

# ENTERPRISE LEVEL GREEN IS STRATEGY FOR DEVELOPING ECONOMIES: CASE OF KENYA

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## ABSTRACT

*Issues to do with environmental management and sustainability have continued to generate great interest in the last two decades. The world seems more united than ever before in trying to find ways to combat this global phenomenon whose impact has had tragic results especially in developing economies. Companies and organizations have been urged to develop innovative ways of doing business without causing any harm to the environment; with that, a number of approaches have been developed including green energy, green construction, green supply chain, green IT, green IS and many others that aim to ensure that every aspect of the organization is analyzed to reduce their carbon footprint. The field of computing has been discussed under green Information Systems (Green IS) and Green Information Technology (Green IT). Green IT aims to reduce the Information Technology (IT) environmental footprint. Green IS tries to look for innovative ways in which organizations can apply Information Systems (IS) to manage their environmental footprint. Research on environmental protection and global green house gas (GHG) emissions seem to concentrate on large companies and developed countries with the notion that developing countries and small and medium organizations contribute less in carbon emissions mostly because of the limited industrial activities in these countries and in the case of computing, the limited number of computers in these firms. The purpose of this research is to highlight the various mechanisms that an organization in developing countries usually small and medium businesses can apply on its internal core functions to reduce its carbon footprint. To achieve this, we first carry out a review of both practitioner and academic literature to justify the scope and focus of the research. We then offer highlights on development of a corporate level green IS strategy and finally we describe each of the internal practices that small and medium size organizations should focus on to reduce their carbon footprint and validating each of them using opinions from past research.*

**Keywords:** green IS, green IT, footprint, sustainability.

## INTRODUCTION

Information systems have for long been recognized as a competitive weapon [1], in the same way, academics and practitioners have claimed that environment-related investments can become sources of competitive advantage [2]. "Environmental policy, like other aspects of corporate strategy, needs to be based in the economic fundamentals of the business: the structure of the industry in which the business operates its position within that structure, and its organizational capabilities." Green IS, therefore, should not be seen as a cost of doing business, but rather it should be seen as an opportunity for organizations to improve productivity, reduce costs and enhance profitability. For the business enterprise, sustainable development means adopting business strategies and activities that meet the needs of the enterprise and its stakeholders today while protecting, sustaining, and enhancing the human and natural resources that will be needed in the future. Profit generation from investments in cleaner technologies might make business sense in certain circumstances, but not in all. This is because poor environmental practices result in many forms of waste such as unused resources, energy inefficiency, noise, heat and emissions which are all waste products that subtract from economic efficiency [3]. With this in mind, therefore, great savings can be made by employing information systems for sustainability.

The success of implementation of green information systems rests in organizations' ability to invest in IS that reduce their carbon footprint. Carbon footprint is the measure of the environmental impact of an individual or organization's lifestyle or operations measured in terms of units of carbon dioxide produced [4]. Many projects that benefit the environment that have been undertaken by corporations in the past have been as a result of new legislations, community pressure or customer safety concerns [5]. [15] Opines that enterprises are changing in ways that improve the environment, and that change is accelerating, yet very few companies have established enterprise-level green strategies. This points to the fact that an organization's response to sustainability is driven by forces outside the organization which can be attributed to the limited view of investments in IS as a cost rather than viewing such systems as an asset that can be exploited to maximize financial gain to the organization and for societal responsibility. [2], opines that a correlation between environmental related investments and competitive advantage would obviously

motivate companies to go beyond mere legal compliance, and industrial competition would itself promote more ecologically sustainable practices. For corporate green IS, environmental awareness and the role of IT has tremendously increased since green IT was identified as a strategic technology in 2008, however, its adoption by organizations has been quiet slow. This is especially relevant in developing countries where small and medium enterprises (SME) are the majority and the application of information systems to support core business functions is quite limited. This is despite the fact that adopting sustainable practices no matter how simple, such as recycling and powering off the PC from the socket can go a long way in ensuring great savings for an organization [6] [7].

The success of implementation of green information systems is dependent on the provision of an effective strategy [8]. This research, therefore, offers an effective framework for strategy development for implementation of green IS by organizations in developing countries. We first offer a justification for our scope based on literature review then on this justification proceed to propose a framework that can be used by organizations in developing countries to develop their corporate level green IS strategies.

**Literature Review**

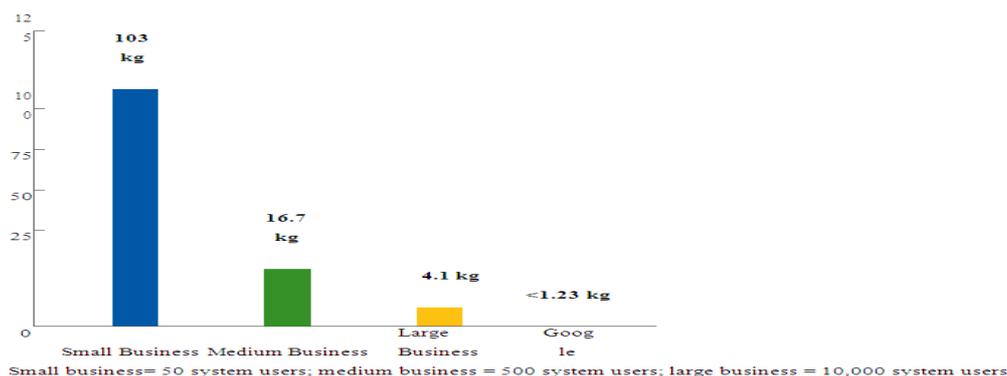
Opinions from practitioner research offer a justification for this research. According ACM, “people in developing world often live in resource impoverished environments so a physical to digital paradigm shift has the potential to enable activities that were hitherto prohibitively expensive and to support development while minimizing its impact.” [4]. From this assertion, we can argue that green IS offers a direct solution for economies and organizations that are faced with challenges of inadequate or unavailable resources as well as providing these economies with an opportunity to contribute in environmental management efforts.

According to the intergovernmental panel on climate change (IPCC) report, carbon emissions from industrialized countries such as US and the EU has greatly decreased in the last four years but that from developing countries has steadily risen [9]. The report notes that there has been an increase in global Green House Gas (GHG) emissions in the last decade. It notes that the rise in carbon footprint of developed nations in some cases is due to increased imports of emission intensive products from middle income countries. According to Google, “large organizations hold an advantage over smaller organizations: they can provision resources more efficiently and they can operate those computers in more efficient facilities” [10] hence developed countries have an advantage based on large scale use of computer based systems. This is not entirely true, however, for all organizations even in these advanced economies because Google notes that 18% of companies in the US are small organizations consisting of less than 20 employees. Developing countries are characterized by an emergence of mostly small and medium enterprises that exist in some given physical location. According to Google, these small organizations are at a distinct disadvantage when it comes to power savings especially as regards to servers as they are forced to acquire expansive resources and computing power which they don’t actually require. Google notes that the energy efficiency of a half utilized server is not different from that of a full utilized server [10]. Their comparison on e-mail hosting for different businesses is shown in Table 1 below.

**Table 1:** Business annual energy usage calculation [10]

<b>Business Type</b>	<b>IT power per User</b>	<b>PUE</b>	<b>Total power per user</b>	<b>Annual energy per user</b>
Small	8 W	2.5	20 W	175 kWh
Medium	1.8 W	1.8	3.2 W	28.4 kWh
Large	0.54 W	1.6	0.9 W	7.6 kWh
<b>Gmail</b>	<b>&lt; 0.22 W</b>	<b>1.16</b>	<b>&lt; 0.25 W</b>	<b>&lt; 2.2 kWh</b>

This table demonstrates that the annual energy consumption for users in small businesses is larger than that of large organizations. Small setups underperform, with both larger per-user energy costs and carbon footprints. When cooling and housing costs are taken into account, the total power per user for a large organization can be 1/20th that of a small business [10] as shown in Figure 1 below



**Figure 1:** Annual CO2 per user based on business size (kg) [10]

Based on this, it is the opinion of the researchers that closer focus needs to be directed towards reducing the IT induced carbon footprint of developing economies. This necessitates the need for an inherent strategy framework that organizations in developing countries can apply in developing their internal frameworks for incorporation of ‘Green’ activities within their operations. By Green IS, we accept the argument of [6] that Green IS includes Green IT and hence we discuss all green IT concepts as part of the wider Green IS.

### Green IS in Kenya

The ICT pervasiveness of Green Information communication technology (ICT) in Kenya can be said to be very low. This is according to the findings of a research carried out by [11]. The findings indicate that organizations have no concern over most of the green ICT aspects except for e-waste and efficiency of cooling and lighting of data centers. They argue that more effort need to be made to increase the green ICT awareness levels in Kenyan organizations especially universities since these are institutions that may have a greater impact on ICT personnel as they train them. One of the noticeable companies in adopting sustainable computing initiatives in Kenya is Safaricom Kenya limited. As part of its Green IT initiatives, Safaricom started to manage its paper consumption in 2008. To minimize paper usage, printing and photocopying are only recommended when absolutely necessary and printers are set to duplex printing by default. All shredded waste paper is sold to Chandaria Industries for recycling [12]. The company’s sites consumes an average of 700,000Litres of diesel per month, 70% consumed by off-grid sites at a cost of KES 87M [13]. This they argue contributes Carbon emissions and environmental pollution from combustion of fossil fuel. Focus is on rolling out energy efficient telecom equipment; reduction of generator running hours to save on NOPEX, conserve the environment (reduce Carbon footprint), green image, green business leadership [13]. Efforts by Safaricom shows the role that firms in developing countries have in identifying areas and practices within their business processes that contribute to their carbon footprint and adoption of sustainable measures to minimize their negative impact on the environment. To support these efforts by the practitioners, we opine that the academic community must be at the forefront of providing actionable alternative solutions that organizations can consider in developing their enterprise level green IS strategies especially for developing economies.

### What is a Green IS strategy?

We can define strategy as “the direction and scope of an organization over the long term which achieves advantage for the organization through its configuration of resources within a challenging environment to meet the needs of markets and stakeholder expectations” [14]. Green information systems are a convergence of three main organizational strategies: Environmental strategy, Information System (IS) strategy and Business strategy. Hence, to exhaustively define and understand Green IS, each of these strategies should be effectively analyzed in the context of enabling organizations achieve a competitive advantage.

Environmental strategy refers to the plan the organization has towards ensuring that the goals of the organization do not cause harm to the environment. We can define an environmental strategy as an organizational structure, planning activities, responsibilities, practices, procedures, processes, resources, and standards employed in formulating an organizations environmental policy and achieving its objectives on both short and long-term basis [6]. Environmental cost leadership strategies can be leveraged through redesigning business and manufacturing processes. Thus, harmful input materials can be substituted and by-products can be recycled. This increases the production efficiency and decreases resource consumption and waste disposal costs. Environmental differentiation strategies can be enabled through Design for Environment [15].

### Need for a green IS strategy

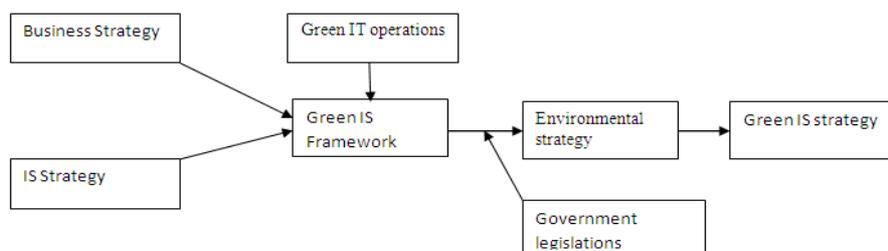
Green IS strategy must be considered at the highest levels of corporate strategies just like any other strategies within the organization (corporate strategy, competitive strategy and functional level strategy) [15]. Scholars of management research have given remarkable amount of attention to environmental strategies and sustainable development, however, the strategic aspects of environmentally friendly Information Systems (IS) have hardly been analyzed by the IS community [16]. This assertion is supported in another research by [15], who argue that “The potential of innovative information systems to support the achievement of environmental targets can only unfold if the IS strategy is aligned

with the environmental strategy of the firm. However, this topic has hardly been investigated by the IS research community". More efforts need to be directed towards aligning Business, IS, and environmental strategies for maximum savings on the environment especially in the utilization of information systems. To achieve societal sustainability, we need the great bulk of major corporations to incorporate sustainability as part of their corporate strategy. To achieve societal sustainability, major corporations need to incorporate sustainability in their core business functions [3]. They argue that a majority of corporations have incorporated sustainability as part of their business strategy because these corporations have recognized that they have a vital responsibility in solving this global problem and that their customers also expect them to provide green products and services. However, as much as their arguments are right, the researchers stress that over focusing on large corporations while ignoring the contribution that small and medium businesses can make in reducing the global carbon footprint may negate the gains made in the long run.

The IT industry is at the forefront of providing sustainable economic development. In 2008, Information Technology was recognized as one of the most important strategic technologies [17]. [18] opines that IS strategy is an important field of research, and meaningful for practitioners as well. They analyze different streams of IS research which are related to IS strategy, such as research on Strategic Information Systems Planning, IS alignment, and IS-based creation of competitive advantage. However, business executives are struggling to identify sustainability based sources of competitive advantage and to integrate environmental aspects into their corporate strategy [19]. This can be supported by the argument by [2] that "While most companies are expected to become "better citizens" as regards environmental management in each industry only a few will be able to transform environmental investments into sources of competitive advantage. This requires a clear strategy: "the creation of a unique and valuable position, involving a different set of activities." This means that for organizations to gain a competitive edge over their competitors, a clear analysis of all its business activities and processes and the development of an inherent strategy is essential. In the field of computing and information systems, this entails an examination of not just the information systems in use but also an examination of the business processes and activities in order to identify areas that can be exploited for environmental as well as business savings and an implementation of IS that maximizes the use of resources within the enterprise. In view of all this, we propose a number of concepts that can be applied in the development and implementation of a corporate Green IS strategy. The process of corporate greening can be understood as a first step towards the superior goal of sustainability [19,6]. This notion emphasizes the fact that enterprise level green practices are the key determinants of the success of corporate sustainable IS initiatives which forms the basis of this research.

#### **Enterprise level Green IS strategy Components**

Vast import of Green IT derives from its potential to create a functional bridge between corporate motivations and environmental ones, to create mutually satisfactory benefits. Since the actual applicability and usage of Green IT tends to vary vastly, an understanding of its underlying concepts is essential to all projects, whether of a theoretical or a practical nature [20]. The overall argument of the proposed strategy is that Green IS strategy is a combination of the various business strategies in the organization which should be well analyzed to develop the organizations overall Green IS strategy. Government legislation is an intervening variable. This is because it is considered that government legislation is considered a key driver of the information system development process and hence new legislation may intervene to influence what systems an organization can be able to adopt. Green IT Operations focuses on issues such as monitoring energy-levels for peak and non-peak usage hours, training employees (assuming human resource elements within Operations) to function in an informed fashion to create tangible results from Green IT implementation, disposal of obsolete computing devices and so on. Every business has a business strategy that defines how it operates, its vision and mission and what strategies it will put in place to compete effectively within the market. Linking IS and business strategy is essential as the IS strategy is supposed to fit within the existing business structures or alter them appropriately to enable the business achieve its goals. In view of this, therefore, a business strategy provides the backbone on which information systems are adopted and implemented. These variables are illustrated in Figure 2 below.



**Figure 2:** Green IS strategy basic model

#### **Green IS and competitive strategy**

While most companies are expected to become "better citizens," by coming up with measures that contribute to a cleaner environment in each industry, only a few will be able to transform environmental investments into sources of competitive advantage. The identification of sources of competitive advantage requires one to make a clear distinction

between products/services and organizational processes [2]. Porter [21] identified low cost and differentiation as two main sources of competitive advantage. The big question therefore becomes, "What role does Green IS have to play in enhancing a firm's competitiveness in the society?" Prior research shows that investments in Green IS/IT saves on cost of operations by reducing energy consumption and by providing avenues where resources such as power and organizations systems can be directed for efficient usage and manage resource wastage. [21] Organizational inefficient processes increases costs of overall products that are passed on to customers in the long run. This means that using information systems that lead to improved organization processes can increase savings that can be passed over to customers leading to low cost products. Consider a case of Green IS: by the use of teleconferencing for example, the organization saves on costs that could have been incurred in travelling; integrating organizational communication systems to improve communication efficiency and at the same time cutting on organizational costs by eliminating paper based communication brings down the cost of operations: by developing inherent green IT energy practices including energy saving plans such as powering off computers overnight and during idle time, acquiring energy efficient computers such as tablets, maximum utilization of natural light in offices and good data center practices, organizations can tremendously reduce the cost of operations by more than half. These savings can thus help organizations apply the cost leadership strategy giving it an edge over the competitors

#### **Environmental strategies**

Four environmental strategies were proposed by [22]. One is Eco-efficiency which aims at minimizing waste, byproducts and emissions. By this, production efficiency can be enhanced and costs reduced. Although initiatives that allow for a reduction of the environmental footprint and simultaneously come along with cost savings and are attractive for virtually every firm, this strategy proves to be particularly appropriate for mass volume producers with intense industrial processing [19]. Thus, this argument by [19] seems to rule out SMEs from the eco-efficiency strategy. Second is the beyond compliance leadership strategy which concentrates on organizational processes as well, but the competitive advantage is rooted in differentiation rather than in cost reductions [19]. Firms pursuing this strategy even approve unprofitable environmental initiatives to reduce their ecological footprint. The positive corporate image helps to attract new customers and to intensify the relationships with established ones [22]. This strategy, however, seems to disadvantage small and medium firms which in most cases face financial challenges and struggle to gain their foot in the market. The third strategy is the eco-branding strategy which refers to a competitive focus on products and services. This strategy strives for competitive differentiation based on ecological product characteristics. The customer must be willing to pay for this ecological differentiation. Hence reputation and credibility are important intangible assets associated with this strategy [19]. Again, based on the fact that developing countries' usually highly price-sensitive markets, few would be willing to pay more for the sake of ecological savings hence not many small and medium size firms would be willing to make such investments. Lastly, in highly price-sensitive markets, the environmental cost leadership strategy can be a suitable approach. This strategy targets radical product innovations instead of incremental process enhancements. Substitution of decisive input materials or new business practices can significantly change markets and competitive conditions [19]. This strategy fits well in developing countries where price is the major consideration and determinant of customer purchase patterns and strength. We, therefore, adopt the environmental cost leadership strategy as the main approach that would provide a win-win situation for both firms and the ecosystem in developing countries or in small and medium size businesses. Next, we provide the major practices that these firms should consider in greening their IT practices based on the environmental cost leadership strategy.

#### **Enterprise Level Green IS practices based on the environmental cost leadership strategy**

There are three goals of sustainability. The first goal is to prevent pollution by minimizing the level of emissions, effluents, and wastes. The second goal is product stewardship, where one focuses on both reducing pollution and also minimizing the adverse environmental effects associated with the full life cycle of a product. This is also known as the 'cradle-to-cradle' approach, where the end state of a product is involved in the beginning of another. The third goal is the use of clean technology that creates no harmful emissions or waste to the environment [3]. Any organizational practices should thus be directed to achieve any of these goals.

#### **Environmental cost leadership Green IS strategy practices**

##### **Improving the firms computing energy efficiency**

A variety of ways can be applied by small and medium firms as well as by large corporations in reducing the energy consumed by their IT systems. These strategies coupled with the recent drive by computer manufacturers to develop energy efficient computer systems play a critical role in reducing the energy consumption of firms [23]. While new technology from the industry will help drive efficiency into the IT infrastructure, it will not replace the necessary ongoing architectural and process commitment [24]. According to [23], there is a direct relationship between energy consumption and performance. Notebook computers use only a third of the electricity of desktop PC's. Organizations can, however, redesign their IT infrastructure to make it more energy efficient. A thin client, a lean PC that relies on a central server for disk storage and applications processing, uses less energy than a regular PC. [3] gives an example of Verizon, which reduced energy consumption by 30 percent by replacing personal computers in its call center with thin clients. Germany's Fraunhofer Institute reports that, when comparing thin clients to personal computers, energy consumption is at least twice as low, even when factoring in the additional energy and cooling power required by the

server associated with the thin clients. In addition to the reduction of emissions, e-waste is also reduced by switching to thin clients. A thin client contains significantly fewer components and has a longer life expectancy than a regular PC [24]. In designing the “building for the future initiative”, at the United Nations Office in Nairobi (UNON), their report notes that “The most obvious IT difference in the new building will be the shift from desktop to notebook computers over the coming months, yielding an immediate energy saving of around two thirds” [25]. This demonstrates the great savings in terms of power consumption that small and medium organizations and even individual users can adopt in reducing their carbon footprint. The report also highlights some important points that would be essential for organizations to consider in reducing their energy consumption. The report highlights the fact that using a single vendor for IT equipment is a central tenet of green procurement. Significant discounts can be negotiated on purchase price, adding to the savings already made by choosing notebooks over more expensive and bulky desktop computers and maintenance is streamlined and made both cost and energy efficient via planned spare parts stock levels, and their timely replacement on site. Additionally, carbon emissions are substantially reduced through a single bulk shipment rather than multiple smaller international dispatches.

#### **Electronic Transactions**

Small and medium companies, large corporations, economies and economic regions can reduce pollution by encouraging a shift to technologies that produce fewer emissions. In the case of IS, the energy cost of exchanging data can be significantly reduced by moving from the postal system to electronic networks. Electronic Data Interchange (EDI), for example, supports the majority of electronic commerce transactions [3].

#### **Powering off the computer**

More than two thirds of power consumed by computers goes to waste [24,26]. Great savings can be made in terms of power savings by adopting sustainable computing practices. Many staff members simply don't shut off their computers. Power management tools and remote systems management software can help IT administrators to enforce a power-off policy, and either shut down, hibernate or put to sleep every idle computer. Sleep and hibernation modes can reduce energy consumption by 60 percent, according to the nonprofit Climate Savers Computing Initiative [26]. According to research, a computer that is powered off without switching off power completely from the socket consumes a third of its power [6]. This means that powering off the computer is not just enough, but switching off the power from the socket would make up major savings.

#### **Adaptation**

Adaptation defines an organization's efforts to maximize its local relevance by being responsive to local stakeholders' needs and desires. Again, this can be done by exploiting in the power of IT and IS strategically. From an environmental perspective, this means adopting specific environmental initiatives that reduce emissions and wastes in the communities in which the organization operates [3].

#### **Shift to networked laser printers and multifunction printers and copiers.**

Mandating the use of networked laser printers (with few exceptions) will not only help save the environment (paper, ink, chemicals, and plastics) but can also help reduce costs. To save more energy, consolidate standalone devices such as personal desktop printers, fax machines, scanners and copiers to multifunction printers or copiers. Management of these systems is relatively simple and can often be performed by network administrators via a web browser. After networking, set these devices to print double-sided, which HP estimates can cut paper usage by 25 percent [27].

#### **Refresh with more energy-efficient computers and monitors.**

When it's time to refresh equipment, purchase desktops, notebooks and monitors that meet stringent government energy-efficiency standards, such as Energy Star or EPEAT (Electronic Product Environmental Assessment Tool). This is particularly important to federal agencies, as the U.S. government requires that 95 percent of all computers purchased for it must meet EPEAT standards. Additionally, more and more states, such as California and Massachusetts, are adopting similar measures. Numerous computers are made with more efficient components, such as processors, power supplies and variable speed fans. On most notebooks, LED screens take up 30 percent less power than regular LCD screens [27].

#### **Individual pollution prevention**

There are several actions that you can take to reduce the IT impact on pollution. For example, turning off your computer when not in use, practicing shutting it down when you are not within, printing on both sides of a sheet of paper or turn on the energy conservation preferences for your operating system so that your computer will go to sleep after a certain period of inactivity. Flexible printing capabilities exist for most operating systems; yet, they are rarely activated. It is estimated that applying energy settings, such as 'sleep when inactive', can reduce greenhouse gas emissions at a rate equal to taking more than 8,000 passenger cars off the road for an entire year, or conserving 16 million liters of gasoline [3].

#### **Reduce travel with video conferencing and unified communications**

Allowing staff to work from home or in teleworking centers helps in reducing travel and carbon emissions. Deploying unified communications aids in teleworking and the overall green effort because it allows staff to stay in contact, collaborate and be productive [3]. Unified communications technology allows staff to hold video and audio conferences, instant message and make and retrieve office phone calls using their computers. High-end video conferencing, such as

Cisco's TelePresence solutions, allows corporate leaders and staff from all over the country — and the world — to hold meetings without having to travel [27].

#### **Intranets and extranets**

An intranet refers to internal organizational networks that use the infrastructure of the internet for communication within the organization. These networks can be exploited maximally to reduce the organizations' carbon footprint and at the same time lower the cost of operation. Online sharing of documents between employees and direct communication between the management and staff eliminates the need for printing hence saving on both costs and environment [6]. Extranets can go a long way in supporting an organization's internal mechanisms to reduce its carbon footprint by enabling electronic communication and availing business information directly between business partners. This eliminates the need for travelling, printing and saves on time that is needed for carrying out business transactions.

#### **Discussion, conclusion and recommendations**

There is great potential for organizations no matter how small to make savings on the environment. This is not determined by how much computing power a firm has invested in but focusing on that one computer to make savings on the environment is essential. Small and medium size companies could make huge cost savings by focusing on and investing in information systems and computing power that specifically meet their needs without wastage. Where that is not possible, investment in public shared infrastructure such as cloud computing would be essential. This would best apply even for large firms which require computing on an irregular basis. To effectively manage and monitor their carbon footprint, firms need to develop inherent strategies that directly address their needs without causing harm to the environment. It should be noted that not all Green IS approaches are compatible to all firms, hence the need for firms to consider all options available in developing their internal green strategies. There is need for the research community to develop models that link business strategy, environmental strategy and IS/IT strategies to encourage even small and medium size organizations to invest in Green IS. This is because unless these organizations are willing to invest in environmental friendly business and computing practices, then the potential for Green IS will remain just that. It is also important to note that this list is not conclusive but a highlight of a few mechanisms that small and medium organizations can apply. Any efforts that would lower a firm's carbon footprint should be pursued by both individuals and organizations. This is because various mechanisms can be applied depending on the organization, environment, country and the existing information systems. To achieve benefits for the organization and environment, organizations need to recognize the vital role that they have in addressing the challenges of sustainable development, hence there is need for small and medium businesses to recognize that they have a role in the drive towards a clean environment.

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