Investigation of a UK Financial Organisation's Green Computing Strategy

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Abstract: This study involves an investigation on the Green ICT strategy of a financial organization. The baseline for the Green ICT strategy implementation is elicited via a semi-structured interview and assessed using a bespoke tool developed for a SURF Maturity Model driven framework. This framework encompasses Green ICT strategy, Greening of ICT in the organization and Greening of operations in ICT. The results of the study reveal that the overall baseline score is 1.8 out of 5.0 which is a relatively low score. However, the overall target level set for organization is 3.0 out of 5.0 accompanied by a roadmap and action plan (with several key action objectives) that covers a 5-year timeframe to bridge the gap between the baseline and the target. An IT representation from the organization provides some feedback on the action plan that leads to several amendments relating to cloud technology and a written business case for promoting a Green ICT strategy.

Keywords: SURF Maturity Model, Green IT Strategy, Greening of ICT, Greening by ICT

1. INTRODUCTION

1.1 Climate Change & ICT
Undeniably, climate changes have a huge influence on global opinion and strategy (e-InfraNet, 2014). Currently, the number of planets required to regenerate humanities demand on Earth stands at 1.5 (Zoological Society of London, Global Footprint Network, Water Footprint Network, WWF, 2014). A study by the UK government in 2007 shows the contribution of ICT to this global emissions total is around 2% (UK Government / AEA, 2010). This means that ICT has a considerable impact on the global carbon footprint. These considerations provide a motivation for conducting research on Green ICT strategies to the global community.

1.2 Organisation and sector background
The case study is on one of the largest financial organisations in the UK and has a global presence in the finance and services industry. In recent years, the sector has experience several instabilities with the recession in 2007 and more recently Brexit in 2016 causing uncertainty in financial markets with many economists predicting a significant and rapid effect on the UK economy (BBC News, 2017). There has been a rise in inflation and devaluation of the pound since the vote (BBC News, 2017). These factors are set to have a negative impact on the organisation from a financial standpoint. More positively the rise in investment in technology has had a positive influence on the sector. ICT Technology is set to replace many workflow processes (Business Insider UK , 2016). This means an increase in use of ICT in the workplace and therefore an increase in influence for Greening of ICT in the workplace.

1.3 Definition of Green ICT strategy
Green ICT strategy is defined as the first steps taken to reduce overall carbon footprint (The Royal Borough of Kensington and Chelsea, 2008). It comprises of a written strategy, an action plan for the strategy, an implementation plan for the strategy and finally evaluation of the strategy success. This will be described in more detail in the methodology section of the paper.

1.4 Rationale
Why choose this organisation? This organisation has been chosen as it is a large organisation in the financial sector. This is relevant as the organisation has influence on the UK economy and from a social perspective. But more importantly, it has influence on the industry from a green perspective. A completed and implemented green ICT strategy for this organisation would provide guidelines and relevance for other organisations in the financial sector and so could therefore be used more widely. The organisation will also contribute a substantial proportion towards the carbon emissions for the sector. So, the combine effect of reducing its own carbon emissions and providing guidelines for others in the sector is good reason for choosing it.

Why conduct this study?
Relevance to climate change: Climate change is a growing concern for the global community as discussed in the background section of the report. The organisation is included in this community and must contribute to the overall reduction in global carbon emissions and push towards a sustainable planet.
Organisational reputation: The organisation's reputation is a consideration for the rationale for the report. In modern days, it is considered good to be green and green initiatives are increasing in popularity (Chron, 2017). If an organisation is found to not be striving to be green, the public response may have a detrimental effect on the organisation. In the financial sector, reputation is a key feature to the success of large organisations.
Cost savings & Sustainability: The biggest value in going green is the contribution to maintaining the health of the environment (Chron, 2017). Utilising sustainability methods can prevent waste of natural and operational resources which contributes to both sustainability and cost savings for the organisation. An organisation will value its assets and any potential savings that can be made or contributions towards sustainability. A big example of what could be included in these savings is waste reduction for the organisation (ibid).

This study will help to identify potential cost savings and sustainability considerations for the organisation.

<u>Corporate and social responsibility:</u> Organisations have an ethical and social responsibility to look after both their community and its environment. Therefore, one of the key drivers for the study is to help the organisation to achieve this through being green in its ICT strategy.

1.5 Aim and objectives

This report will have the following aims and objectives for the study of the organisations ICT strategies:

Aim: To understand the ICT strategy of a given financial organisation and how the strategy is implemented, to provide a roadmap and action plan on how this strategy can be improved or implemented better to improve the Green ICT strategy for the organisation.

Objectives

R01 – To conduct a critical literature review on the current trends in Green ICT strategy from EU down to the sector of the given organisation to understand the background of the study.

R02 – To examine current macro level methodologies in Green ICT strategies to provide a structure for the methodology to be used to look at the ICT strategy of the organisation

R03 – To survey current techniques in micro methodology and outline the techniques and tools to be used for the study

R04 – To conduct a semi-structured interview and document review to acquire data on the company's current Green ICT strategy and their future strategy

R05 – To conduct data analysis for R04 to establish the baseline for the organisation.

R06 – To assess the awareness of end users on Green ICT directives and legislation, the Green ICT strategy of the organisation and how the users behave to adhere to the legislation and Green ICT strategy.

R07 – To devise a roadmap with target and action plan for the organisation's Green ICT strategy.

R08 – To provide future strategy for implementation of green IT strategy of the organisation and highlight any key changes or developments in current process, gaining their feedback on the action plan and roadmap.

2. LITERATURE REVIEW

Firstly, it is necessary to understand the area of green ICT strategy to provide context on the study and background information to help the organisation improve its green ICT strategy. The review will consider the various levels of green

Figure 1: C0$_2$ abatement potential by sector (2030) (GeSI, accenturestrategy, UNFCCC, 2015)
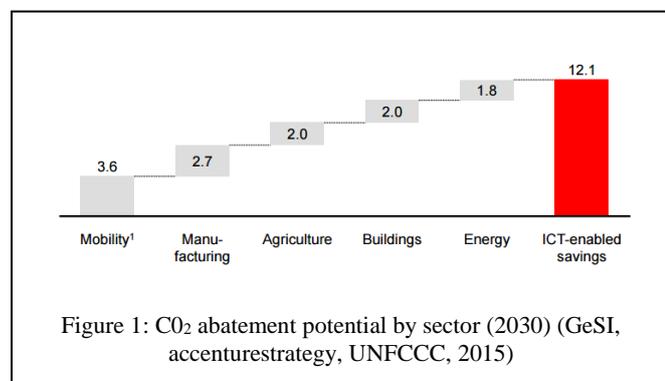
ICT strategy from European level in a funnel shape down to organisational level. Examples of recent strategies are given for each tier to be considered. Since 2008, *the Global e-*

Sustainability Initiative has been looking at ways to reduce the overall global CO2 emissions and move towards a more sustainable society (GeSI, accenturestrategy, UNFCCC, 2015). This is a study with potential results that could be in place in 2030. It has been recently found that ICT becoming faster, cheaper and more accessible globally, this can have a powerful effect on environmental, economic and social change and is included in SMARTER 2030. This change has driven several strategic findings to implement into the SMARTER 2030 piece. These findings include ICT enabling a 20% reduction in global C0$_2$ emissions by the 2030 deadline through greening by ICT. Figure 1 shows the significance of ICT as a potential saver of emissions.

This is coupled with avoiding the trade-off of prosperity for environmental protection which until recently was thought to not be possible. It was also found that ICT emissions will fall from 2.3% of global emissions to just 1.97% (GeSI, accenturestrategy, UNFCCC, 2015). ICT can also offer significant environmental benefits in addition to reducing carbon emissions, in other areas for example producing a 30% increase in agricultural crop yields saving 300 trillion tons of water and 25 billion barrels of oil per year. Through assessment of 8 economic sectors including work and business which is the category this organisation will fall under studies show global generation of $11 trillion in economic benefits due to ICT by 2030 as the worldwide digital economy continues to grow. ICT will connect with 2.5 billion extra people by 2030 in the developing world and provide an extra 1.5 billion with access to healthcare benefits (GeSI, accenturestrategy, UNFCCC, 2015). Figure 2 below shows the financial benefits of SMARTER 2030. These two key themes, greening of ICT and greening by ICT which are highlighted in SMARTER 2030 are a key consideration for the development of the organisation's ICT strategy and will be used in the study. SMARTER 2030 also highlights three key stakeholders in the consideration of green ICT strategy including government, business leaders and consumers (GeSI, accenturestrategy, UNFCCC, 2015). In the context of the organisation this translates to UK government (as it is a UK based organisation), organisation leaders and end users in

Figure 2: Economic – Global economic benefits of ICT-enabled solutions (GeSI, accenturestrategy, UNFCCC, 2015)
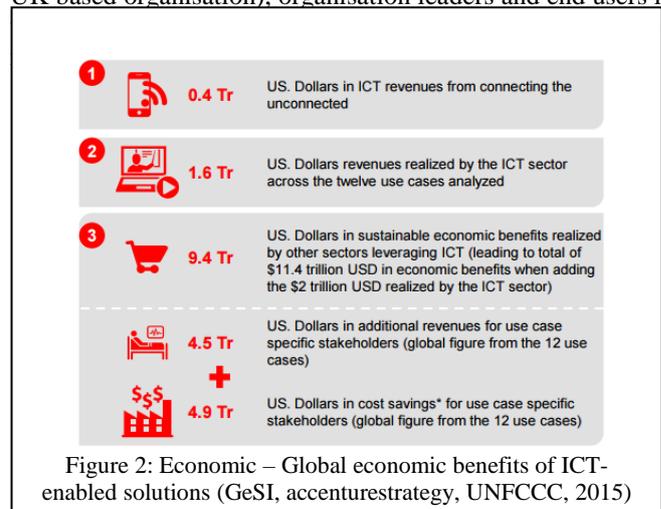
2.1 UK Strategy

The UK Greening government document outlines the vision the government have for the UK which is a cost effective and energy efficient ICT estate enabling a sustainable public sector (HM Government, 2011). The strategy from 2011 was targeted to be implemented by 2015. It is an approach to embed sustainable development in the procurement and operation of all central government departments and related organisations (ibid). On an organisational level, it targets to ensure:

• Purchase of sustainable and efficient products and services;
• Proactive management and reduction of CO_2 emissions by 25% across government estates;
• Ensure redundant ICT is reused within government or wider public sector when practical.

The strategy states that environmental impacts of ICT spans from design all the way to disposal, through the lifecycle, not just in the energy used in operation. The strategy is split into two main sections part 1 – greening by ICT across the lifecycle and part 2- using ICT as an enabler (ibid).

2.2. Part 1 – Greening by ICT

The strategy includes efficient operation of ICT equipment by sharing applications and infrastructure and services such as human resources and commercial functions which are relevant for the organisation. There are propositions for a single ICT infrastructure to deliver savings and green improvements. This is happening by way of the PSN (Public Service Network). Other considerations in the strategy include pieces on Data centres, end user device strategies and sub strategies in different areas (HM Government, 2011). These factors help to improve the efficiency of the equipment and reduce carbon emissions thus greening of ICT.

2.3 Part 2 – Using ICT as an enabler

Similarly, to SMARTER 2030 the strategy considers the use of ICT as an enabler to reduce carbon emissions in other areas. Areas such as travel emissions can be reduced due to using remote communication techniques like video conferencing.

2.4 Organisational level strategy – SURF Maturity Model

Green ICT in the organization	Greening of ICT	Greening of operations with ICT
Green ICT Strategy	Computing Infrastructure	Travel Reductions with ICT
ICT Governance	Network Infrastructure	Space Reductions with ICT
Green ICT Procurement	Storage Infrastructure	Energy Reductions with ICT
E-waste policy	Housing	Paper Reductions with ICT
Green ICT Architecture Principles	End User ICT Equipment	Other Reductions with ICT
Information Management	ICT Services	Environmental Awareness and Decision Support
Community Collaboration	Green Software Development	
Green ICT Supply Chain Management		

Figure 3: The domains and attributes of the SURF Green ICT Maturity Model - (Albert Hankel, 2014)

Now national level strategy has been considered it is necessary to consider the green ICT strategy in the sector for the organisation. The SURF Maturity model (SURF, 2014) is used to provide a framework for analysis of the ICT strategy of an organisation. This tool maps out four areas of study, Greening ICT in the organisation, greening of ICT, greening of operations by ICT and greening of primary process by ICT (Kor, 2017). This model therefore considers the entire process for the ICT strategy of the organisation which is more comprehensive than the UK government strategy which only covers the operational level of the strategy (HM Government, 2011). It provides a structure like a marking scheme and gives spider diagram outputs to evaluate the baseline strategy and action plan for an organisation. The table below shows the areas that the SURF Maturity Model covers.

2.5 Organisational level strategy - Environmental Management Systems

An environmental management system is a structure that allows organisations to manage their environmental goals through consistent review, evaluation and improvement of the environmental performance (United States Environmental Protection Agency (EPA), 2017). Assessing regulatory demands in a cost efficient and systematic way. Helping to reduce risk of non-compliance and improve the health and safety of employees. It also looks at energy conservation and improvements to the operational control of the organisation.

Diagram to show the continuous cycle of an EMS (United States Environmental Protection Agency (EPA), 2017) is found in Figure 4. The start of this process being the organisation committing to a policy or process. The combination of these two analysis methods for organisations could be used to develop a hybrid method discussed in the methodology section of the report.
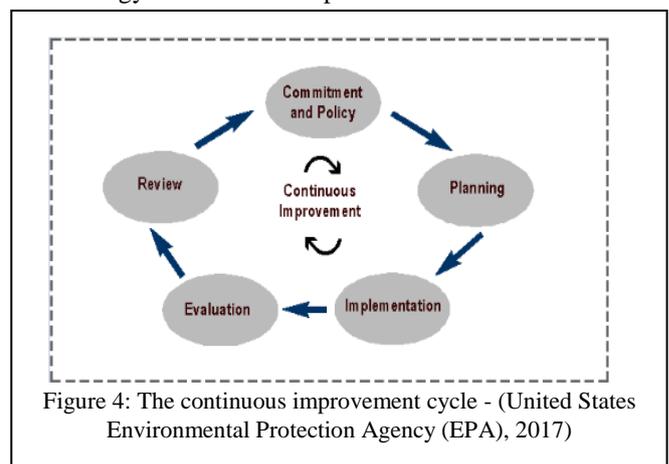
Figure 4: The continuous improvement cycle - (United States Environmental Protection Agency (EPA), 2017)

4. METHODOLOGY

4.1 Macro Methodology

The existing strategies discussed above can be used as a framework to produce the methodology that will be carried out in this report. The methodology will produce a bespoke checklist of tools and strategies relevant to the organisation to create a method that will help the organisation in its Green ICT strategy. This method will consider all the phases of the process best depicted by the diagram given below.
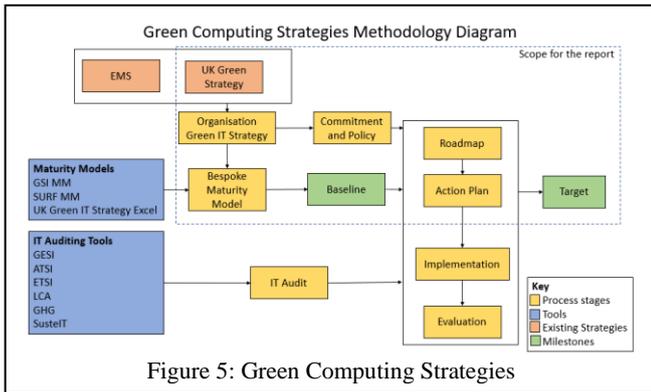
Figure 5: Green Computing Strategies

4.1.1 Scope

Before determining the methodology for the report the scope must be determined.

- The scope of the study focuses on the strategy for one regional UK site owned by the organisation as looking at the entire organisation will not be practical within the time frame of study;
- The scope considers the analysis of the current strategy for the organisation or baseline;
- The scope sets the target for the organisation in consultation with relevant staff members.
- The action plan for the organisation at this stage will not consider the implementation of the strategy or further analysis;
- The strategy entail the development of a roadmap for the strategy looking at targets within a 5-year window from the time of study (April 2017);
- Use of a bespoke tool for analysis of the organisation is in scope with the SURF Maturity model providing the framework;
- Awareness of Green ICT strategy and legislations is considered within the scope;
- Scoping of the strategy addresses the "cradle to grave" areas of the lifecycle with procurement, operations and disposal all considered in the strategy piece.

4.1.2 Establish the baseline (what the organisation is currently doing)

Firstly, assessment of the current organisational strategy is conducted by use of a bespoke strategy tool using the SURF Maturity model (discussed above), due to its detailed approach to the strategy, with input from other areas to generate an assessment tool that is most appropriate for the organisation. Information on the organisation is gathered via interview with a member of the relevant ICT team who will remain anonymous. A document review of the organisations strategy is conducted to complement results found in the interview. The results are depicted in the form of spider diagrams.

4.1.3 Target

Analysis of the baseline strategy will allow the development of a target strategy for the organisation within the scope of the analysis.

4.1.4 Roadmap

Upon completion of the assessment using the bespoke assessment tool, a roadmap for improvement of the current strategy will be written based on similar practises to the UK Green IT strategy and other areas to provide a best practice strategy for the organisation. This roadmap will align the

baseline strategy to the target strategy. The full strategy will be broken down into a set of objectives including immediate wins, short term, medium term and long term objectives for the organisation to improve its strategy. The literature analysis provides reasoning and backing for the points considered in the roadmap.

4.1.5 Action plan

Upon completion of the roadmap, an action plan is devised to lay out the actions required to carry out the objectives of the roadmap and to provide guidance on implementation of the new Green ICT strategy. Key considerations for the roadmap and the action plan are given in the form triangle diagram below (see Figure 6).
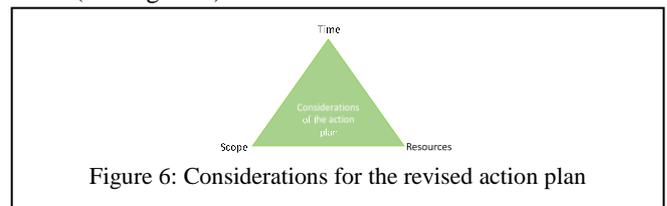

Figure 6: Considerations for the revised action plan

4.1.6 Feedback on revised action plan

Once the action plan has been devised, feedback on the changes will be collated through interview of the significant member of organisation staff, the assessment tool findings and completion of an ICT audit (however the latter is out of scope). The responsibility for implementation of the strategy would fall with the organisation's champion of Green ICT strategy.

4.1.7 Implementation

The action plan will consider the way the strategy will be implemented and how to evaluate the success of the strategy this however is not part of the analysis for this report. Considerations for the implementation will be within the limits of the bespoke tool further considerations are out of scope for the study.

4.1.8 Evaluation

Evaluation can be conducted periodically at certain milestones after implementation, by way of an ICT audit of the organisation. This will be coupled with a revisit to the bespoke tool used to initially assess the organisation. A life cycle assessment audit and use of the Suste-IT tool[1] will provide information on how the company has worked to improve its carbon emissions. The reuse of the bespoke tool will provide information on how well the strategy has been implemented and how this has cascaded through the organisation. The ICT strategy of the organisation is a fluid on-going process so that is why evaluation has to be continuously conducted.

4.2 Micro Methodology

Details of the specific methods used in this study are now given including the bespoke tool to be used.

4.2.1 Bespoke assessment tool

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[1] http://www.susteit.org.uk/files/

A bespoke assessment tool is used to assess the Green ICT strategy of the organisation during this study. The tool is developed using the SURF Maturity model tool as a framework (SURF, 2014). The tool focuses on the Green ICT in the organisation. This is followed by how the organisation promotes Greening of ICT and Greening by ICT. The tool grades the organisation between 1 and 5 with each ascending level showing a greater competency from the organisation in terms of Green ICT strategy. The output of this is a spider diagram that represents the overall score for the organisation in terms of Green ICT strategy, Greening of ICT and Greening by ICT.

4.2.2 Qualitative research methodology - interview
Alongside the bespoke tool, a qualitative interview is conducted with an anonymous representative of the organisation who is an expert in the ICT strategy. The interview covers key green ICT strategy points such as the awareness of Green ICT strategy within the organisation, compliance with legislation and the structure of the Green ICT strategy.

5. Results of the Study and Discussion
Upon completion of the study, the results of the bespoke tool and interview are discussed to understand the baseline strategy of the organisation. The interview answers and results from the bespoke tool are provided by a representative from the organisation.

5.1 Green ICT Strategy
The baseline Green ICT Strategy is first considered for the organisation. It is found from the interview that no strategy exists specifically for Green ICT in the organisation. See excerpt (by IC1 below).
"So, I do not believe the ICT department itself has any Green Strategy. Procurement, I believe have a Green Strategy. Which is part of their sustainability piece which they do." (IC1)
The overall grading for the Green ICT strategy is given in Figure 7 below.

Figure 7: Spider diagram to show the Green ICT strategy for the organisation - baseline

Despite this lack of green strategy, there are other areas of focus for the organisation's strategy which complement Green ICT strategy. Firstly, the procurement phase as mentioned in the comments above does have some considerations related to sustainability. It scored a 2 in the analysis tool meaning some basic environmental considerations are made this is supported by comments in the interview given below in IC2, although considerations are not made for hardware.
"We have made purchases, within the ICT department that would green issues in mind but that has not been at the forefront and its

not been a key strategy piece." – This point also goes further to support the idea that the organisation's strategy complements green issues but doesn't look at them directly." (IC2)
"So for hardware I would say no, I don't think we do. We look at the performance of the hardware is and the value of the hardware." (IC3) – when asked directly whether the organisation has a Green procurement policy.
The focus of the ICT department is more on the performance of the equipment and the cost of the equipment during procurement. The representative went on to say in IC4:
"We don't look at how its environmental impacts when that's been manufactured. Whether change is still compliant or anything like that." (IC4)
This suggests that the focus is not on the Green ICT issues when the procurement of ICT is carried out. Another key area of interest was the organisation's policy with regards to e-waste. The organisation does comply with the WEEE legislation when disposing of its e-waste which is supported by comments in IC5. The organisation also scored higher in this field with a 3 overall meaning the ICT department has a clear policy for the disposal of e-waste.
"So yes to the EU ROHS, and the WEEE legislation, we dispose of all of our waste in accordance with WEEE." (IC5)
Although it was found later that compliance with WEEE was more for security and data protection reasons than for Green ICT strategy as shown in the comments in IC6.
"That's actually driven more around security aspect of it. We have to comply with ISO 27001 for the disposal of systems. The companies that we use are WEEE or EU rosh companies. So, they are not guided through the emissions of it they are guided through security and compliance issues." (IC6)
The organisation does score highly in Figure 7 with regards to governance of ICT services. The representative also suggested that the organisation comply well with several legislations again for several varied reasons, rather than that of the Green ICT strategy these can be seen from IC7 and IC8.
"So yes, to the EU ROHS, and the WEEE legislation." (IC7)
"We have to comply with ISO 27001 for the disposal of systems" (IC8) – when asked about certain legislations the organisation complies with.
However, when asked in more detail, the representative mentioned that standards such as the ISO standards are not followed directly but for specific examples such as the one given below in IC9.
"So we don't directly, and the ISO standards I am aware of are 15001 and 14001. When we work with our own data centres again the things we look for are whether they were compliant or follow those prototypes or standards and whether the things we do follow those standards." (IC9)

5.2 Greening of ICT in the organisation
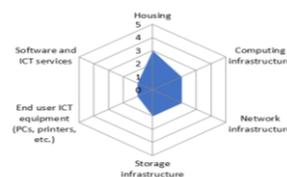
Figure 8: Spider diagram to show the Greening of ICT in the organisation - baseline

The organisation also scored poorly with regards to Greening of ICT in the organisation again suggesting focus is away from Green ICT strategy for the organisation and more aligned to other areas. The spider diagram in Figure 8 shows low scores for End user equipment and software with only Housing scoring as much as 3. This means generally there is

a lack of the most successful initiatives to decrease energy consumption in the ICT equipment for the organisation.

5.3 Greening by ICT in the organisation

Figure 9: Spider diagram to show the Greening by ICT in the organisation - baseline
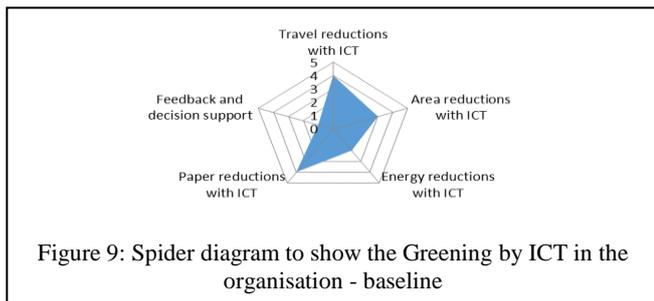
In contrast the organisation scored highly in the Greening by ICT section of the checklist. Paper reductions and travel reductions both scoring 4. This means the ICT department is actively attempting to carry out energy reductions in these areas. However, despite high scores these are being achieved with the companies flexible working scheme and more in the interest of cost reduction, convince and improvement of process efficiency than with an eye to reduce consumption for Green ICT reasons.

5.4 Awareness and behaviour of staff

Finally, the awareness and behaviours of the staff at the organisation are assessed with regards to the Green ICT strategy. During the interview, the representative states that end users are only aware of the disposal procedure for ICT equipment as represented in the comments in IC10.

"So I think they are only aware of the disposal of the things. I think it's acceptable because we have a controlled process for how we dispose of items." (IC10) -when asked if staff members are aware of legislation and standards discussed in the strategy.

In terms of staff behaviours, the organisation takes Green ICT considerations as low priority and therefore staff behaviours will reflect this. This can be seen from the representative comments in IC11. It can be seen however that the organisation has awareness of the benefits a change in policy has and the savings that could be made.

"I think it is yes. It's a shame in a way because a leader in procurement one of his ideas was we could advertise it internally and sell it almost. Especially the Green issue because we would be saving so much energy. In a lot, more efficient places or ways of cooling things like this." (IC11)

The comments in IC12 reflect the attitude of the organisation with regards to prioritising Green ICT and illustrate the issues and barriers caused by this that will be faced when attempting to change the policies. A meaningful change in attitude and awareness will be required to better the Green ICT strategy for the organisation.

"You are ultimately at the whim of the business as well sometimes because the business is concerned with ticking a certain box. You know, there is nothing you can really do about that so that's just going to win all the time." (IC12)

5.4 Summary

In summary, it has been noted that the organisation does not have a Green ICT strategy in place. However, the organisation follows several processes and policies related to other strategic areas which complement the Green ICT strategy. A strategy needs to be built around this initial

starting block. The average scores for the organisation are given in Figure 10. The organisation averages, 1.9 for Green ICT strategy, 1.8 for Greening of ICT and 2.8 for Greening of operations within ICT. This gives an overall score of 2.1 out of 5 for the organisation.

Figure 10: Average scores for the organisation - baseline
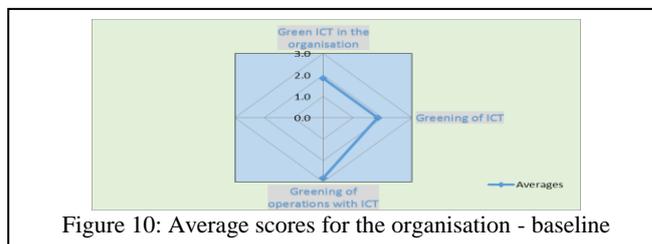
In terms of Greening of ICT, the organisation has little focus and needs improvement due to its lack of a green ICT piece in the overall strategy. For Greening by ICT, the organisation does better but only to improve other areas of strategy such as cost reduction and process efficiency. The attitude and awareness of the organisation towards Green ICT policy needs to be significantly changed for the organisation to move forward with a Green ICT strategy piece. These results for the baseline provide much room for improvement in the action plan for the organisation which will now be developed.

Dimensions of the strategy	Averages (between1 - 5)
Green ICT in the organisation	1.9
Greening of ICT	1.8
Greening of operations with ICT	2.8

Table 1: Average scores for the organisation - baseline

5.5 Action Plan for the organisation

Having established the starting point with the baseline strategy it is now appropriate to develop and action plan with time frames for the organisation to move towards building and improving on its Green ICT strategy. The results from the bespoke tool and the interview will be considered for the development of the action plan. This will be done in three key stages:

- Establishing a target point for the organisation to reach for its Green ICT strategy;
- Develop a roadmap of steps and time frames to reach this target;
- Devise an action plan for the key actions required to reach the target.

5.6 Target for the organisation

The target for the organisation is now broken into several points with the overall target to increase the overall average score in the bespoke tool from 2.1 up to 3 out of 5. The focus of the target will be on the Green ICT strategy section and the Greening of ICT section as these sections scored lower in the tool. The target overall would therefore look like Figure 11.
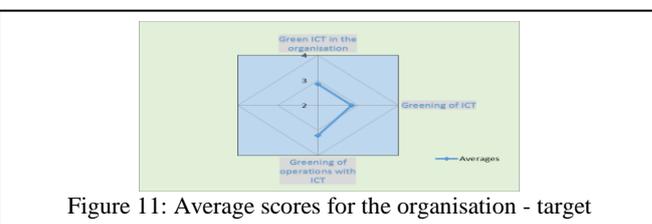

Figure 11: Average scores for the organisation - target

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The new average target scores for each section for the organisation are given in Table 2.

| Sections of the strategy	Averages (between1 - 5)
Green ICT in the organisation	2.8
Greening of ICT	2.8
Greening of operations with ICT	3.2

Table 2: Average scores for the organisation - target

The target will involve the scripting of a new Green ICT strategy for the organisation as one currently does not exist. This will look to develop a green ICT perspective on key areas such as procurement, how the organisation collaborates with suppliers and outside stakeholders and architecture. A written Green ICT strategy piece followed by the organisation in these areas would drive the overall score up to 2.8 for the first section and the target spider diagram would look like Figure 12.

Figure 12: Spider diagram to show the Green ICT strategy for the organisation - target
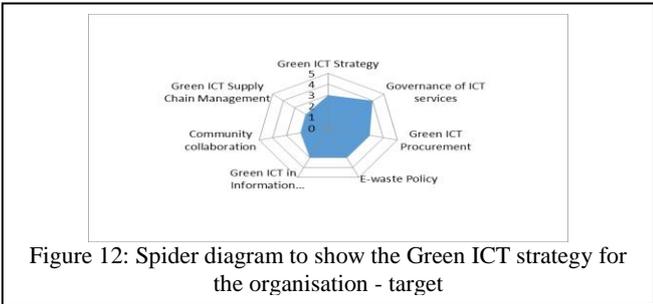
The target would look to increase the average score of Greening of ICT in the organisation up to 2.8. This would be achieved by improving the overall resourcing and energy efficiency considerations for all types of ICT equipment and would be a key point in the overall Green ICT strategy piece. A target improvement such as this would give the following spider diagram in Figure 13.

Figure 13: Spider diagram to show the Greening of ICT in the organisation - target
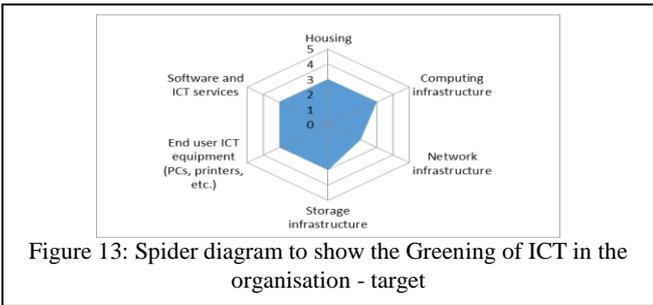
Greening of operations with ICT would receive specific improvements the area where it scores lower which is Feedback and decision support, this will be included in the

Figure 14: Spider diagram to show the Greening by ICT in the organisation - target
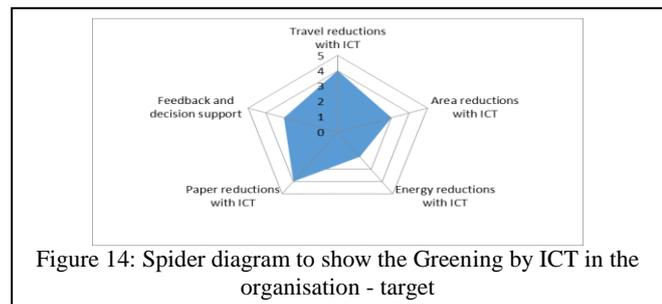
new Green ICT strategy. This will drive the average score up to 3.2 for this section. Figure 14 shows the target for this area.Finally, the target must look to consider the awareness and behaviours of staff and a campaign to increase awareness of issues in Green ICT and convince influential stakeholders to improve the Green ICT strategy of the organisation must be included in the target for the organisation.

5.7 Roadmap & Action Plan

The roadmap will bridge the gap between the baseline and target strategy for the organisation this will be split into several key objectives with timeframes for completion for the organisation. These will include:

- Quick wins that can be carried out in the first 3 months upon completion of the study;
- Short term objectives for the organisation which will be carried out in the first 6-12 months upon completion of the study;
- Medium term objectives to be carried out by the first 1-2 years upon completion of the study;
- Long term objectives to be carried out in the first 5 years of the implementation of the strategy.

This means implementation of the roadmap will look to reach the target for the organisation by May 2022 (report date May 2017). Table 3 shows full details of the roadmap and necessary actions:

Objective No.	Objective type	Objective Description	Completion Date
		Roadmap & Action plan for the organisation	
1	**Overall – Short term**	**Develop a Green ICT Strategy for the organisation**	**May 2018**
1.1	Quick Win	Development of framework of an overall Green ICT strategy for the organisation taking into consideration current successes and areas for improvement within the organisation with regards to Green ICT strategy. This would include alignment of current processes that are considered "Green" but are carried out for separate motives into the Green ICT strategy	August 2017
1.2	Short term	Green ICT strategy improvements for the procurement of ICT equipment	October 2017
1.3	Short term	Green ICT strategy improvements for the system architecture of the organisation	October 2017
1.4	Short term	Green ICT strategy improvements for the interactions with suppliers and outside stakeholders for the organisation	October 2017
1.5	Short term	Roll out of full new Green ICT strategy for the organisation	May 2018
1.6	Short term	Integration of Green ICT strategy within overall ICT strategy for the organisation	May 2018
2	**Overall – Long term**	**Improvements to energy efficiencies of ICT equipment**	**August 2020**
2.1	Short term	Full assessment of ICT inventories for the organisation's equipment including: End user equipment, network equipment, housing equipment, storage equipment and software.	May 2018
2.2	Medium term	Procurement of required new ICT equipment for the improvement of energy efficiencies based on the inventory assessment 2.1. Use of new strategy for procurement in 1.1 during this process.	May 2019
2.3	Long term	Roll out of assessed Green ICT equipment that has been procured in 2.2.	May 2020
2.4	Long term	Disposal of old ICT equipment and e-waste because of the roll out 2.3. Disposal in compliance with the new Green ICT strategy 1.	August 2020
3	**Overall – Long term**	**Improvement to overall awareness and behaviours of staff in the organisation**	**May 2022 (Ongoing)**
3.1	Quick Win	Presentation on the key benefits of a Green ICT strategy and the findings of this study to raise awareness of key stakeholders and leaders within the organisation.	August 2017
3.2	Short term (Ongoing)	Awareness campaign on Green ICT strategy and the effects of ICT on the environment within the organisation. Ensure campaign is maintained.	May 2018 (Ongoing)
3.3	Medium term	Cascading of the new Green ICT strategy through the organisation (1).	May 2019 (Ongoing)
3.4	Long term	Continued reinforcement of Green ICT strategy and raising awareness through ongoing regular updates on the strategy and Green ICT issues	May 2022 (Ongoing)
4	**Overall – Long term**	**Evaluation and support using ICT**	**May 2022 Long term**
4.1	Medium term	Procurement / development of process / equipment to be used to conduct ICT audits of the organisation to assess energy consumption and energy efficiencies of the organisation	May 2019
4.2	Short term	ICT audit of the organisation in the first 12 months to establish the energy consumption / energy efficiencies of all ICT equipment.	May 2018
4.3	Medium	Second ICT audit of the organisation after 2 years to establish the energy consumption / energy efficiencies of all ICT equipment.	May 2019
4.4	Long term	Continued ICT audits of the organisation on a yearly basis to assess the energy consumption / efficiencies of all ICT equipment in the organisation	May 2022 (Ongoing)

Table 3: Roadmap and Action Plan for the Organisation

6.0 Conclusions of the study

It can be concluded from the study that the organisation currently has no formal Green ICT strategy. Despite this, the organisation does have some processes in place which are complimentary to Green ICT strategy such as following of

governance and legislation like the WEEE directive and development ICT improving other operations such as travel reduction and paper reductions. The organisation's current score of 2 out of 5 on average in the bespoke tool points to the need for a formal strategy. The organisation must develop strategy for the Greening of ICT equipment and improve the overall perception of Green ICT. For this to be successful the overall attitude and behaviours taken up by the organisation with regards to Green ICT must change significantly. A target has been developed for the organisation that would move the overall score up to an average of 3 out of 5. This can be achieved by following the roadmap and action plan that has been developed because of the study.

6.1 Limitations of the study
A few limitations of the study will now be discussed. Conducting only a single interview provides limitations as there is only a view from one perspective within the organisation. Additional interviews could be conducted to provide more data and a wider perspective of the organisation's current Green ICT strategy. This could include more detailed study in the procurement are of the organisation. Use of the bespoke tool provides a score for how good the current Green ICT strategy is but this is also based on the opinion of the representative for the organisation. To make these scores more reliable, several representatives from diverse backgrounds could be asked to score the organisation and an average value could then be taken.

6.2 Next steps
Now that the action plan has been developed for the organisation feedback is given from the representative from the organisation on the action plan provided. This will be used to develop a revised action plan and highlight the next stages in the process for the organisation moving forward from this study.

6.3 Feedback on the action plan
The representative from the organisation has provided a feedback on the action plan this feedback is discussed to produce a revised action plan. Firstly, to advertise the strategy, it must be presented in a more positive way that encourages people to the change as reflected in the feedback comments (FC1).
"A successfully strategy has to ultimately be attractive, drive change and encourage people on the journey. A green strategy must reduce or remove inefficient and non-green choices from the portfolio; but crucially whilst still offering attractive options and not putting undue burden onto the enterprise. People are inherently resistant to change, so they need to be provided a 'better alternative'." (FC1)

Therefore, in future a business case for the promotion of the Green ICT strategy and action plan must be written and presented to the business. But focus must be on the way the organisation can save money.
"It is indeed relevant to consider green & greening ICT. In the long term, greening, such promoting energy efficiencies will save money." (FC2)

The representative agreed with the action plan looking at both green ICT and greening by ICT for the organisation but again emphasises the need to save money to advertise this to the rest of the business (FC2).

The representative mentions the use of Cloud technology as an influence in the strategy piece as this can move energy demand away from the organisation and the suppliers of these services work with green issues higher on their agenda (FC3). A look at migration to use of Cloud for data storage must therefore be included in the Green ICT strategy.
"Cloud (and you don't mention this) is almost the silver-bullet when it comes to the enterprise delivering on a green strategy. It moves a huge energy demand away from the enterprise, directly, and becomes the issue of the supplier/vendor. The major cloud providers can deliver on huge economies of scale, they make it their business to deliver on the green issue." (FC3)

Feasibility of the strategy is considered by the representative of the organisation. Suggestions that amending the action plan to look at 'compliant systems' that fit the green model become the ones to be purchased rather than a complete overhaul (FC4). Suggestions are given that there should not be a fixed time frame for this activity but systems should be replaced as and when they are out of use to help with the business case for the organisation are to be included in the revised action plan (FC4).
"Instead, I feel you would be better placed to determine a catalogue of 'compliant' systems that fit the green model and these become the systems to be purchased. As and when systems are depreciated they are then replaced with the new models – importantly investment driven by new projects is chosen from this catalogue; so by natural attrition the environment becomes green." (FC4)

Finally, the compliance with FSA standards for the disaster state of systems is considered by the representative. Arguing that duplicated systems for preservation purposes are a detriment to energy efficiency. A risk assessment should therefore be completed for not having an immediate recovery for a service, but a regular back up rather than a full duplicate. This however is said to be hard to convince the organisation (FC5). Consideration for this must be added to the revised action plan.
"A practice to adopt could be to understand the risks of not having an immediate recovery for a service, what are the impacts to the business? If they're minimal/marginal, then it's entirely possibly only a regular backup of the service is taken rather than maintaining a full duplicate." (FC5)

6.4 Revised Action Plan
Changes to the action plan from the feedback are underlined (see Table 4).

6.5 Implementation
The next steps of this process would be to carry out the implementation of the action plan for the organisation. This would involve converting the theoretical analysis conducted in this study into a real functioning Green ICT strategy for the organisation. Some of the issues with the implementation of the action plan may be, push back from key stakeholders, issues with feasibility in terms of cost and time frames and ensuring all parts of the action plan are conducted correctly and comprehensively.

6.6 Evaluation

The evaluation phase will involve regular ICT audits of the organisation at specific milestones of the roadmap and action plan to determine the carbon footprint of the organisation. This will quantify whether the organisation is progressing because of the new Green ICT strategy that has been implemented. The evaluation stage will provide a way of checking if the organisation has reached its overall target. The evaluation stage will also prevent the Green ICT strategy study from being a singular linear offering. It will allow for adaptation of the Green ICT strategy as the organisation's position and external factors outside the organisation such as climate change, progress with time.

Revised Roadmap & Action plan for the organisation			
Objective No.	Objective type	Objective Description	Completion Date
1	Overall – Short term	Develop a Green ICT Strategy for the organisation	October 2018
1.1	Quick Win	Development of framework of an overall Green ICT strategy for the organisation taking into consideration current successes and areas for improvement within the organisation with regards to Green ICT strategy. This would include alignment of current processes that are considered "Green" but are carried out for separate motives into the Green ICT strategy	August 2017
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1.3	Short term	Green ICT strategy improvements for the system architecture of the organisation	October 2017
1.4	Short term	Green ICT strategy improvements for the interactions with suppliers and outside stakeholders for the organisation	October 2017
1.5	Short term	Considerations for migration to Cloud technology within the Green ICT strategy to save on energy demand	October 2017
1.6	Short term	Risk assessment for replacement of full duplicate systems (compliant with FSA standards) to regular back ups	October 2017
1.7	Short term	Written business case on the economic savings of the Green ICT strategy to advertise to the wider organisation	May 2018
1.8	Short term	Roll out of full new Green ICT strategy for the organisation	October 2018
1.9	Short term	Integration of Green ICT strategy within overall ICT strategy for the organisation	May 2018
2	Overall - Long term	Improvements to energy efficiencies of ICT equipment	August 2020
2.1	Short term	Establishment of green compliant ICT inventories for the organisation's equipment including: End user equipment, network equipment, housing equipment, storage equipment and software.	May 2018
2.2	Medium term	Procurement of required green compliant new ICT equipment for the improvement of energy efficiencies based on the inventory assessment 2.1. Use of new strategy for procurement in 1.1 during this process.	As and when necessary (old equipment depreciates)
2.3	Long term	Roll out of assessed Green ICT equipment that has been procured in 2.2.	As and when available
2.4	Long term	Disposal of old ICT equipment and e-waste because of the roll out 2.3. Disposal in compliance with the new Green ICT strategy 1.	August 2020
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4	Overall – Long term	Evaluation and support using ICT	May 2022 (Ongoing)
4.1	Medium term	Procurement / development of process / equipment to be used to conduct ICT audits of the organisation to assess energy consumption and energy efficiencies of the organisation	May 2019
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4.3	Medium	Second ICT audit of the organisation after 2 years to establish the energy consumption / energy efficiencies of all ICT equipment.	May 2019
4.4	Long term	Continued ICT audits of the organisation on a yearly basis to assess the energy consumption / efficiencies of all ICT equipment in the organisation	May 2022 (Ongoing)

Table 4: Revised Roadmap and Action Plan for the Organisation

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3.1	Quick Win	Presentation on the key benefits of a Green ICT strategy and the findings of this study to raise awareness of key stakeholders and leaders within the organisation.	August 2017

Table 4: Revised Roadmap and Action Plan for the Organisation

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