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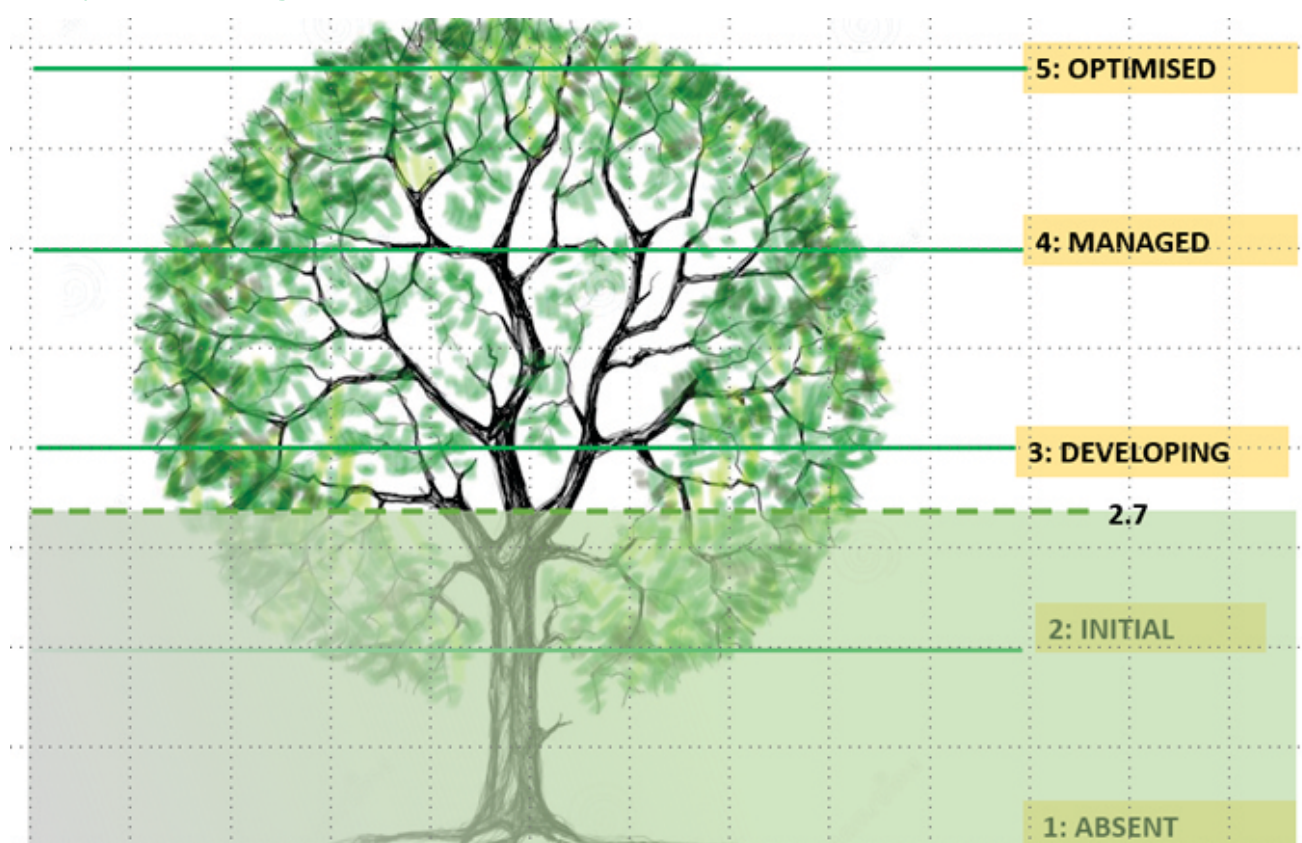
*An Assessment of Green Information Communication
Technology Practices, Including E-Waste Management,
by Telecommunications Operators in Zimbabwe*

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EXECUTIVE SUMMARY

This report presents a comprehensive assessment of Green Information Communication Technology (ICT) practices, with a specific focus on e-waste management, among telecommunications operators in Zimbabwe. The increasing ubiquity of ICT infrastructure underscores the imperative for sustainable practices, particularly in emerging economies like Zimbabwe. The survey sought to assess Green Information Communication Technology practices, including e-waste management, by telecommunications operators in Zimbabwe. Sixteen (16) out of the targeted seventeen (17) licensed and active telecommunications service providers participated in the study.

Key Findings:



Overall Green ICT Maturity Level:

- The Green ICT maturity score was 2.7, implying that Green ICT principles are starting to be imbedded into organisational processes and practices, but the level of incorporation is still low.

Awareness

- The awareness levels on ICT-related environmental issues, particularly the Green ICT concept, were generally high. This was perceived to be due to the global wave of environmental activism and the climate change movement. However, the survey further revealed that environmental awareness did not always translate to environmental accountability.

Governance

- The adoption of internal Green-ICT related policies as well as adherence to international environmental standards was low (31%); never-the-less the proportion of telecommunication operators who set aside financial resources for Green-ICT initiatives was high (62.5%).

ICT Procurement

- The consideration of environmental criteria in the procurement of ICT equipment and software was still low. Only 31.3% and 52.4% of telecommunications operators took environmental criteria into consideration when procuring ICT software and ICT equipment respectively.

Electronic Waste

- Only 25% of operators recycled ICT equipment and devices at end-of-life and their recycling decisions were mainly influenced by awareness of environmental impacts of e-waste, convenience, monetary incentives as well as the availability of recycling agents.

Carbon Footprint

- Only one entity had measured their carbon footprint and initiated Net Zero targets. Net Zero is an international scientific consensus that to prevent the worst climate damages, global net human-caused emissions of carbon dioxide (CO₂) need to fall by about 45 percent from 2010 levels by 2030 and reach net zero around 2050.

Carbon Offsetting

- The study revealed that many organisations were yet to prioritise carbon offsetting as a way of addressing their carbon footprint. The few (19%) who engaged in carbon offsetting had implemented initiatives such as renewable energy provision, reforestation, and afforestation projects and some were working on plans to purchase carbon credits.

Green Principles at Data Centres

- Green data centres have emerged as a transformative solution, embodying a growing commitment to sustainability through eco-friendly practices and cutting-edge technologies.

The study proffered several recommendations based on the findings. Chief among them, being the need for Zimbabwe's telecommunication operators to give priority to the implementation of green ICT practices. The need for a policy framework was also emphasised, signalling the need for collaboration between the ICT sector and the Environmental Management Authority. Green ICT practices, particularly recycling of e-waste, also contributes to economic value downstream through job creation and providing a second market for the recycled materials; hence, there is need to incentivise investment in this industry and promote the development of recycling programs. Furthermore, the need to raise awareness not only to the sector players but the generality of consumers is very pertinent.

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Background Of The Study

1.1 INTRODUCTION

In this digital era, Information and Communication Technologies (ICTs) are driving economic growth, social development, and technological advancement. However, the adoption of ICTs has also sparked environmental concerns, notably carbon emissions, energy use, and the proliferation of electronic waste. The idea of "Green ICT" has arisen in response to these issues, promoting the adoption of environmentally friendly practices along the entire value chain of the ICT industry. Green ICT focuses on minimising the the ICT industry. Green ICT focuses on minimising the adverse effects of ICT operations on the environment by designing, manufacturing, operating, and disposing of ICT products in an environmentally friendly manner.

Like many other developing nations, Zimbabwe is experiencing a surge in ICT adoption and telecommunications infrastructure development, fuelled by increasing connectivity demands and technological innovation. While this growth in ICT adoption presents opportunities for socio-economic progress, it also poses environmental challenges that cannot be ignored. The adoption of Green ICT practices can help promote sustainability while at the same time improving efficiency, reducing costs, and ensuring companies remain competitive in a rapidly evolving technological landscape. It is also linked specifically to the following Sustainable Development Goals (SDGs):

- SDG 11: Sustainable cities and communities.
- SDG 12: Responsible consumption and production.
- SDG 13: Climate change action.

Given the recognised impact of ICTs on environmental sustainability, the International Telecommunications Union developed a Toolkit on Environmental Sustainability for the ICT sector focusing on the application of standards and guidelines on data centres, telecommunications networks, end-of-life management, environmental impact assessments amongst other issues. ITU-T Study Group 5 is also leading work on the environmental mandate, specifically studying the effects of ICTs on climate change and designing methodologies to reduce ICTs and e-waste's adverse environmental effects. ITU has also initiated the collection of country data on green ICT practices through the ITU Sustainability Office. This shows the importance of Green ICT practices, it is not just a trend. POTRAZ embarked on this comprehensive study to investigate the Green ICT strategies, initiatives, and practices by Zimbabwean telecommunications operators.



1.2 STATEMENT OF THE PROBLEM

The ICT sector is a recognised contributor to Green House Gas (GHG) Emissions and e-waste, globally. According to the ITU², the ICT sector (telecommunications, computing and the Internet, but excluding broadcasting transmitters and receivers) contributes around 2 to 2.5 per cent of GHG emissions, at just under 1 Gigatonne of CO₂ equivalent. The main constituent (40 per cent) of this is the energy requirements of personal computers and data monitors, with data centres contributing a further 23 per cent; fixed and mobile telecommunications contribute an estimated 24 per cent of the total.

As the ICT industry is growing faster than the rest of the economy, this share may well increase over time, further contributing to global warming. This justifies the need for coordinated intervention, guided by evidence, for informed decision-making. The lack of comprehensive data on green ICT management practices presents a significant information gap, hindering effective policy intervention. With a clear understanding of the extent to which telecommunications operators adopt environmentally sustainable practices, it is easier to develop targeted interventions and policies to mitigate the sector's environmental impact, hence this baseline study.

1.3 RESEARCH OBJECTIVES

The key objectives of the assessment of green ICT practices, including e-waste management by telecommunications operators in Zimbabwe, were as follows:

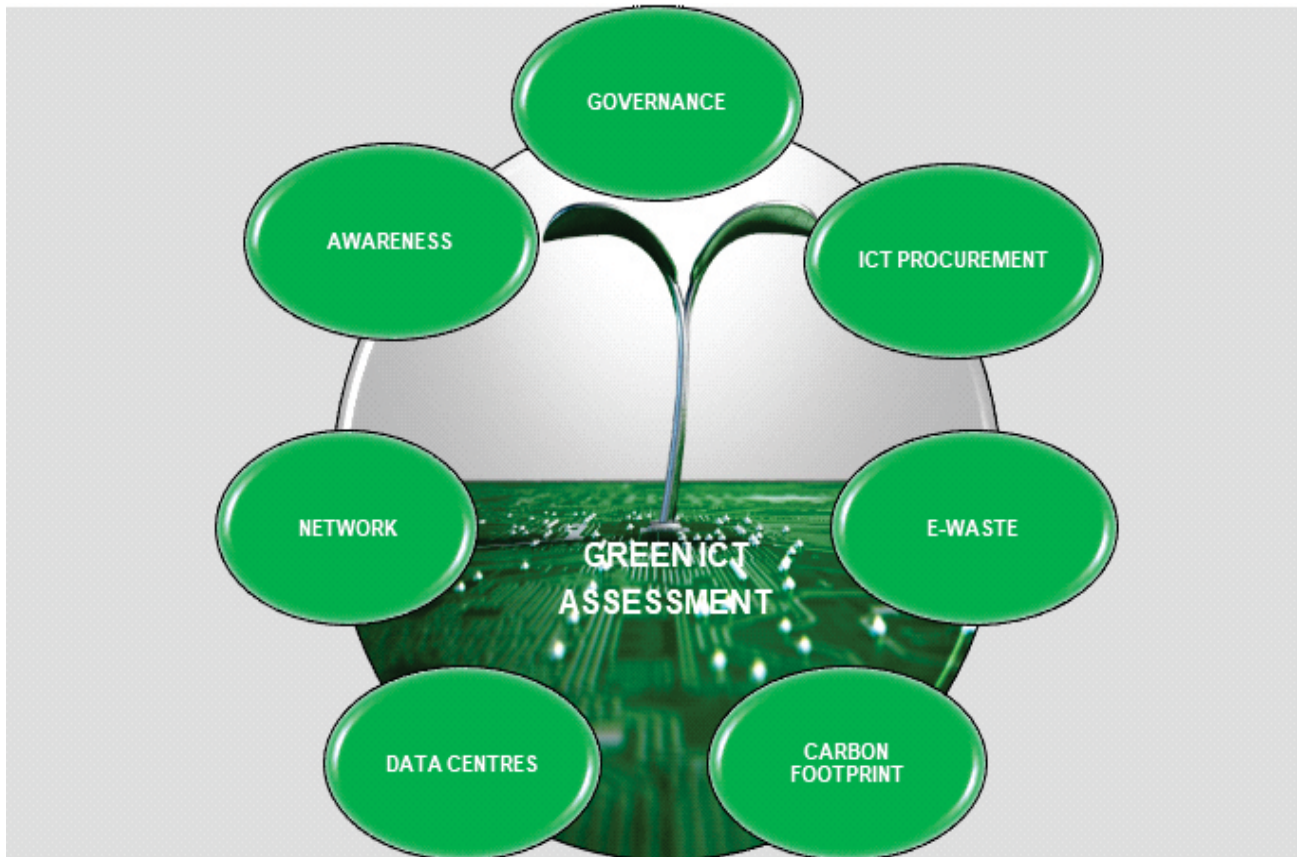
1. To assess the Green ICT practices by operators in the Zimbabwean telecommunications sector.
2. To assess electronic waste management practices by operators in the Zimbabwean telecommunications industry.
3. To evaluate the Green ICT maturity level of the Zimbabwean telecommunications industry.
4. Provide policy recommendations.

1.4 SIGNIFICANCE OF THE STUDY

Evidence-based recommendations support policymakers in crafting effective strategies to promote Green ICT practices and enhance e-waste management efforts. By identifying best practices and areas for improvement, the study offers guidance to operators seeking to improve their Green ICT initiatives and e-waste management strategies. The study can serve as a basis for collaboration and knowledge-sharing among stakeholders in the telecommunications industry within Zimbabwe and globally. The study also facilitates dialogue on environmental sustainability and to promote best practices.

1.3 SCOPE OF THE RESEARCH

The scope of the study is summarised by the following green ICT framework:



GOVERNANCE	Assessing evidence of green ICT governance such as policies, strategies, budgets etc.
ICT PROCUREMENT	Evaluating the consideration of environmental issues in ICT supplier selection (software, equipment etc)
E-WASTE	Analysing environmental considerations in ICT equipment replacement and disposal
DATA CENTRES	Assessing the application of green practices in data centres
NETWORK	Evaluating the integration of green ICT principles in network management
CARBON FOOTPRINT	Gauging the implementation of measures to reduce the amount of greenhouse gases (GHGs), expressed as CO2 equivalents, that are emitted directly or indirectly because of a specific activity
AWARENESS	Measuring general awareness and organisational concern on environmental issues

Table 1: Scope of the Study

2. RESEARCH METHODOLOGY

2.1 INTRODUCTION

This section provides an overview of the research design, including the target population, sampling method, survey instrument, the procedures used to gather empirical evidence and the criteria employed to ensure its validity and reliability. It also describes the analytical methods used to analyse the collected data to derive meaning and produce insights.

2.2 RESEARCH DESIGN

The study relied on primary research that sought to obtain information directly from the licensed operators through a survey. A mixed questionnaire was used, combining elements of quantitative research and qualitative research, allowing a deeper exploration of the subject matter.

2.3 SAMPLING STRATEGY

2.3.1 INCLUSION CRITERIA

The inclusion criteria for the study participants were as follows:

1. Telecommunications service providers licensed by POTRAZ under various license categories such as Application Services, Network Services, Network Facilities Services, Internet Service Providers, Internet Access Providers, Mobile Virtual Network Operators and Unified Telecommunications licensees were targeted. The inclusion criteria also targeted licensees.
2. Over and above licensing, the licensee had to be operational, i.e., operating active telecommunications equipment/infrastructure and offering services to consumer at the time of the study.

Due to the second inclusion criteria above, seventeen (17) telecommunications licensees constituted the target population.

2.3.2 SAMPLING METHOD

The researchers purposively selected companies from the target population, targeting all active telecommunications service providers licensed by POTRAZ for inclusion in the sample. This ensured the sample was well-suited to address the research objectives and generate meaningful insights.

2.3.3 ATTAINED SAMPLE SIZE

Sixteen (16) out of the targeted seventeen (17) licensed and active telecommunications service providers participated in the study. The participant licensees are broken down by licence category as shown in Figure 2 below:

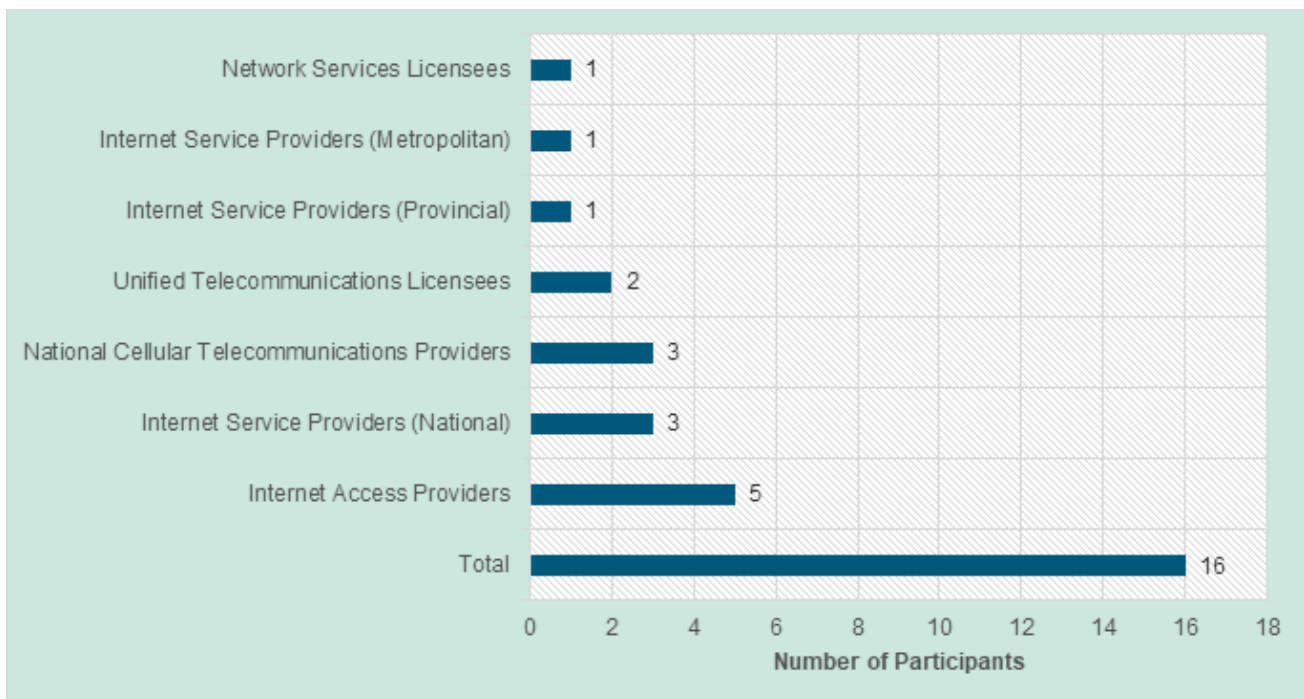


Figure 2: Attained Sample Size

The response rate was 94.1%, as sixteen (16) out of the targeted seventeen (17) licensed and active telecommunications service providers participated in the study.

2.4 SURVEY INSTRUMENT

A semi-structured questionnaire was used to gather data from selected telecommunication service providers in Zimbabwe. The researchers identified the key areas or themes of interest, such as corporate sustainability initiatives, e-waste management, and sustainable procurement. A set of closed and open-ended questions was developed for each key area identified. These questions allowed for in-depth exploration and encouraged participants to provide detailed responses. The researchers took caution to avoid biased questions to maintain neutrality and objectivity. The questionnaire started with broad, introductory questions before delving into specific topics to build rapport and establish context. The questions were also organised logically to allow flexibility for probing and follow-up inquiries based on participant responses. Table 2 below outlines the thematic areas of the questionnaire.

Table 2: Questionnaire Themes

SECTION	THEMES
Section A	Administrative Data
Section B	General Awareness
Section C	Governance
Section D	ICT Procurement
Section E	Electronic Waste
Section F	Carbon Footprint

The survey instrument was administered electronically

2.5 DATA ANALYSIS

2.5.1 QUANTITATIVE DATA ANALYSIS

SPSS and Excel were used to analyse quantitative data. The quantitative data was also cleaned before analysis. This entailed examining the responses for anomalies, missing numbers, and consistency. Descriptive statistics were used to summarise critical features of the quantitative data, such as mean, median, and mode. This gave a preliminary comprehension of the degree of green maturity in the telecom sector. Chi-square tests were used to investigate associations or links between variables. Additionally, the researchers used cluster analysis, which involves allocating comparable cases or respondents into groups according to their responses. This made sample segmentation easier and unveiled unique profiles of organisations.

2.5.2 QUALITATIVE DATA ANALYSIS

Thematic analysis was used to find recurrent themes, patterns, or subjects in the qualitative data. This required analysing the data iteratively to find patterns and variances across replies. Through data triangulation, the researchers combined quantitative and qualitative data. This allowed for a comprehensive understanding of Green ICT practices by combining insights from both data types.



2.6 ETHICAL CONSIDERATIONS

Principles of informed consent and voluntary participation were followed in the administration of the survey. This was in cognisance of the fact the research was not a compliance audit but an exploratory assessment. Privacy and confidentiality of research participants were also ensured as data was sufficiently anonymized and pseudonymized. Participants were not subjected to any form of harm or liable to any penalties emanating from their disclosures in this research.

3. RESEARCH FINDINGS

3.1 INTRODUCTION

This chapter presents and discusses the findings of the study on Green ICT management practices by telecommunications licensees in Zimbabwe. The qualitative and quantitative data gathered from the survey were analyzed using the Statistical Package for Social Scientists (SPSS) and Power BI. The findings are presented in themes that were derived from the research objectives.

3.2 ENVIRONMENTAL AWARENESS & ATTITUDES

Figure 3 below illustrates how telecommunications licensees rated their Green ICT awareness levels.

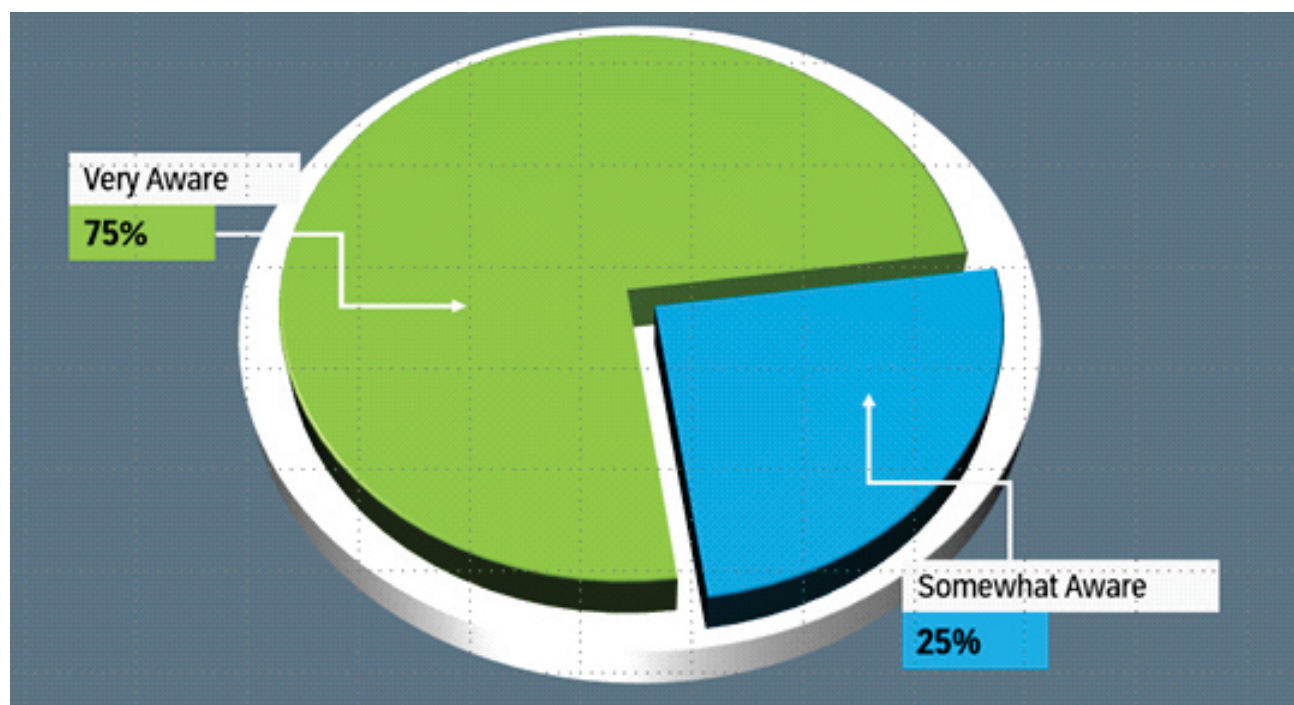


Figure 3: Awareness of the Concept of Green ICT

The rating suggests high levels of awareness of ICT related environmental issues, particularly the Green ICT concept. This was expected due to the global wave of environmental activism and the climate change movement. However, environmental awareness does not always translate to environmental accountability. Hence, respondents were asked to rate their organisational attitudes towards environmental issues; the responses are shown in Figure 4 below:

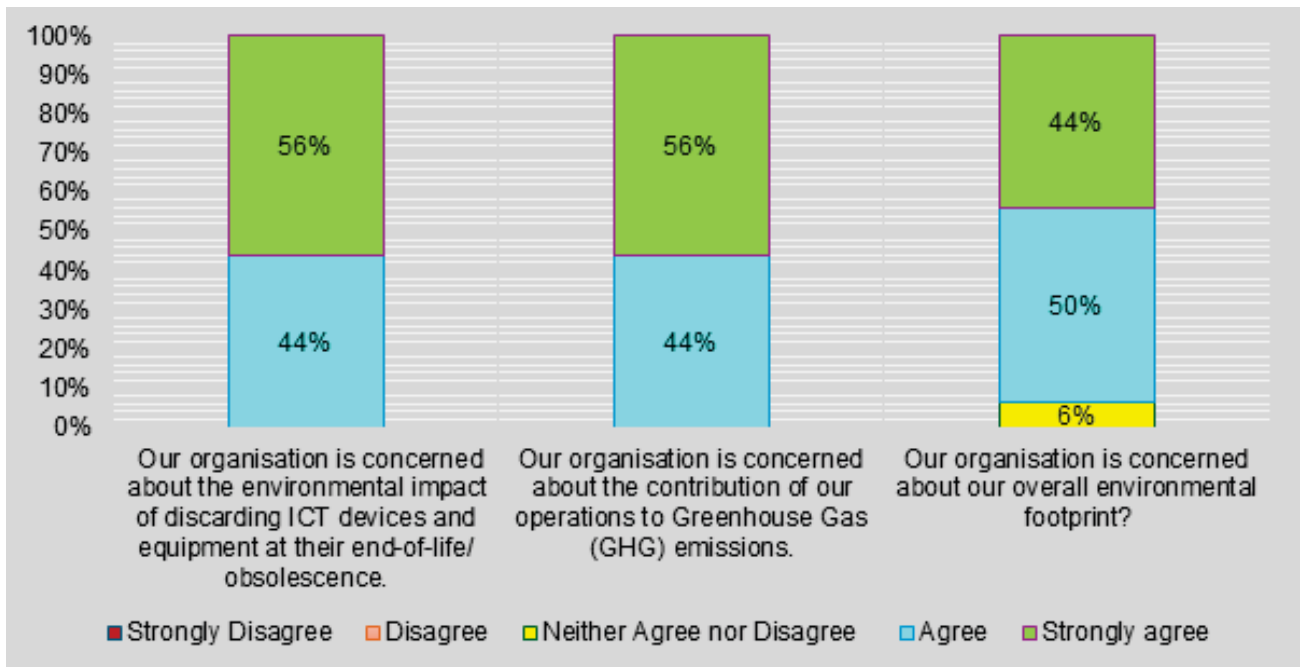


Figure 4: Operator's Attitudes Regarding the Concept of Green ICT

The responses showed a generally high level of concern with regards to e-waste, GHG emissions and overall environmental footprint. They cited their various responsibilities in fostering environmental sustainability through the implementation of various initiatives, some of which are summarised in Figure 5 below:

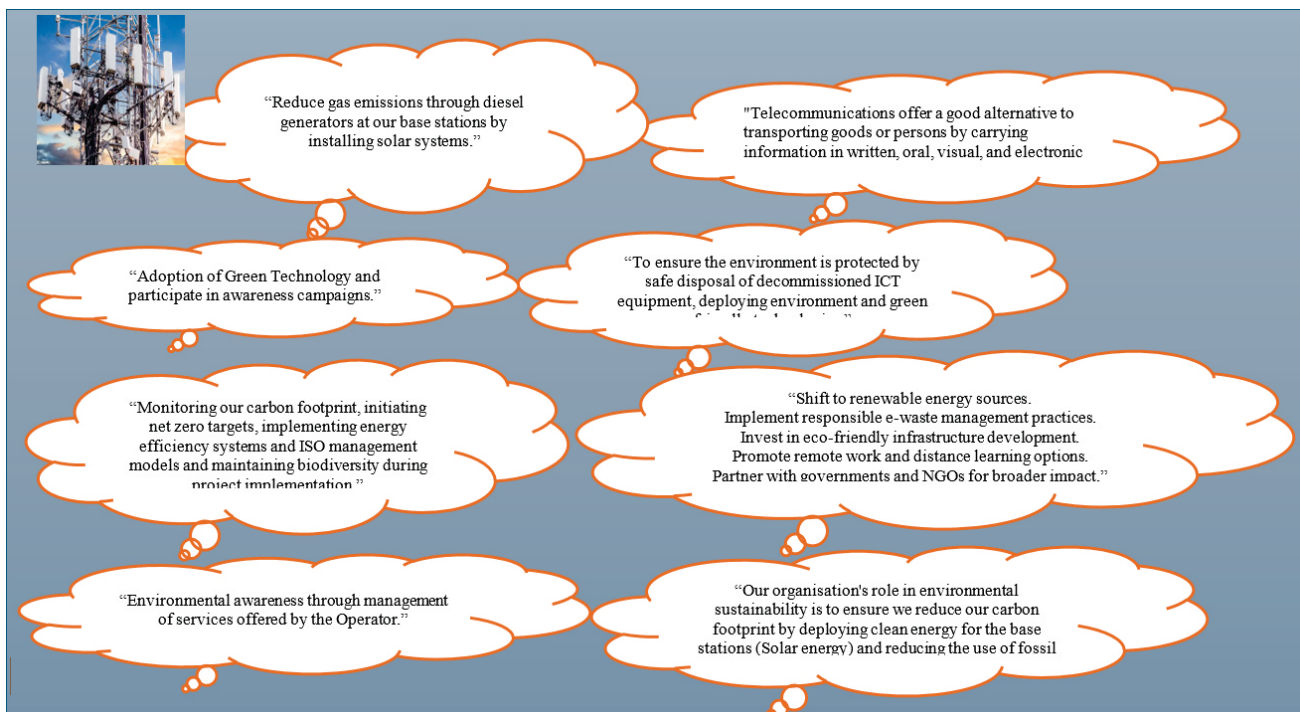


Figure 5: Role of Operators in Promoting Environmental Sustainability

However, presumed attitudes are tested by actual organisational practices; these practices were also evaluated in the subsequent sections of this study report.

3.3 GOVERNANCE

The study also assessed evidence of green ICT governance, such as the existence of policies, strategies for promoting environmentally friendly ICT practices, adherence to international standards as well as the allocation of Green-ICT targeted budgets. The findings are shown in Figure 6 below:

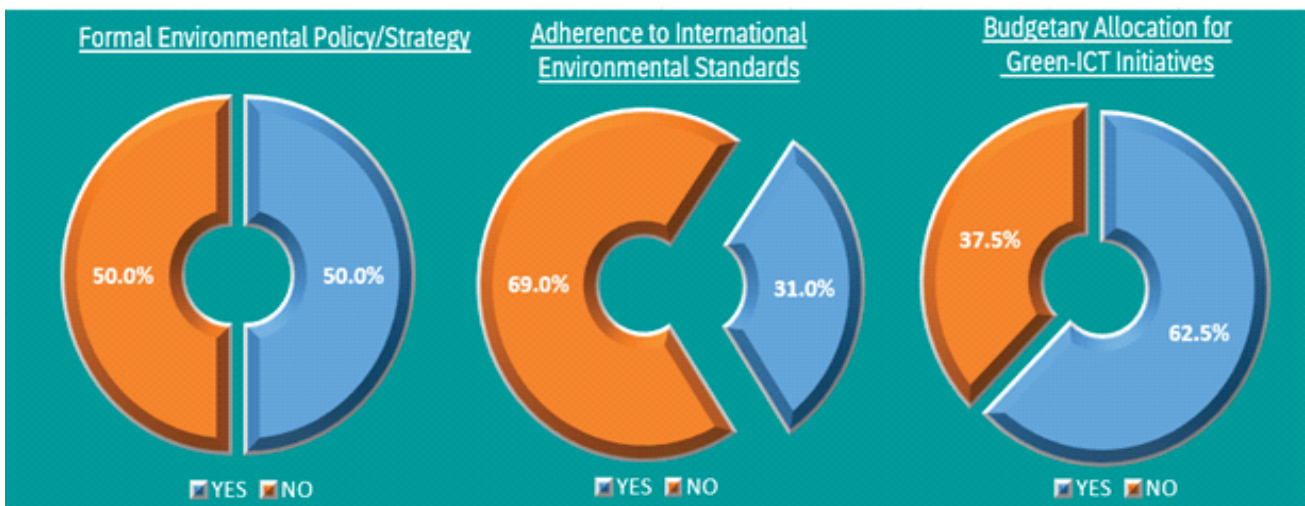


Figure 6: Green-ICT Governance

As shown above, 50% of telecommunications operators did not have an internal policy or strategy targeted at promoting environmentally friendly ICT practices. Operators that reported having formal policies or strategies in place stated that the critical elements of their policies included:

- Prioritisation for overhead installation over digging trenches.
- Energy Efficiency
- green procurement
- adoption of cloud computing amongst others

One operator had gone further to include the reporting of Environmental, Social, and Governance issues (ESG) and related KPIs in their internal performance reporting systems.

Adhering to internationally recognised environmental standards demonstrates commitment to ethical and sustainable environmental practices. However, most of the operators (69%) did not follow international environmental standards. The operators who affirmed their conformance to international standards cited the ISO14001 standard and the and International Federation of Global & Green Information & Communication Technology (IFGICT) standards. Given the above information on policies and adherence to international standards, a Chi-Square Test was conducted, at 5% significance level, to test the following hypothesis:

Hypothesis

H_0 : There is no association between having a formal policy/strategy and adherence to international standards related to Green ICTs.

H_1 : There is an association between having a formal policy/strategy and adherence to international standards related to Green ICTs.

Table 3: Expected Frequencies for Chi-square Tests on Governance Practices

		Adherence to any international standards/certifications related to Green ICT		Total
		No	Yes	
Existence of a formal Policy/Strategy for promoting Green ICT	No	50%	0%	50%
	Yes	20%	30%	50%
Total		70%	30%	100%

Table 4: Chi-square Tests on Governance Practices

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.286	1	.038		
Continuity Correction	1.905	1	.168		
Likelihood Ratio	5.487	1	.019		
Fisher's Exact Test				.167	.083
No of Valid Cases	10				

The results in Table 3 above show $\alpha = 0.038$, which is less than 0.05, which means we reject our H_0 in favour of H_1 and conclude that there is an association between having a formal policy or strategy and adhering to international standards related to Green ICT. In other words, this means that there was a positive relation between existence of internal formal policies and adherence to international standards.

Despite the low prevalence of internal Green-ICT related policies as well as low levels of adherence to international environmental standards as shown in Figure 6, the proportion of telecommunication operators who set aside budgets for Green-ICT initiatives was high (62.5%). With the availability of dedicated resources, organisations are better positioned to implement meaningful Green ICT initiatives.

3.4 ICT PROCUREMENT

The use of ICT products and services is associated with several environmental externalities, hence the growing drive towards sustainable procurement, that is the consideration of environmental criteria in purchasing decisions. The study revealed that environmental criteria were mainly taken into consideration when procuring ICT equipment, but was not yet a key criterion for ICT software procurement as shown in Figure 7 below:

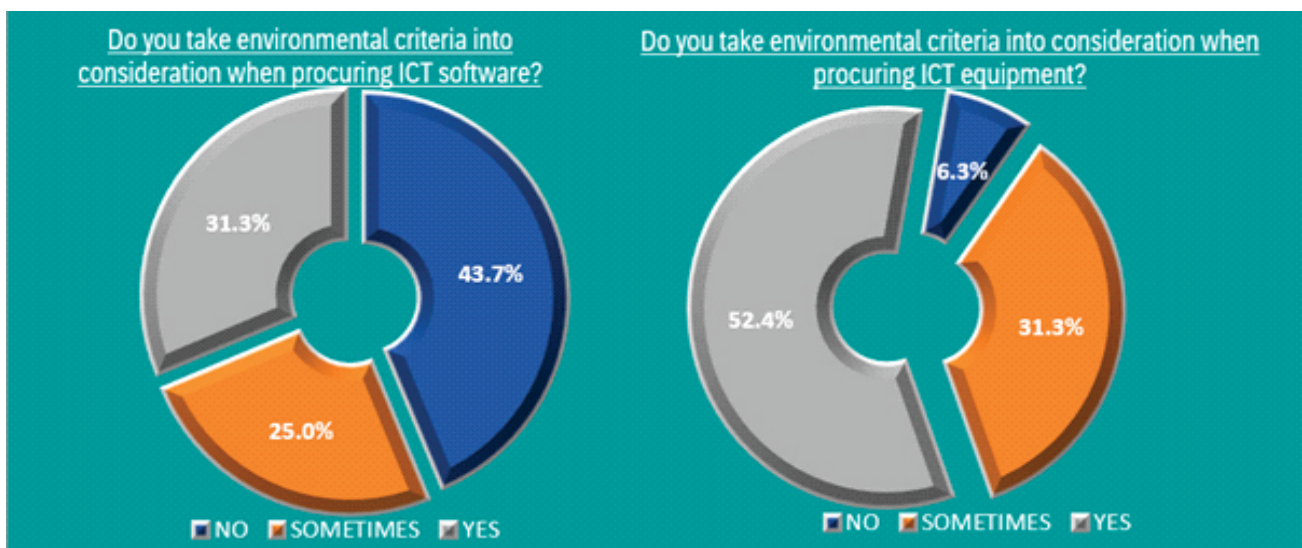


Figure 7: Qualification and Selection of ICT Supplies

As shown above, 43.7% and 6.3% of the telecommunications operators did not consider environmental criteria as a key factor when procuring ICT software and ICT equipment respectively. Historically, sustainable procurement efforts were targeted towards ICT equipment, but there is now a growing focus on ICT software as well. This is because ICT software affects hardware's energy consumption, thereby influencing its operations and impacting carbon emissions. The environmental criteria for consideration in procurement of ICT equipment include end-of-life management i.e., whether the supplier can provide a take-back, re-use or recycling services. Criteria such as energy efficiency, repairability, upgradeability and recyclability are also important. Given that ICT equipment has predetermined shelf lives, it is important that telecommunications operators consider environmental criteria in procurement to minimise the problem of e-waste.

3.4 ELECTRONIC WASTE

Electronic waste, also known as e-waste, is the term used to describe discarded electronic equipment and devices that have reached the end of their useful lives or that their owners no longer want. Consumer and corporate electronics such as computers, laptops, mobile phones, tablets, televisions, and printers are all included in the category of e-waste. As technology becomes more advanced, the life span of ICT equipment and devices keeps getting shorter. The fast-growing number of unwanted devices means the amount of e-waste being sent to landfills is skyrocketing and with it comes an environmental ticking time bomb. E-waste contains a wide list of toxins, including mercury, cadmium, hexavalent chromium, lead amongst others, which if improperly managed, can pose severe threats to human health and the environment.

3.4.1 RECYCLING

Recycling raw materials from end-of-life electronics is regarded as the most effective solution to the growing e-waste problem. Recycling recovers valuable materials from old electronics that can be used to make new products thereby saving energy, reducing pollution, reducing greenhouse gas emissions, and saving natural resources by extracting fewer raw materials from the earth. The study revealed that the proportion of telecommunications operators who recycled ICT equipment and devices at end-of-life was very low as shown in Figure 8 below:

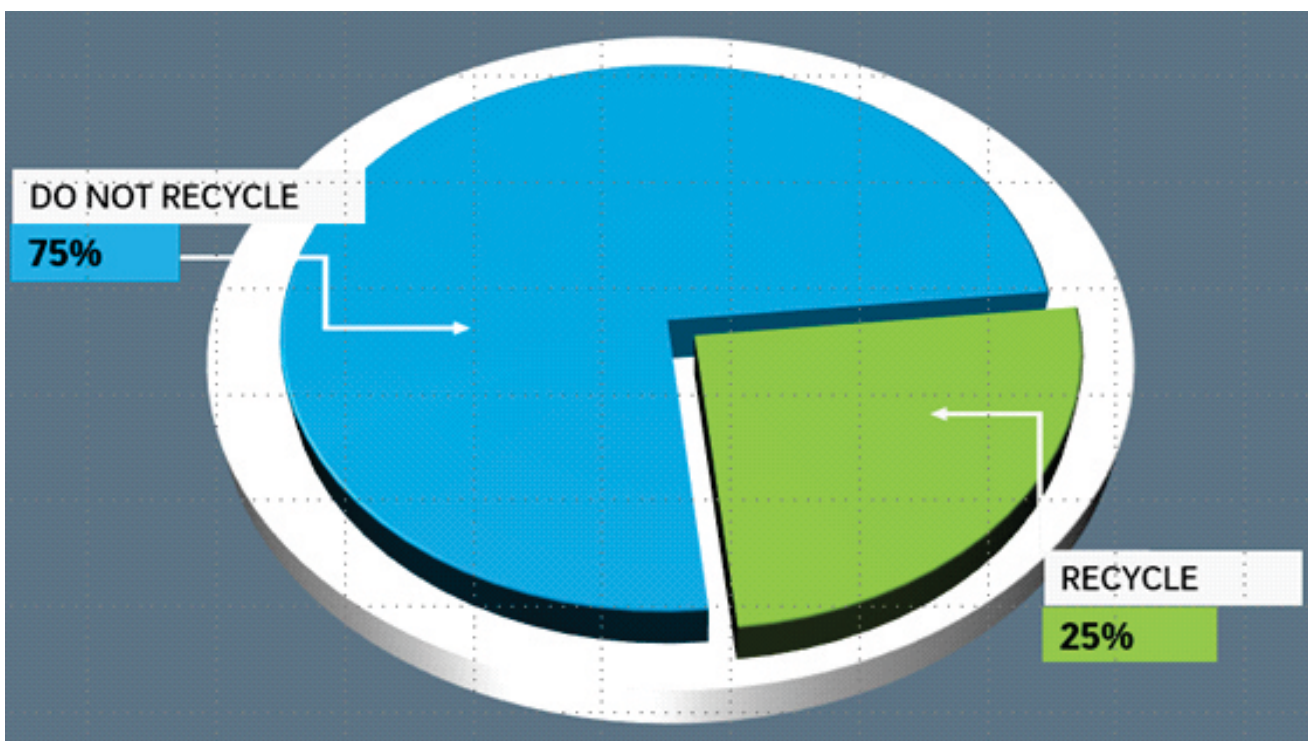


Figure 8: E-Waste Recycling

As shown above only 25% of operators recycled ICT equipment and devices at end-of-life. The main recycled items included printers, laptops, mobile phones amongst others. Operators cited that their recycling decisions were mainly influenced by awareness of environmental impacts of e-waste, convenience, monetary incentives as well as the availability of recycling agents. The following were cited as the main e-waste recycling firms and agents used by the telecommunications operators:

- EnviroServe
- Rabo Metals
- Liquid Zimbabwe

Besides providing proper handling and management of toxic chemical substances like mercury, lead and cadmium contained in the e-waste stream, recycling also contributes to economic value downstream through job creation and providing a second market for the recycled materials. Raising awareness on the importance of e-waste recycling and incentivising recycling can further encourage operators to prioritise recycling.

3.4.2 OTHER E-WASTE DISPOSAL METHODS

Other e-waste disposal methods used by telecommunications were as follows:

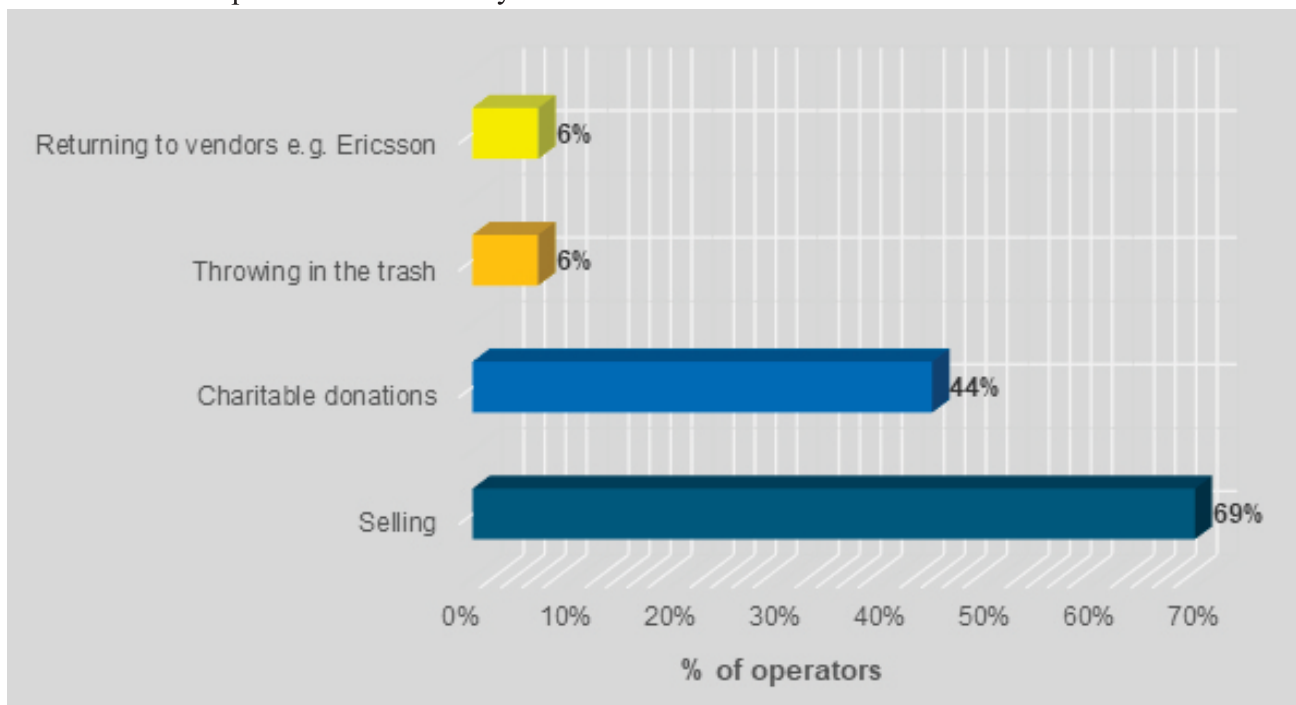


Figure 9: Other Disposal Methods

The selling of unwanted electronic devices and charitable donations provides avenues for re-use. It is environmentally friendly in the short run as devices can be refurbished and reused by the less privileged; however, in the long run, there is no control over the disposal methods used downstream.

3.4.3 EXISTENCE OF A FORMAL E-WASTE MANAGEMENT STRATEGY

An organisational e-waste management strategy or policy demonstrates commitment to effective e-waste management practices and standards. The study revealed that the proportion of telecommunications operators who had e-waste management strategies or policies was very low as shown in Figure 10 below:

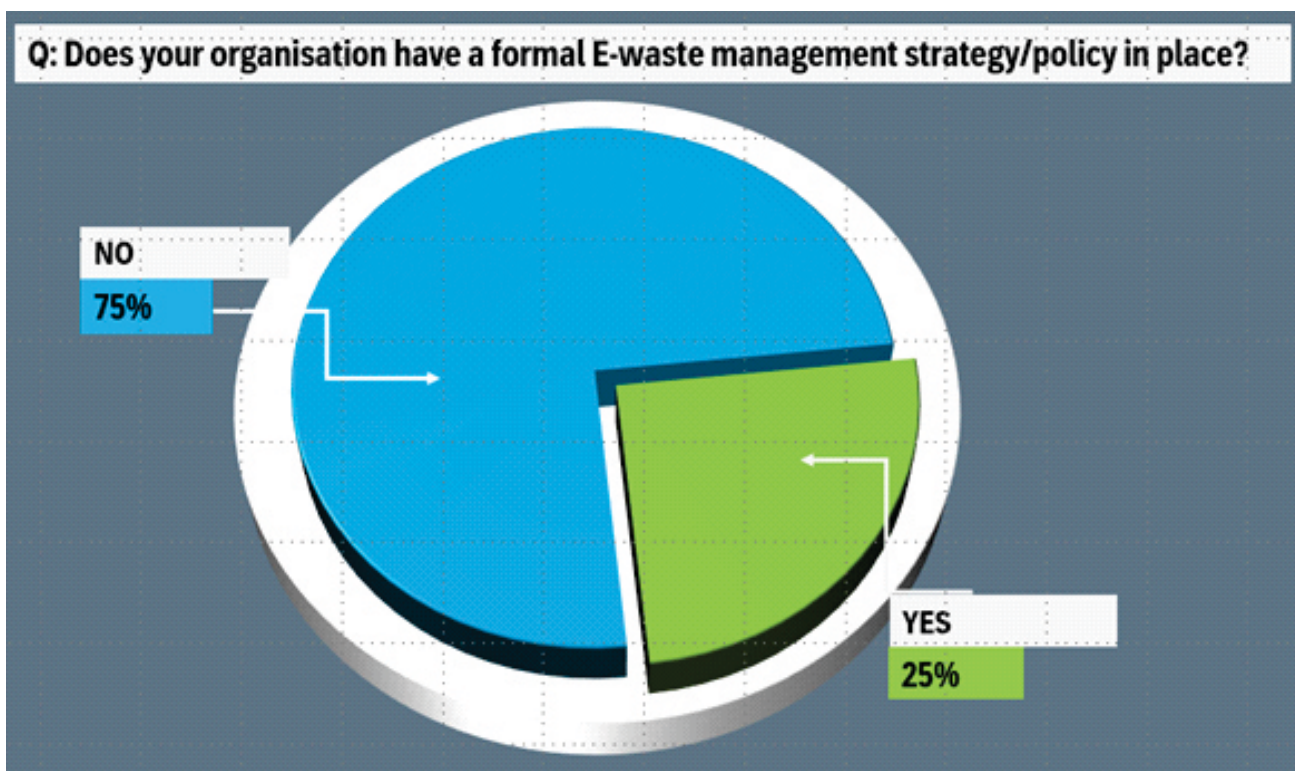


Figure 10: Existence of a formal E-waste Management Strategy

It is important to note that there was a positive correlation between recycling and having an e-waste management strategy. All the Unified Telecommunications licensees, one Internet Access Provider licensee as well as one national cellular telecommunications services licensee had e-waste management strategies. According to the licensees, the main elements of the e-waste strategies included recycling programs, awareness initiatives as well as product take-back initiatives.

3.5 CARBON FOOTPRINT

According to the United Nations Framework Convention on Climate Change⁵, a carbon footprint is a change in climate attributed directly or indirectly to human activity that alters the composition of the world's atmosphere. It is an environmental indicator that represents the amount of greenhouse gases (GHGs), expressed as CO₂ equivalents, that are emitted directly or indirectly because of a specific activity. Measuring an organisation's carbon footprint is important because it helps them understand and take responsibility for the greenhouse gases they are generating into the atmosphere through their activities. It is a crucial first step in comprehending an organisation's environmental impact and finding areas where emissions can be reduced. The study revealed that most of the telecommunications operators were yet to do so as shown in Figure 11 below:

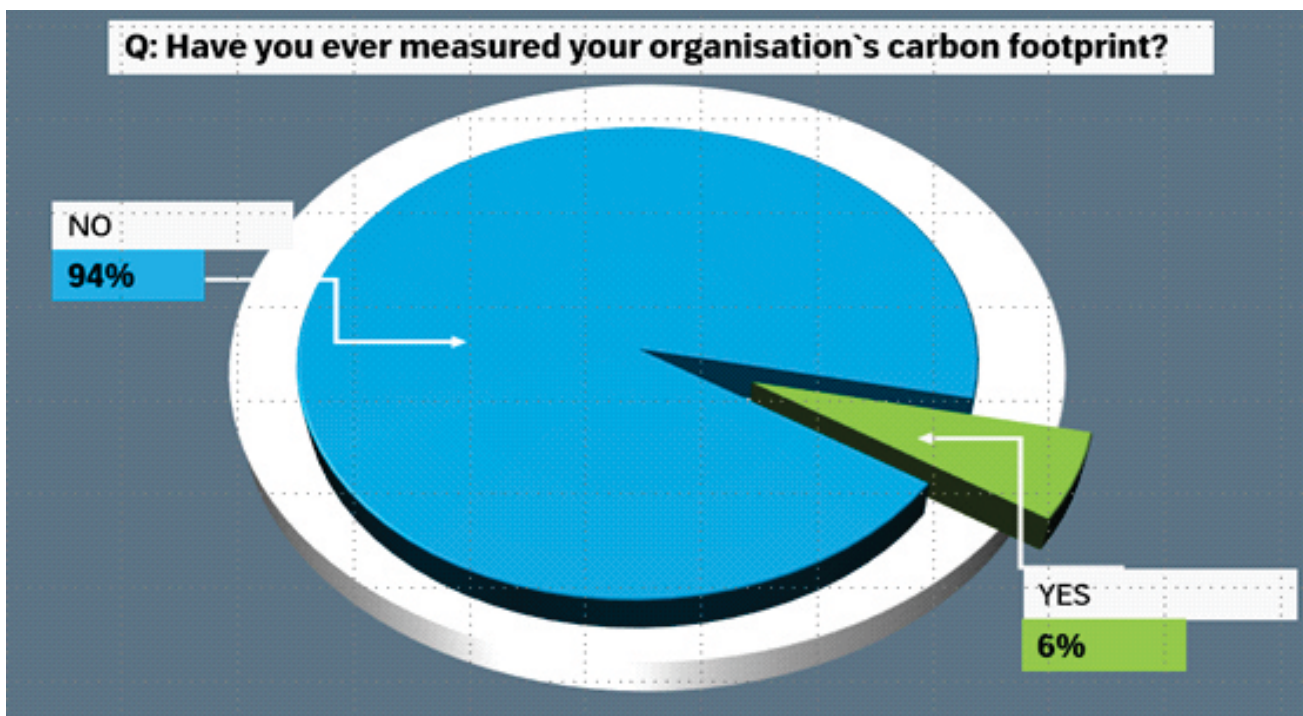


Figure 11: Measurement of Carbon Footprint

Only one entity, an Internet Access Provider, had measured their carbon footprint and initiated Net Zero targets. Net Zero⁴ is an international scientific consensus that, to prevent the worst climate damages, global net human-caused emissions of carbon dioxide (CO₂) need to fall by about 45 percent from 2010 levels by 2030 and reach net zero around 2050. Global warming is proportional to cumulative CO₂ emissions, which means that the planet will keep heating for as long as global emissions remain more than zero, hence the global push for reducing carbon footprint. The group's carbon footprint for 2023 was 142,539.73 tCO₂e, according to their 2023 Sustainability Report.

3.5.1 CARBON OFFSET INITIATIVES

According to the World Economic Forum 7, carbon offsetting is a carbon trading mechanism that enables entities to compensate for their greenhouse gas emissions by investing in projects that reduce, avoid, or remove emissions elsewhere. Carbon offsetting is a vital tool to restore nature and contribute to environmental health. Carbon dioxide (CO₂) emissions have a global impact; therefore, carbon offsetting contributes to global efforts to restore and protect the planet. The study revealed that many organisations were yet to prioritise carbon offsetting as a way of addressing their carbon footprint as shown in Figure 12 below:

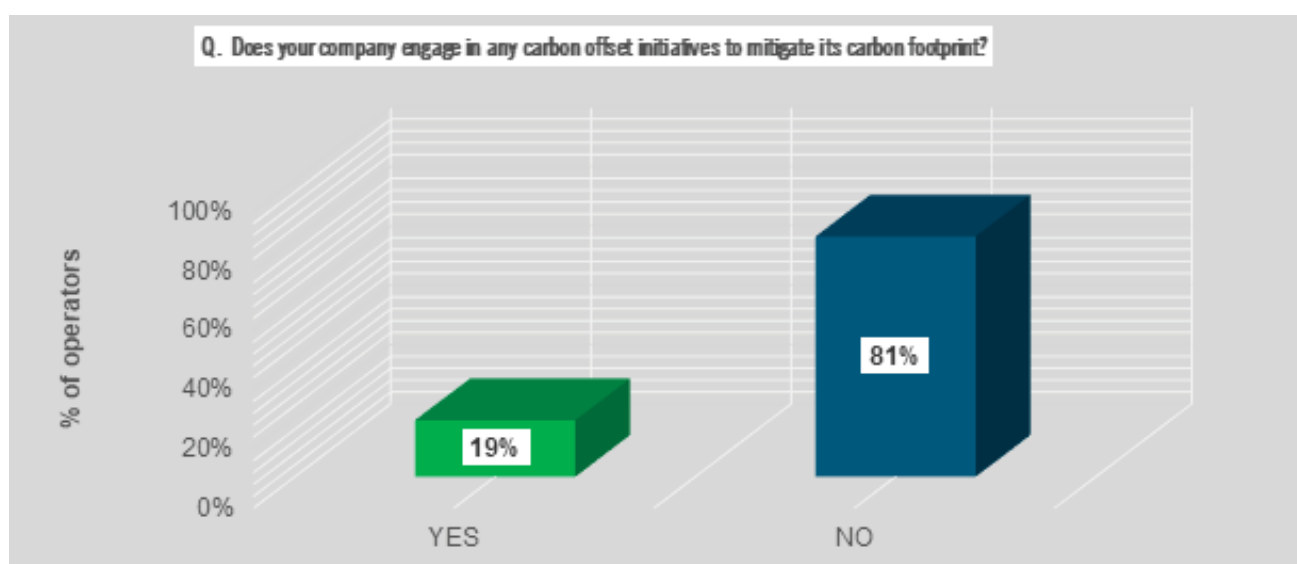


Figure 12: Carbon Offsetting

The few operators who engaged in carbon offset initiatives reported that they had the following initiatives towards mitigating their carbon footprint:

- Renewable energy provision projects.
- Reforestation and afforestation projects.
- Working on plans to purchase carbon credits (one carbon credit is equivalent to 1 tonne of carbon dioxide equivalent (CO₂e) emissions. These credits can be bought, sold, and traded in the carbon market, incentivising businesses to take responsibility for their carbon footprints).

Carbon offset initiatives are aligned with broader corporate sustainability strategies and demonstrate corporate responsibility and environmental leadership. Figure 21 below shows some of the challenges that respondents cited:



Figure 13: Challenges in Reducing ICT Carbon Footprint

The overall low proportion of telecommunications operators engaging in carbon offset initiatives may be attributable to a lack of awareness about carbon offsetting options, perceived complexity or cost associated with carbon offset projects, competing priorities for allocating resources within organisations and an overall lack of interest.

3.6 GREEN PRINCIPLES AT DATA CENTRES

The digital age has led to a surge in connectivity, innovation, and information exchange, but it has also led to escalating energy consumption by data centres. Data centres are integral to the digital infrastructure, but they consume vast amounts of energy and contribute to greenhouse gas emissions, so their rapid growth has raised concerns about their carbon footprint and energy consumption. Embracing sustainability in data centres is crucial to minimizing greenhouse gas emissions, reducing their impact on climate change, and reducing reliance on non-renewable energy sources. The respondents were asked whether they apply green principles at their data centres and the responses are summarised in Figure 14 below:

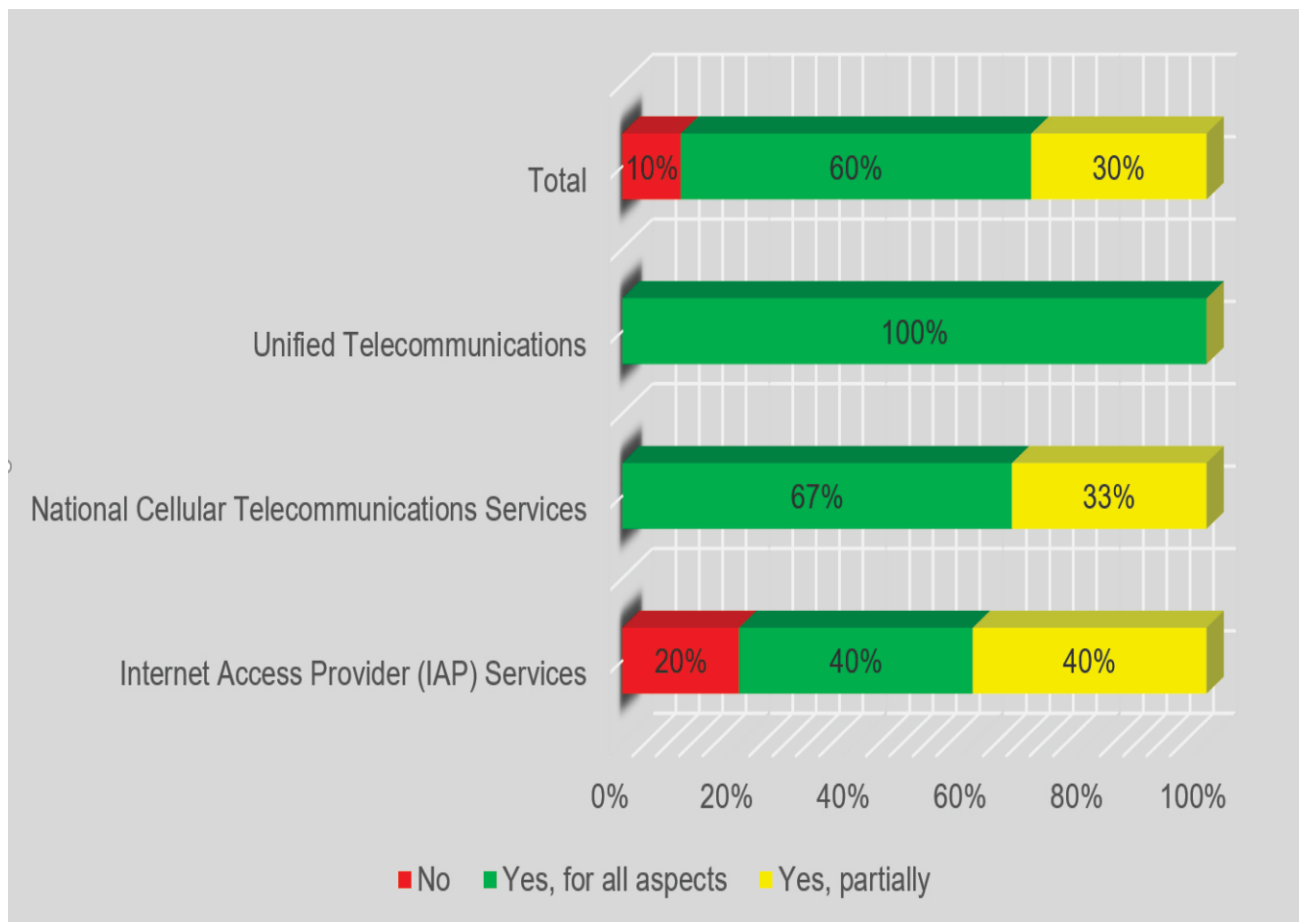


Figure 14: Application of Green Principles at Data Centres

Results in Figure 14 indicate that 60% of operators applied green principles for all aspects of their data centres, while 30% did so partially, and only 10% did not apply green principles at all. The fact that 90% of operators either partially or fully apply green principles in their data centres reflected a recognition of the environmental impact of data centre operations, a proactive effort to minimise environmental impacts as well as a drive towards cost efficiency. Key principles of green data centres include energy-efficient hardware, renewable energy integration, advanced cooling systems, and resource optimization strategies. Energy-efficient hardware involves replacing outdated servers, storage systems, and network equipment with energy-efficient alternatives. Renewable energy integration reduces dependence on traditional power grids and fossil fuels, ensuring an eco-friendlier energy supply. Green data centres have emerged as a transformative solution, embodying a commitment to sustainability through eco-friendly practices and cutting-edge technologies.

3.7 OVERALL GREEN ICT MATURITY LEVEL

The green maturity level demonstrates progress made on embedding Green ICT into organisational processes and practices. It displays the level of development towards reducing ecological impacts, implementing sustainable practices, and incorporating environmental factors into its primary business operations and decision-making procedures. The study classified the following levels of Green ICT Maturity:

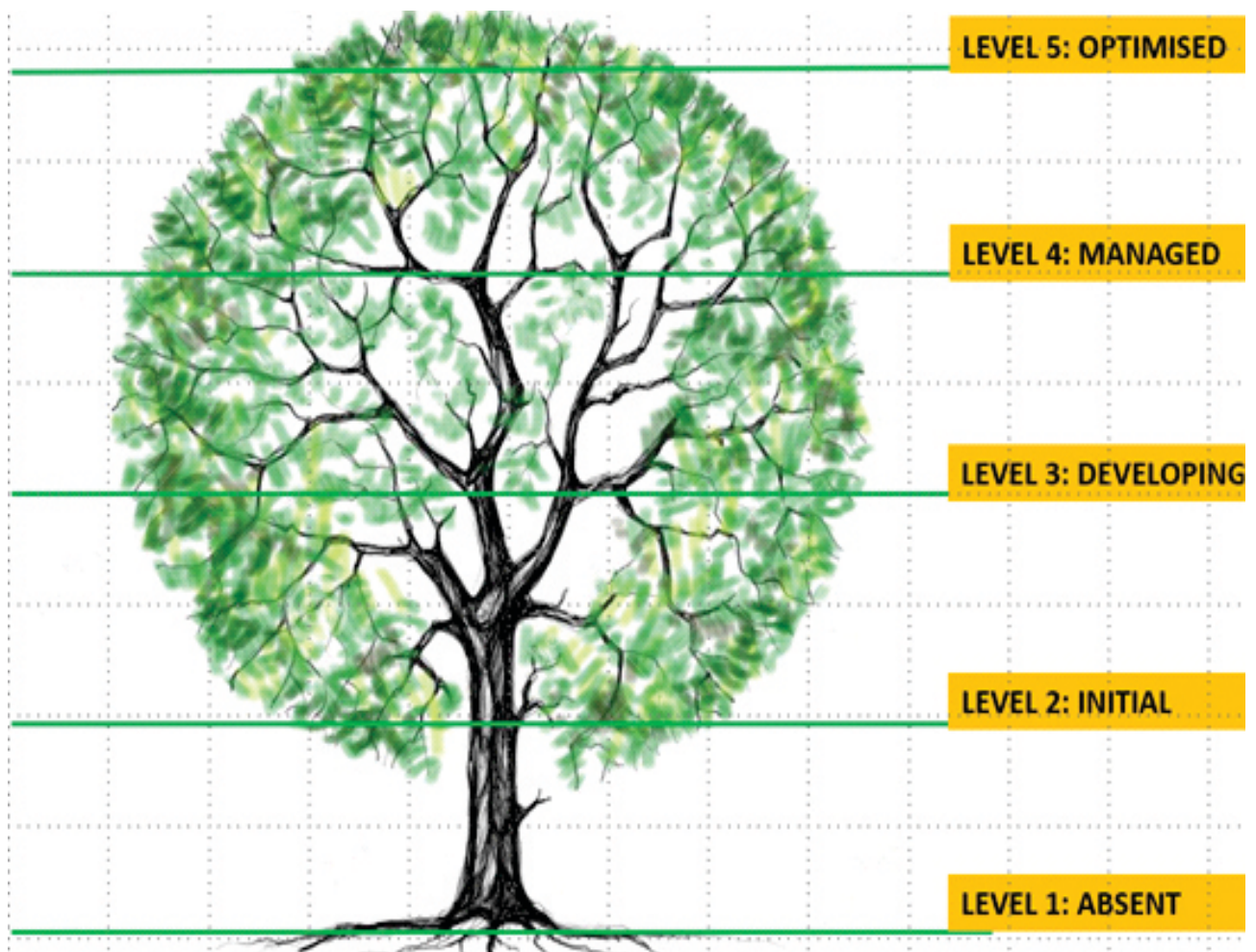


Figure 15: Green ICT Maturity Levels

The maturity levels are explained in the following table:

Maturity Level	Description
Level 1: Absent	Green ICT principles are not imbedded into organisational processes and practices
Level 2: Initial	Green ICT principles are starting to be imbedded into organisational processes and practices, but the level of incorporation is still low.
Level 3: Developing	Progressive adoption of Green ICT Principles. Moderate level of implementation across organisational processes and practices
Level 4: Managed	Green ICT principles are imbedded into most organisational processes and practices.
Level 5: Optimised	Complete integration of Green ICT principles.

Table 5: Green ICT Maturity Levels

Attaining a high green maturity level signifies that an organisation has created a thorough and integrated strategy for sustainability, considering environmental aspects in its operations. The maturity levels were tested on ICT procurement criterion, end-of-life management of end-user devices and printers, policy and governance, ICT software & e-services, cloud computing, data centres and overall network management. The results are shown in Table 6 below:

	ICT Procurement	End-User Devices & Printers	Policy & Governance	ICT Software & E-services	Cloud Computing	Data Centres	Network
Mean	2.81	2.75	2.50	2.06	3.25	2.91	2.73

Average = 2.7 (Level 2: Initial stages)

The Green ICT maturity score of 2.7 shows that the telecommunications industry is still in the Initial stage as shown in Figure 16 below:

The maturity levels are explained in the following table:

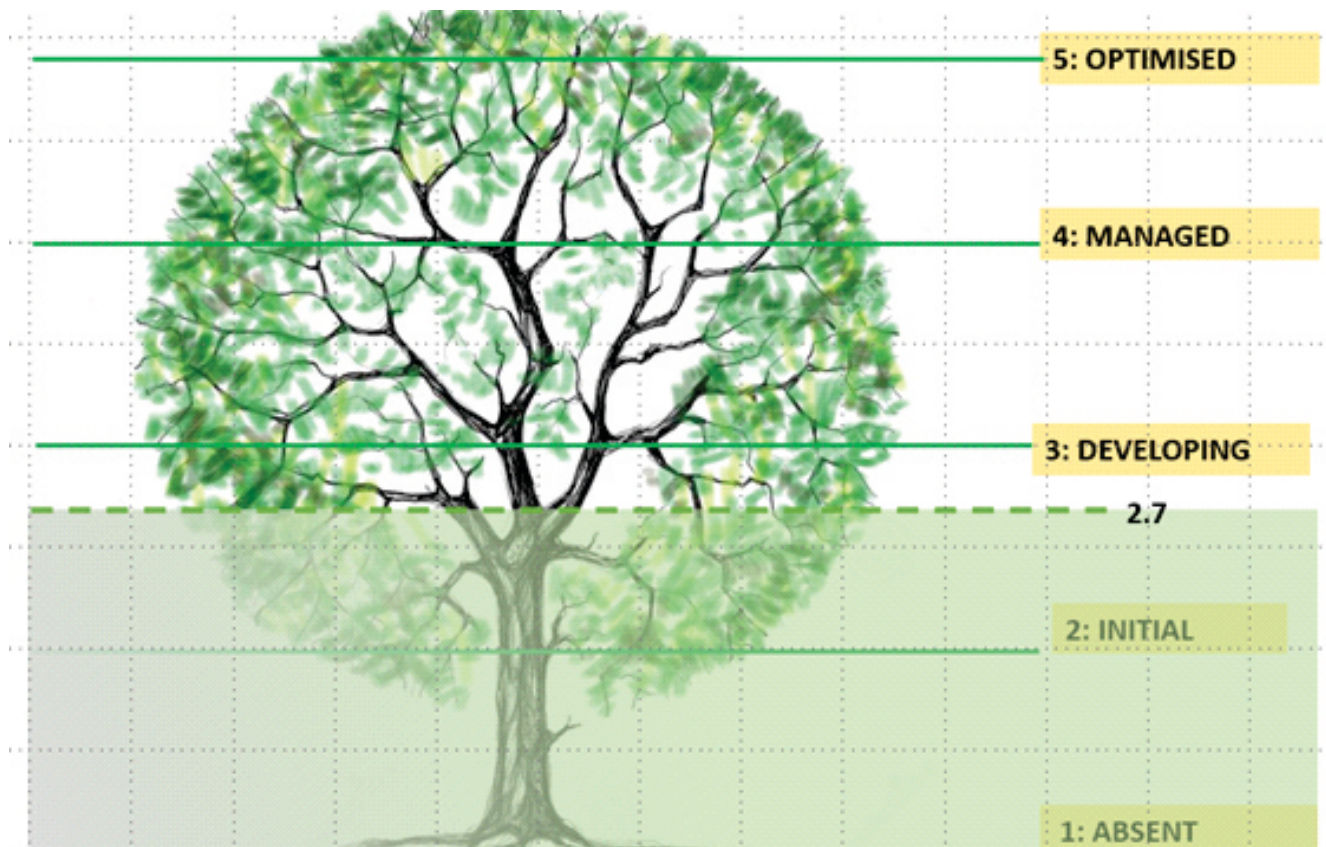


Figure 16: Integration of Green ICT Practices by Organisations

Green ICT principles are starting to be imbedded into organisational processes and practices, but the level of incorporation but more still needs to be done. The maturity scores for the individual assessment pillars are shown in Figure 17 below:

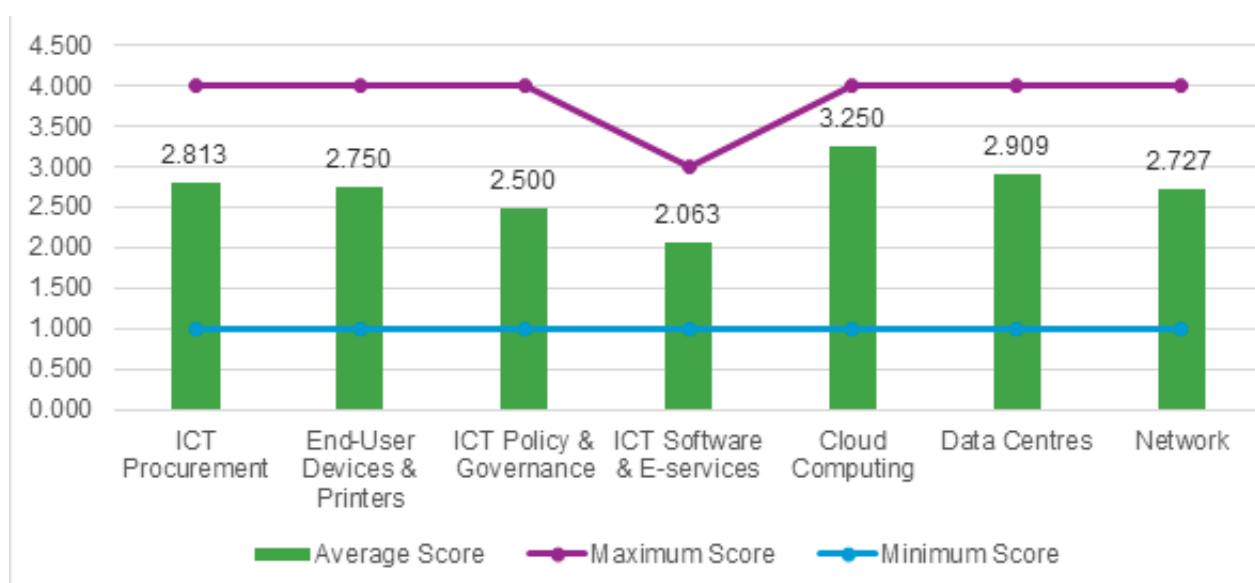


Figure 17: Maturity Scores per Pillar



As shown in Figure 17 above, ICT Software & E-services had lower maturity for the telecommunications operators showing that firms do not take much consideration of environmental factors on this pillar. The policy and governance pillar also had a low maturity level as most operators were yet to imbed environmental considerations into organisational strategies or policies.

3.6 RECOMMENDATIONS TO GOVERNMENT BY OPERATORS

Below are some of the recommendations that were made to the government by operators:

- National policy formulation on green ICT can cascade to implementation proponents and organisations, effectively ensuring the adoption of Green ICT programs during implementation.
- Promotion of green energy solutions and e-waste management policies.
- Tax reduction on all solar equipment to cut costs.
- Regulation on Data Centre power consumption per rack
- Ensure every organisation has a Green ICT Policy aligned with the National Green Policy. The Ministry of Energy is spearheading green initiatives, so it is prudent that the Ministry of ICT also take the lead in promoting Green ICT.
- The government should promote awareness of Green ICT and provide tax incentives for the adoption of Green ICTs.
- Avail grid power to reduce the private running of generators.
- Courts should have stiff penalties for thefts of solar plants and batteries.
- Collaboration on green solutions
- Fund Green ICT research

4. CONCLUSIONS AND RECOMMENDATIONS

This section outlines the conclusions and recommendations for fostering green ICT practices, including e-waste management by telecommunication service providers in Zimbabwe. The survey results highlighted areas of strengths, weaknesses, opportunities, and threats for telecommunication service providers concerning Green ICT practices including e-waste management. It has become increasingly important for companies to emphasise environmentally responsible practices as they manage the intricacies of a quickly changing digital landscape.

4.1 CONCLUSIONS

4.1.1 Awareness

The rating suggests high levels of awareness of ICT related environmental issues, particularly the Green ICT concept. This was perceived to be due to the global wave of environmental activism and the climate change movement. The responses showed a generally high level of concern with regards to e-waste, GHG emissions and overall environmental footprint. However, environmental awareness does not always translate to environmental accountability.

4.1.2 Governance

Half of the telecommunications operators did not have an internal policy or strategy targeted at promoting environmentally friendly ICT practices. Most of the operators (69%) did not follow international environmental standards though adhering to internationally recognised environmental standards demonstrates commitment to ethical and sustainable environmental practices. Despite the low prevalence of internal Green-ICT related policies as well as low levels of adherence to international environmental standards, the proportion of telecommunication operators who set aside budgets for Green-ICT initiatives was high (62.5%).

4.1.3 ICT Procurement

43.7% and 6.3% of the telecommunications operators did not consider environmental criteria as a key factor when procuring ICT software and ICT equipment respectively. Historically, sustainable procurement efforts were targeted towards ICT equipment, but there is now a growing focus on ICT software as well. Given that ICT equipment has predetermined shelf lives, it is important that telecommunications operators consider environmental criteria in procurement to minimise the problem of e-waste.



4.1.4 E-Waste

The fast-growing number of unwanted devices means the amount of e-waste being sent to landfills is skyrocketing and with it comes an environmental ticking time bomb. Recycling raw materials from end-of-life electronics is regarded as the most effective solution to the growing e-waste problem. According to the licensees, the main elements of the e-waste strategies included recycling programs, awareness initiatives as well as product take-back initiatives. Only 25% of operators recycled ICT equipment and devices at end-of-life and their recycling decisions were mainly influenced by awareness of environmental impacts of e-waste, convenience, monetary incentives as well as the availability of recycling agents. Recycling recovers valuable materials from old electronics that can be used to make new products thereby saving energy, reducing pollution, reducing greenhouse gas emissions, and saving natural resources by extracting fewer raw materials from the earth. Raising awareness on the importance of e-waste recycling and incentivising recycling can further encourage operators to prioritise recycling. The selling of unwanted electronic devices and charitable donations provides avenues for re-use.

4.1.5 Carbon Footprint

The few operators who engaged in carbon offset initiatives had renewable energy provision, reforestation and afforestation projects and working on plans to purchase carbon credits. The overall low proportion of telecommunications operators engaging in carbon offset initiatives may be attributable to a lack of awareness about carbon offsetting options, perceived complexity or cost associated with carbon offset projects, competing priorities for allocating resources within organisations and an overall lack of interest.

4.1.6 Green Principles at Data Centres

The fact that 90% of operators either partially or fully apply green principles in their data centres reflected a recognition of the environmental impact of data centre operations, a proactive effort to minimise environmental impacts as well as a drive towards cost efficiency. Key principles of green data centres include energy-efficient hardware, renewable energy integration, advanced cooling systems, and resource optimization strategies. Green data centres have emerged as a transformative solution, embodying a commitment to sustainability through eco-friendly practices and cutting-edge technologies.

4.1.7 Green ICT maturity level

The green maturity level demonstrates progress made on the integration of Green ICT into organisational processes and practices. The maturity score of 2.7 highlighted that Green ICT principles are starting to be imbedded into organisational processes and practices in Zimbabwe's telecommunications sector, but the level of incorporation still needs more to be done. Attaining a high green maturity level signifies that an organisation has created a thorough and integrated strategy for sustainability, considering environmental aspects in its operations. The average shows that the integration of Green ICT practices in organisations' operations and decision-making processes was still in its initial stages.

4.2 RECOMMENDATIONS

Below are recommendations targeted at the government of Zimbabwe and telecommunications service providers to promote Green ICT and e-waste management for environmental sustainability.

4.2.1 The Government of Zimbabwe

✓ **Collaboration and Information**

Encourage cooperation amongst government agencies, telecommunications companies, environmental groups, and other interested parties so that best practices, information, and resources about green ICT efforts can be shared. Collaborate with other nations and international organisations to unify norms and laws on green ICT practices and e-waste management.

✓ **Public Awareness Campaigns**

Start public awareness programs to inform people about how ICT products affect the environment and how crucial it is to recycle e-waste.

✓ **Extended Producer Responsibility**

Implement Extended Producer Responsibility (EPR) schemes that hold telecommunications operators accountable for collecting, recycling and proper disposal of their products once they reach the end of their life.



✓ Investment in Recycling Infrastructure

There is need for a national drive to invest in the e-waste recycling industry and promote the development of recycling programs and e-waste collection centres to encourage proper disposal of old electronics.

✓ Policy Development

There is need to develop a national policy framework on Green ICTs, focusing mainly on e-waste management as it is a growing scourge.

✓ Incentives and Support Programs

Provide incentives and support initiatives to encourage companies to implement green ICT practices. This could include tax incentives and subsidies for e-waste recycling infrastructure.

✓ Research and Development

Support research and development efforts aimed at developing sustainable materials, energy-efficient technologies, and innovative recycling processes for ICT products. Provide grants or funding opportunities for companies and academic institutions conducting research in green ICT and e-waste management.

4.2.2 Telecommunications Operators

✓ Policy Development

Develop formal internal policies that outline commitment to green ICT practices and e-waste management. These policies should define responsibilities and measures related to environmental sustainability.

✓ Product Design and Procurement

Prioritise energy-efficient and environmentally friendly materials when designing and procuring ICT equipment or software. Consider products' lifecycle impact, including energy consumption during use and recyclability at end-of-life.

✓ Energy Efficiency

Focus on optimising the energy efficiency of ICT infrastructure, including data centres, network equipment, and telecommunications facilities.

✓ Renewable Energy Adoption

Invest in on-site renewable energy generation, such as installing solar or wind power systems.

✓ **E-Waste Management**

Partner with certified e-waste recycling facilities to ensure proper handling and recycling of end-of-life ICT equipment. Set up e-waste collection and recycling procedures to properly handle end-of-life electronic equipment.

✓ **Customer Education and Engagement**

Educate customers about the environmental impact of ICT usage and offer incentives for customers to trade in old devices for recycling or purchase energy-efficient products. Engaging in knowledge-sharing forums to share concepts, firsthand expertise, and perspectives about Green ICT.

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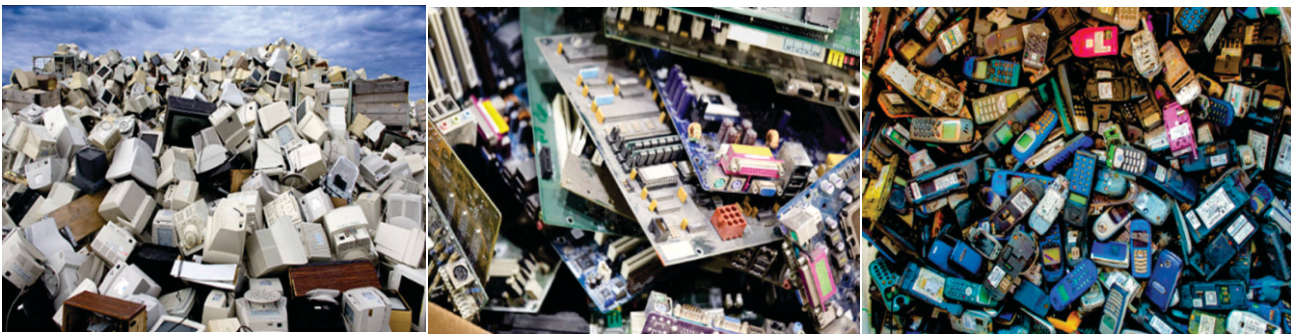
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ANNEXURE



Questionnaire No.

'creating a level playing field'



AN ASSESSMENT OF GREEN INFORMATION COMMUNICATION TECHNOLOGY PRACTICES, INCLUDING E-WASTE MANAGEMENT, BY TELECOMMUNICATIONS OPERATORS IN ZIMBABWE.

INTRODUCTION:

As the world becomes more conscious of the environmental impact of technology, the need to integrate sustainability into operations has become essential. Green ICT focuses on minimising the negative effects of ICT operations on the environment by designing, manufacturing, operating and disposing of ICT products in an environmentally friendly manner (e-waste management). POTRAZ is conducting this survey to assess the Green ICT practices by licensed operators in Zimbabwean and evaluate the Green ICT maturity level. This will enable benchmarking, formulation of policy recommendations and the provision of country data to ITU. Hence, your input is very crucial. Thank you for participating in this important survey, as together, we strive to foster sustainable development.

RESPONDENT DETAILS

Name of Organisation	
Completed by:	
Date completed:	

GENERAL

1.How do you rate your awareness level of the concept of Green ICT?

- ☐ Very Aware
- ☐ Somewhat Aware
- ☐ Not Aware

2.Our organization is concerned about the environmental impact of discarding ICT devices and equipment at their end-of-life/ obsolescence.

- ☐ Strongly Disagree.
- ☐ Disagree.
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

3.Our organization is concerned about the contribution of our operations to Greenhouse Gas (GHG) emissions.

- ☐ Strongly Disagree.
- ☐ Disagree.
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

4.Our organization is concerned about our overall environmental footprint.?

- ☐ Strongly Disagree.
- ☐ Disagree.
- ☐ Neither Agree nor Disagree
- ☐ Agree
- ☐ Strongly Agree

5.What do you believe is your role, as a telecommunications service provider, in environmental sustainability?

.....

.....

.....

GOVERNANCE

6.a. Does your organisation have a formal policy or strategy for promoting environmentally friendly ICT practices?

- ☐ Yes
- ☐ No

b. If Yes, please provide a brief overview of the key elements of the policy or strategy.

.....

.....

7.a. Does your organisation adhere to any international standards or certifications related to Green ICT (e.g., ISO 14001, EPEAT)?

- ☐ Yes
- ☐ No

b. If yes, please specify the standards or certifications followed and their impact on your company's Green ICT practices.

.....

.....

.....

8.Has your organisation set aside a budget/resources for Green ICT initiatives?

☐ Yes

☐ No

9.What is the proportion of the resources set aside for Green ICT initiatives in relation to the overall budget?

☐ Less than 1%

☐ 2-3%

☐ 3-4%

☐ 4-5%

☐ Above 5%

☐ No budget

10.Has your organisation implemented any green ICT initiatives?

☐ Yes

☐ No

If YES to Question 10 above, kindly provide details on such initiatives.

.....

.....

.....

11.a. Does your company collaborate with local or international partners or participate in knowledge-sharing forums focused on Green ICT?

☐ Yes

☐ No

b. If Yes to question 17 above, please specify the nature of collaboration or participation and any significant outcomes.

.....

.....

12.Do you take environmental criteria into consideration when qualifying and selecting ICT suppliers?

☐ Yes

☐ No

☐ Sometimes

13. Do you take environmental criteria into consideration when procuring ICT equipment?

☐ Yes

☐ No

☐ Sometimes

14. Do you take environmental criteria into consideration when procuring ICT software?

☐ Yes

☐ No

☐ Sometimes

ELECTRONIC WASTE

15. How do you usually dispose of your old electronic devices? (Select all that apply)

☐ Recycling through designated E-waste collection centres

☐ Donating to charities

☐ Selling or trading in

☐ Throwing in the trash

☐ Other (please specify).....

16. For those who selected 1 above (recycling), kindly provide details of the e-waste collection centres/agents you use.

.....
.....

17. For those who selected 1 above (recycling), which of the following ICT equipment do send for recycling?

Equipment	Yes	No
Printers		
ICT hardware (e.g., storage, server, firewall, etc.)		
Mobile phones		
Laptops		

18. What factors influence your decision on how to dispose of electronic devices? (Select all that apply)

- ☐ Convenience
- ☐ Environmental impact
- ☐ Monetary incentives
- ☐ Awareness of E-waste recycling programs
- ☐ Lack of awareness
- ☐ Other (please specify):.....

19.a. Does your organization have a formal E-waste management strategy in place?

- ☐ Yes
- ☐ No

b. If Yes to question, what are the key elements of your E-waste management strategy?

- ☐ Internal recycling programs
- ☐ Product take-back initiatives
- ☐ Awareness campaigns
- ☐ Export to other countries for recycling
- ☐ Other (please specify):.....

CARBON FOOTPRINT/PRACTICES

20. Have you ever measured your organisation's carbon footprint?

- ☐ Yes
- ☐ No

21. If Yes to question above, kindly provide your approximate annual carbon footprint

.....

22.a. Does your company engage in any carbon offset initiatives to mitigate its carbon footprint?

☐ Yes

☐ No

b.If Yes to question 22 above, please describe the nature of these initiatives and their impact on reducing carbon emissions.

.....

.....

.....

23.a. What are your company's main challenges in reducing its ICT carbon footprint?

.....

.....

b. Are there any specific opportunities you see for further reducing carbon emissions within your company's operations?

.....

.....

24.Do you tend to apply green principles for your data center?

☐ Yes, partially

☐ Yes, for all aspects

☐ No

OVERALL

25.Overall, using a scale of 1 to 5 where 1 is Not at all, 2 is Slightly, 3 is Moderately, 4 is Mostly, 5 is Completely integrated, to what extent have Green ICT practices been integrated into your organisation`s operations and decision-making processes?

ICT Area	1	2	3	5	4	99/NA
ICT procurement						
End-user devices & printers						
ICT policy & governance						
Software & e-services						
Cloud computing						
Data centre						
Network						

26.To what extent do you believe Green ICT initiatives contribute to the competitiveness of telecommunications companies in Zimbabwe?

- ☐ Significantly
- ☐ Somewhat
- ☐ Minimally
- ☐ Not at all

27.What are your recommendations to Government? Do you have any suggestions for fostering Green ICTs in Zimbabwe?

.....

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Thank you for completing our survey! Your input is valuable in understanding and improving Green ICT management practices.