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Quantifying resistance to the diffusion of information technology sustainability practices in United Kingdom service sector

Justin Sutton-Parker*

University of Warwick, Computer Science Department,
Coventry, CV4 7AL, United Kingdom

Abstract

The United Kingdom (UK) Service Sector employs 16.1m people, representing 50% of the country's workforce [1, 2]. Consuming 32% of UK electricity, with an estimated 10% attributed to information technology (IT) use phase electricity (UPE) consumption, the sector is a high contributor to the nation's greenhouse gas (GHG) emissions [3, 4]. Although the reduction of IT energy consumption through efficiency measures is substantiated to abate concomitant GHG emissions [5,6,7], widespread diffusion of the practice experiences resistance that is limiting success. This research proposes that identifying, categorising and quantifying the resistance at a sector and job role level will enable organisations to anticipate resistance pain points and plan accordingly to accelerate success. Doing so will contribute to the UK's GHG abatement strategies and support the Government's aspirations to becoming carbon neutral in 2050 [8, 9]. As such, this research conducts a survey of over five hundred UK service sector managers and, through a method of triangulation, presents the data in an easily consumable framework that offers percentages of resistance attributed to awareness, actions and barriers experienced when proffering sustainable IT practices.

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* Corresponding author. Tel.: +44-(0)7976-818-530.

E-mail address: Justin.Sutton-Parker@warwick.ac.uk

1. Introduction

To help decelerate global warming, the UK Government has committed (United Nations, 1992, 1998, 2015a) to reducing GHG emissions by 80% below 1990 levels [10, 11, 12] to 156.62MtCO₂e in 2050. As energy and business contribute to 43% of UK emissions [3], commercial and public sector organisations represent a rich source of abatement and as such are now subject to GHG legislation [11, 13-16]. Consequently, all quoted companies operating in the UK, all large unquoted companies and large Limited Liability Partnerships (LLPs), Government departments, non-ministerial departments, agencies and Non-Departmental Public Bodies are now subject to annual mandatory GHG emissions reporting.

The organisations subject to this legislation are categorised as the ‘Service Sector’. Collectively the sector employs 16.1m people with 10.743m employees working in large companies and 5.37m in the public sector, representing 50% of the UK total workforce (32.4m) [1, 2]. Consuming 32% of UK electricity, with an estimated 10% attributed to information technology (IT) use phase electricity (UPE) consumption, the sector’s IT estate is a high contributor to the nation’s GHG emissions [3, 4] and a focal point for sustainability practices such as equipment energy efficiency [5,6,7]. Already, Public Sector bodies are also subject to more granular legislation focusing directly on IT estates [15, 16].

The emissions are to be reported within annual, company and director reports, plus quarterly public sector transport and estates accounts as CO₂e units and categorised as Scope 1 (direct emissions from owned or controlled sources), Scope 2 (indirect emissions from the consumption of purchased energy) and Scope 3 (indirect emissions that occur in the value chain of the reporting company) [17]. Not only are organisations expected to account for GHG emissions they are also required to undertake strategies to reduce emissions and achieve progress.

As the service sector is dominant within the UK workforce, the government and business community have an opportunity for the GHG specific legislation to not only enforce environmental reporting compliance but also to raise awareness, drive actions and overcome barriers to accelerate the adoption of sustainable IT practices to accelerate abatement of concomitant GHG emissions towards 2050. However, whilst climate change is well publicised due to media coverage of demonstrations from Extinction Rebellion demonstrations, David Attenborough television programmes and the voice of Greta Thunberg many people will remain unaware of related business legislation and abatement impacts delivered by high consumers of electricity such as IT. As such, it is hypothesised by this research that without greater diffusion of such information, resistance will exist, slowing the adoption of sustainable IT practices.

To test the hypothesis and gauge the level of resistance, this research conducts a survey of over five hundred service sector managers. Asking ten questions, the data creates what is termed as ‘intensity of resistance percentages’ generated for the three specific categories of awareness, action and barriers. Discussed in the context of a sector and job role level, the results highlight differing responses to the resistance of adopting sustainable IT practices.

2. Service Sector Sustainability Barrier Survey

Conducted online in 2019 in accordance with ESOMAR principles [18], the survey targeted and received responses from 503 people in decision making managerial roles. All worked in commercial companies of 250+ people or the public sector in the UK Service Sector. The questions were designed to document the existing depth of awareness of GHG legislation and consequential policies, what related actions were already in place to deliver against the legislation and what barriers exist from embracing sustainable IT practices. The ten questions asked were:

- Are you aware the UK Service Sector is subject to annual mandatory Greenhouse Gas emissions reporting?
- Does your organisation have a CSR policy that includes strategies to reduce GHG emissions?
- Does your organisation have a specific CSR / sustainability strategy for information technology?
- Does your organisation measure IT end user computing device electricity consumption?

- Does your organisation measure and report IT related to greenhouse gas emissions?
- Are you or your team responsible for or influence the CSR policy setting for your organisation?
- Are you or your team subject to performance measurements related to IT sustainability?
- How much of a priority is IT sustainability is for your business, beyond mandatory reporting requirements?
- What barriers, if any, are holding you back from building a more sustainable IT model for your business?
- Which of the following statements do you think best describes the impact IT departments can have on how a business reduces carbon emissions, improves sustainability and generally embraces greener practices by default? A) IT departments have some impact and can make an important contribution but it will be in line with other departments, B) IT departments have more of an impact than any other department as IT can drive widespread and crucial change across the whole business, C) IT departments can have an impact but it can't drive major change in the business, D) IT departments have no impact)

The demography of the responses created a data set proportionately representative of the UK service sector employee balance almost exactly including 66% commercial (331) and 34% (172) public sector responses [1].

Categorised and analysed in three major resistance categories of awareness, action and barriers, the survey results indicate that whilst the board directors were far more aware of legislation, company policies and actions than middle managers, a consistent set of barriers emerged across all variations of job role and sub sector including time, money and belief that IT could deliver impactful abatement (Figure 1). The following section discuss these results in each of the three focus categories.

Table 1 - Summary Intensity of Resistance Percentage Results Table

Intensity of Resistance	Service Sector	Commercial Sector	Public Sector	Board Level
Awareness	25	24	25	8
Action	28	30	26	17
Barriers	24	24	23	21

2.1 Awareness

At the service sector level, the data confirmed that 31% of managers were unaware of national GHG legislation. Twenty-four percent did not know if consequential company CSR policies included GHG abatement. The same percentage were unaware of any IT sustainability policies. Whilst twenty and twenty-three percent respectively did not know if EUC device electricity consumption was measured or concomitant GHGs reported.

As such, the ‘intensity of resistance percentage’ for the sector is scored at 25% derived from the average of ‘don’t know’ responses given to questions 1 to 5 inclusive.

Awareness resistance is significant if accelerated IT abatement is to be achieved as it directly decelerates the subsequent action and perceived barrier categories. As an example, if stakeholders determined to be capable of influencing the success of objectives [19] are not aware of facts, they cannot form an opinion that may eventually result in a positive abatement action. This influencing precedent is substantiated by NRDC [20] research highlighting that IT energy efficiency in data centres was limited due to only twenty percent of IT engineers being aware of energy consumption rises. The reason given was that they did not have knowledge of utility bill costs and as such were unaware that action was required to reduce consumption.

Similar examples are also reflected in the early Energy Star research [21], indicating that despite prior elaborate attempts at efficiency, the greatest results were achieved when users were simply made aware of the fact that they were leaving their PCs switched on at night. By increasing awareness, the companies noted significant reductions in power use associated with IT as users powered down PCs before going home.

Koomey [22] supports awareness as a significant issue and highlights that awareness should be championed by board level executives. In doing so, he indicates that through increased awareness and diffusion comes wider stakeholder responsibility. Consequently, priorities align amongst diverse employee roles and objectives, such as GHG emissions abatement, become part of business culture with results improving rapidly. The survey indicates that in the service sector a gap exists between the awareness levels of the board and other managers, suggesting that Koomey's concept of champions is not being fully exploited. Compared to the 25% limited awareness at sector level, board executives are in fact 92% aware. As such, it is evident that this executive stakeholder group is not driving awareness throughout the hierarchy of management.

Specifically, the Chief Technology Officers (CTO), responsible for supplying energy and or GHG data generated by IT systems to the executive board, were 100% aware of the legislation and 93% aware that IT was being measured for GHG emissions. Comparatively, all other non-board job roles were 59% aware of legislation and only 40% aware of IT GHG emissions being measured. This indicates that whilst the legislation GHG measurement and reporting is happening, communications to managers beyond those accountable to the driver of legislation and responsible for the action of measurement, is limited and causing this exaggerated lack of awareness in the wider organisation. Returning to Koomey's point, aligning the executives with the managers may drive better awareness results.

2.2 Actions

The difference between 'actions' and 'awareness' is explained as follows. Acknowledging national GHG legislation is awareness, whereas creating and executing a CSR strategy that addresses the legislation is an action. Consequently, awareness, or a lack of, focuses predominately on 'don't know' answers, yet action focuses on 'no' answers. The rationale being that not knowing about an action doesn't mean it isn't in place.

As such, at the service sector level, the data confirmed that 15% of organisations did not have a GHG focused CSR strategy, 16% were without a sustainable IT policy, 25% didn't measure device energy consumption, 23% didn't measure IT GHG emissions, 51% were unable to influence CSR policy and 40% were not measured and rewarded on CSR success. If, hypothetically, including the 'don't know' answers as an indication of no action being undertaken, then the range could be as high as 38%, 40%, 45%, 49%, 57% and 47% created an intensity of resistance of 46%.

However, to avoid supposition and retain validity, the action intensity of resistance percentage is determined by the survey to be 28%. This indicates that over one quarter of organisations have not undertaken a combination of actions that support GHG abatement related to IT.

With specific relation to sustainable IT practices, the actions category can be analysed further by dividing responses into two sub categories of policy actions and physical actions. Focusing on the physical first, these actions are determined as activities undertaken as part of a policy to reduce IT GHG emissions. As such, the survey indicates that the adoption of physical actions such as device energy measurement and IT GHG reporting is arguably less prolific than the resistance intensity suggests at 55% and 50% respectively.

Policy action measurement enables an understanding of what policies exist that could include physical actions undertaken to reduce GHG emissions. Whilst it could be suggested that one does not exist without the other, the rationale for separating policy and physical actions removes assumption that because a sustainable IT policy exists, GHG measurement is being conducted and the focus isn't entirely on other practices such as recycling.

Doing so uncovered that whilst the definitive 'no' answers responding to whether the CSR policy included IT sustainability are low at 16%, the 'no' answers for whether EUC UPE consumption was measured are 25%. This indicates a gap of 9% between the two values, suggesting that this specific action may be influenced by a mixture of awareness and barriers. These may include being unaware that UPE consumption affects GHG emissions, believing that the impact of this is low, or simply not knowing how to accurately measure the energy consumption of devices that are constantly on the move.

The concept of further resistance categories affecting the action category is also apparent with regards to the specific CSR actions. This is highlighted in the ‘influence over CSR shaping’ and ‘goal/KPI’ action values. In isolation, both values are far higher than the intensity of resistance of 28% at 51% and 40% respectively. Examining the same responses by job role reveals that these two values reduce considerably at the board level. Amongst the executives, both values halve to 25% and 20%. This reduced resistance is also reflected consequently in the CSR awareness value. For the board executives, awareness of the existence of a CSR policy that includes GHG abatement is only 93% compared to 61%.

The disparity in values reveal that as the C-suite has a high level of influence on the crafting of CSR framework and is measured upon its success these employees naturally have a far higher awareness of the policy. Whereas, non-executive employees not influencing or being measured have a far lower awareness. Whether one factor leads the other is not strictly determined although the values do suggest that by including a wider stakeholder group beyond the board to help craft and deliver the CSR policy and objectives would consequently open dialogue as to what actions can reduce GHG emissions. Through this action, amplified appreciation and understanding would become widespread and consequentially, the awareness intensity resistance percentage would decline accordingly.

The subject is examined by Robalino & Lempert [23] researching the effectiveness of technology focused incentives and penalties that could overcome barriers to achieving IT energy efficiency. In this example, the authors came to the conclusion that whilst their model showed the approach to be worthwhile, the levels of stick and carrot had to be high enough to deliver significant impact on GHG abatement. Achieving the correct levels as being key to success is supported by and links to the survey results for the specific barrier of ‘low company priority’, scoring 25% as a sector average. Comparatively, at a board level the score is significantly more positive at only 10%. As such, the data confirms that those in executive job roles responsible for CSR content and goaled on success, consider the subject of IT sustainability to be far more important than those without input or measures. Consequently, the survey substantiates that many of the barriers indicated are once again interconnected and affected by both awareness and action factors.

2.3 Barriers

Barriers represent obstacles that are preventing or delaying adoption of sustainable IT practices. The total resistance intensity percentages from the awareness and action categories are included as barriers. The rationale being that a lack of awareness and a lack of action create barriers to adoption. In total, eleven barriers are measured by the survey ranging from financial burden to employee impact perception as highlighted in question ten. At a sector level the resistance intensity percentage was 24% suggesting that a quarter of all companies suffer from barriers that prevent them from embracing sustainable IT practices. Perhaps unsurprisingly, the highest scoring barrier is a lack of budget, at 48%. The concern for profit coming before environmental impact has long been subject to scrutiny, arguably reaching the global stage in the early 1960s [24]. Within the text the author describes the impact of chemicals such as DDT on the organic and human environment created by companies chasing high profits whilst ignoring the death of people, animals and landscapes.

Following three decades of subsequent scientific examination of anthropogenic interference, research [25-27] led to the publication of ‘Climate Change’ [28]. This latter work was the combination of over one thousand scientists gathering evidence of humankind’s impact on the planet caused by innovations such as electricity and transportation that were also driving economic growth. The data was as comprehensive as it was concerning and influenced the creation of the United Nations Framework Convention on Climate Change [10]. Whilst IPCC reports and UN actions continue today, the original expose caused people beyond the realm of science and politics to deduce ways of assessing how to measure progress versus harm. As an example, Rees & Wackernagel, [29] addressed humankind’s material impact on Earth and set the tone for what would emerge as carbon footprint. Five years later, Elkington [30] discussed the idea that profit doesn’t need to equal environmental damage. Expanding upon CSR works such as Carroll [31] and Spreckley [32] by suggesting companies could adopt a non-traditional approach to accounting that includes profit, social wealth and environmental performance elements.

Today the theme of overcoming cost barriers by creating self-funding actions continues [9]. Gove notes that human health and prosperity depend on the health of the planet quantifying that the annual cost of breathing related illnesses to the UK economy could be reduced by as much as £5.3 billion by reducing emissions. delivering again clean air policy. In the context of this research the barrier intensity value of 48% attributed to cost may at first be seen as insurmountable. However, if the awareness that certain EUC devices are 55% more efficient than similarly specified devices [33], the cumulative monetary value of electricity saved by transitioning to efficient devices may be significant enough to kick-start actions to measure and abate EUC device GHG emissions.

Second to money the survey indicates that a lack of time is considered the second largest resistance barrier at 33%. It is reasonable to state that this is likely driven by negative perception fuelled by limited awareness highlighted in the survey. As an example, 25% of managers indicated that IT cannot drive major GHG abatement impact within their organisation despite considerable research existing substantiating the fact [5,6,7] and legislation already in place specifically to focus on IT GHG emissions [15]. The rationale being, that if sustainable IT is not seen as a priority due to low impact then it will not be supported with dedicated human capital, thus becoming a subject that cannot be afforded time.

Time however does not necessarily prevent willing. Understanding that employees may personally wish to prioritise sustainable IT but do not feel supported could deliver higher success in the long term if the barrier is removed. To explain, 47% of managers suggested IT sustainability was judged a medium or less priority for the company, whilst only 16% stated it wasn't a personal priority. Notably, this suggests that whilst company perception is moderate, 84% of employees do see it as a priority suggesting willingness could leave staff open to sustainable IT programmes if the impact is evangelised. Theoretically the barrier at a personal level may not even exist as 20% believe that employee push back would be heightened if sustainable changes were introduced in IT. Whilst unanswered, the data suggests that all but 4% of the people who do not see GHG abatement in IT as a priority, could be the same people opposing the sustainability programmes. Again this leads back to Koomey's research [22] that indicates the executive board should lead the conversation to ensure barriers are equal amongst the executive board and non-executive managers. However, in the case of EUC UPE energy consumption being an accelerator of GHG emissions abatement the board too appears conflicted. Specifically, the survey notes that 21% of managers believed there is no executive support for sustainable IT programmes. Comparatively, the CEOs consider this to half the resistance intensity at 11% suggesting that there is almost 90% support from the executive board. Unlike awareness and actions, with the board delivering harmonised responses, the variation in resistance intensity in barriers is pronounced.

As such, it is noted that the CTO role responsible for delivering sustainable IT responded with a threefold increase of 33% concern that other board executives are not supportive. Evidently pressurised by limited resources, a lack of time is noted as 40%, superseded only by employee pushback at 47%. This last figure is surprising considering that 84% of the managers suggested sustainability was a priority indicating that perhaps the pushback is from non-managerial staff. Consequently, it is fair to suggest the data indicates that on one side the role signing off the information for GHG accounting in company and quarterly reports, the CEO, feels supported by the person supplying the data, the CTO. Whereas in contrast, the CTO feels unsupported by both the executive board for not allocating sufficient resources to the task and the company as a whole for not perceiving IT sustainability practices to be worthwhile when compared to interruption to productivity that may arise during technology transformation.

This returns to the concept that awareness of impact of IT (the carrot) is being overshadowed by legislation (the stick), causing not only frustration but also additional, and perhaps unnecessary resistance to the adoption of sustainable IT practices. It is therefore suggested that in light of the data, executive boards need to harmonize with regards to addressing barriers before communicating the policy and expected goals to a wider stakeholder group including both non-executive managers and non-managerial staff. Beyond the obvious savings in electricity consumption and reduction of GHG emissions the move may also align with seemingly unrelated priorities such as human resources. The rationale being that as top HR priorities include prospective employee attraction, current employee experience, engagement and retention sustainable outcomes could be used as an appeal. After all, research

indicates [34] that 64% of millennials will not work for companies with weak CSR policies and 83% will stay with companies that contribute to environmental and social causes.

3. Summary

The objective of the survey is to generate substantiated intensity of resistance percentages in three categories of awareness, action and barriers that will offer an indication to the UK Government and the service sector what is preventing widespread adoption of sustainable IT practices. As discussed and highlighted in table 2, between 24% and of 28% organisations suffer from resistance related to limited awareness towards UK GHG legislation and the content of company CSR policies and strategies. From actions created to reduce GHG emissions not being diffused and adopted across the sector. From barriers that include time and money, support, indifference and perceived impact. As such it is proposed that taking a top down approach [22], the executive boards within the UK Service Sector could lead the charge for sustainable IT practices and through increased awareness and diffusion deliver wider stakeholder responsibility. Consequently, priorities may align amongst diverse employee roles and objectives, such as GHG emissions abatement, and become part of business culture with results improving rapidly.

Table 2 - Summary Intensity of Resistance Percentage Results Table

Resistance Intensity Percentage	Total %	Legislation (National)	Strategy (CSR GHG)	Strategy (Sustainable IT)	Energy (Device Measurement)	GHG (IT Measurement)	Influence (CSR Shaping)	Goaling / KPI	Barriers (Limited Awareness)	Barriers (Limited Action)	Barriers (Low Company Priority)	Barriers (Low Personal Priority)	Barriers (Lack of Budget)	Barriers (Lack of Time)	Barriers (Executive Support)	Barriers (Employee Pushback)	Barriers (Education)	Barriers (Not Suitable)	Barriers (Impact Perception)
		Q1	Q2	Q3	Q4	Q5	Q6	Q7			Q8	Q9	Q9	Q9	Q9	Q9	Q9	Q9	Q10
Service Sector																			
Awareness	25	32.41	23.5	23.75	19.68	23.4													
Action	28		15.1	16.25	25.25	22.86	50.8	40.4											
Barriers	24								25	28	25.45	16.3	47.91	33	20.87	19.88	13.32	3.98	29.6

4. Conclusion

It is clear that resistance to IT sustainability practices exists in the UK Service Sector. The lack of appreciation for environmental legislation, involvement in CSR shaping and limited time and money is accentuated by the results. Arguably, in this context, Elkington's [30] 'Triple Bottom Line' approach suggesting Planet, People, and Profit needing to be acknowledged in order to gain support for sustainability, is substantiated. As such, by highlighting the intensity issues as a collective it is suggested that organisations will look beyond isolated pockets of resistance and share the strategy of sustainability across all employees. The concept is not to shift the environmental impact from the business to the individual. It is to speak to a wider stakeholder audience and appeal to their role based interests, needs and viewpoints. Consequently, if a CFO takes interest in the economic benefits of IT sustainability and the CEO focuses on the positive impact of lower GHG emissions and compliance, then employees may also become more aware and engage in action to overcome barriers and help reduce the organisation's per capita carbon footprint.

5. Limitations and Recommendations

Due to the size of the service sector [1,2] it is arguable that anything less than a sample group of 500 managers would generate inadequate resistance intensity data. However, the survey remains limited as the sample set represents 0.2% of sector employees if it is estimated that 20% of the workforce are managers. Consequently, as this research forms part of ongoing research by the author to create a cloud computing application capable of accurately measuring and reporting EUC energy consumption and concomitant GHG emissions, further surveys must be built into three planned case studies to expand upon the sample set. Doing so will further substantiate the results.

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