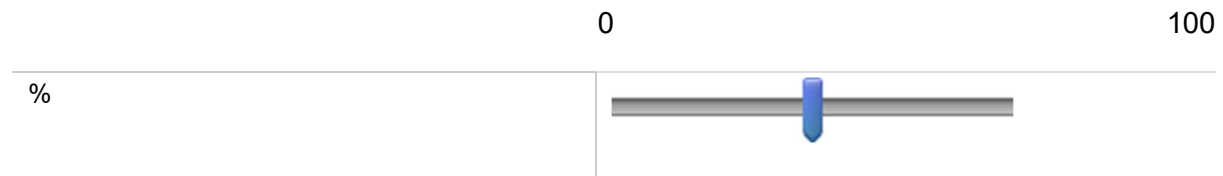○ Unsure/prefer not to answer

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Q39 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output goes to landfill?

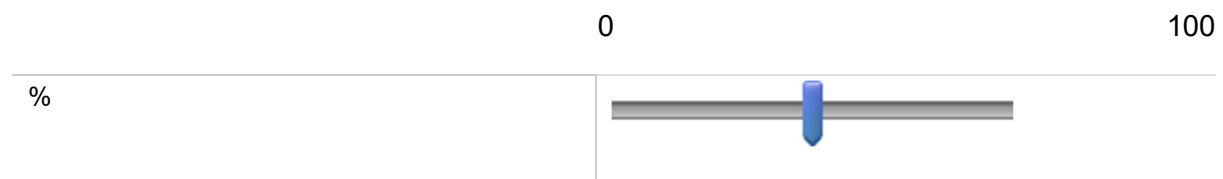◯ Unsure/prefer not to answer

0   100

%

Q40 Please estimate the proportion by weight of your business' input e-waste that has been sent to incineration processes in the last 12 months
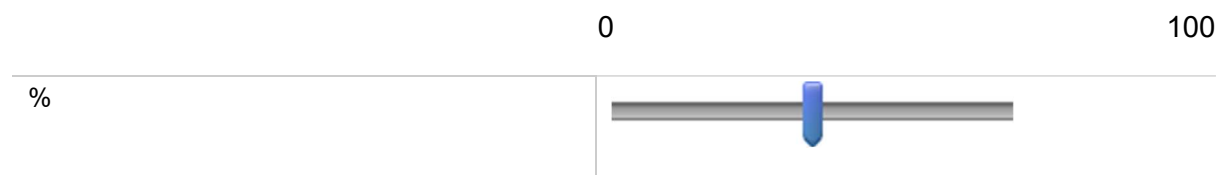
◯ Unsure/prefer not to answer

0   100

%

Q41 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much of your e-waste output goes to incineration processes?

Unsure/prefer not to answer

◯ Unsure/prefer not to answer

0   100
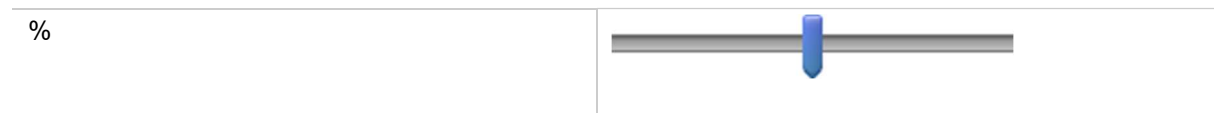
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Q42 Please estimate the proportion by weight of your business' input e-waste that has been exported overseas for further processing in the last 12 months.

○ Unsure/prefer not to answer

0   100

%

Page Break

Q43 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how much e-waste output is exported overseas?

○ Unsure/prefer not to answer

0   100

%

Page Break

Q44 Approximately, what percentage of customers ask (e.g., in tenders, or verbally) how your business handles hazardous waste materials?

○ Unsure/prefer not to answer

0   100

%

Q45 Have any customers requested the weights of e-waste output sent to landfill, further recyclers, incineration and overseas?

○ Yes (please state what data your business provided to customers)

_____

○ No (please state what data you would be willing to provide to any customers)

_____

○ Unsure/don't know

○ Prefer not to answer

End of Block: Waste management