

Analysis of Factors Motivating Sri Lankan Organizations towards Green IT

A SURVEY AMONG GREEN AWARDED ORGANIZATIONS

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Abstract- The green concepts have been now identified as the right element to connect both corporate innovation and environmental integration. It is encouraging to identify that few Sri Lankan organizations have initiated green concepts including green IT practices. There are internal as well as external factors which motivate Organizations towards 'Greening'. This paper Identifies motivation factors for implementing Green IT among forty five Sri Lankan 'Green awarded' organizations. This data can be utilized in setting green targets of the country and for the benefit of organizations who are planning to 'Go green' in future facing minimal barriers with maximum productivity.

The results show Green IT initiatives taken by majority of the green awarded Sri Lankan companies have aimed at cost minimization. Government energy efficiency regulations, , Greenhouse gas regulations, regulations on discarding e-waste, encouragement from industry associations show very low impact on motivating organizations towards achieving green IT. Green awarded organizations with clear vision and mission, are more focused and are more successful in retaining green concepts and green processes. In addition Defining a vision & mission will help an organizational management to educate their employees and motivate towards participating in greening their IT processes.

Index Terms- Green IT, Motivation Factors, Trends, Green IT in Sri Lanka.

I. INTRODUCTION

Green IT is becoming a popular topic in the world forums day by day. The attention it grabs is peaking while diversifying the attentive that attract to the topic ranging from politicians, industrialists, environmentalists to IT professionals. No Wonder the number of researchers interested in the topic and the number of researches based on the above topic is gradually rising. This literature review was carried out In search of the current available detailed knowledge on 'Green IT' and subtopics. Broad and systematic surveys lead to the identification of knowledge gaps and areas which need further evaluation.

The Importance of IT

The power consumption and consequent environmental impact of ICT is much greater than is generally realized. Due to the considerable pressure from competitors, regulators, community groups and environmentalists implementing sustainable business practices to balance the economic and environmental performance has been identified as a key strategic issue [1]. Understanding and implementation of green concepts and opportunities can be considered as critical and vital in the above context. Green IT practices are becoming an important and attractive topic for the media in part, because of a broader interest and emphasis on corporate social responsibility (CSR) programs. In the infrastructure support (ICT) and data center management communities, there is a growing body of evidence that IT organizations can also "green-up" their energy, procurement and recycling practices. These efforts are being closely watched across the industry because, while they contribute to the broader corporate social and environmental agenda, evidence indicates that the initiatives make sound economic sense and in many cases generate substantial savings.

A. Working Definition of Green IT

Though the term is widely used, a precise definition of it is lacking. A simple working definition of Green IT can be stated as "The study and practice of using computing resources in ways that help reduce energy and operating costs enable sustainable business practices and reduce the environmental impact of IT practices in the larger Community" [1].

B. Green IT Adoption Trends

A research carried out by IBM and InfoTech research group [2] has identified that many businesses have discovered that Green IT initiatives offer costs savings benefits while reforming the organization, meeting stakeholder demands and complying with laws and regulations. Also they have found complete Green IT initiatives realize significant cost savings alongside superior environmental performance, Virtualization and Consolidation, Energy Efficiency, Travel Reduction and Asset Disposal as the main areas for adopting Green IT [2].

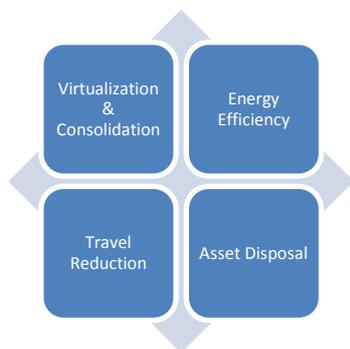


Fig. 1: Holistic view of Green IT

C. Benefits of Green IT

By introducing Green IT solutions, many organizations are saving tons of money, reducing the amount of power need for servers/workstations and most importantly helping to minimize their environmental impact. Recent reports from Gartner, Forrester, and McKinsey highlight the costs and savings from implementing green-tech corporate strategies. All three reports highlight the cost benefit possible from green IT strategies while ultimately reducing the green house gas emission participating for a social responsibility. All three reports mainly target the highly technical industries which are looking forward to develop more environmental friendly policies. According to the Gartner, within the context of an enterprise green IT can be defined as “optimal use of information and communication technology (ICT) for managing the environmental sustainability of enterprise operations and the supply chain, as well as that of its products, services and resources, throughout their life cycles [1].”

Gartner report which offers definitions and prescriptions which are supposed to be beneficial for the enterprises awaiting to go greener, offers a list of practical tactics for greening a company’s IT program such as devising metrics to assess the energy use, material selection, supply chain compliance and staff engagement as well as use of carbon foot prints. Though it does not clearly indicate the measure to go greener these recommendations can be utilized as guidelines when an enterprise decides to go greener [1] [3].

The report, “Green Progress in Enterprise IT” published by Forrester in December, 2007 [4] state data gathered at two surveys carried out six months apart at among 130 executives in charge of IT operations and procurement at a variety of unnamed U.S., Canadian, and European companies from the technology industry. 22% said their corporations had absolutely no intention of buying greener IT, 39% said even though there was no environmental policy in place, their companies would consider implementing one. Among these respondents only 15% claimed that their companies had a specific strategy for buying and using greener IT devices or engaging in other environmentally friendly activities relating to IT. 25% said that they have active plans for implementation of green IT [4] [5]. The McKinsey report focuses on a broader sense of energy efficiency. The authors point out that implementing such energy efficiencies could offset 85% of projected energy demands by 2030 [6].

D. Holistic Approach to Green IT

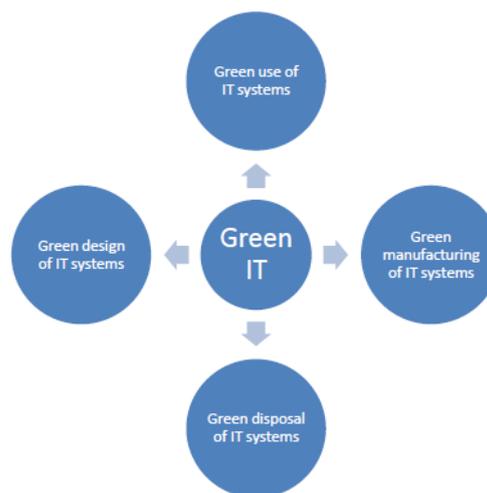


Fig. 2: Holistic view of Green IT

E. Motivation for Green IT

It is clear that in many sectors the corporate IT budget cannot withstand the demand of the IT needs of a company along with the rapidly developing technology which enables business growth. This leaves the IT managers to turn on ‘Green IT’ only if Green solutions are affordable and yield tangible savings. Due to the fact that Green IT initiatives are relatively new and immature IT managers need to justify Green IT initiatives. Thus, we can see that the practitioners are eager to understand the role of Green IT and why they need to fund Green IT initiatives. So, it is important to identify that there are some other drivers which motivate organizations to adopt Green concepts other than the most obvious cost effectiveness. Molla has divided the Green enterprises into 4 clusters according to their position in Green initiation [8].

F. Organizational Motivation theory

Organizational readiness for change is a multi-level, multi-faceted construct which can be defined as “shared resolve to implement a change (change commitment) and shared belief in their collective capability to do so (change efficacy)”. The three key determinants of implementation capability of a change are task demands, resource availability, and situational factors. When organizational readiness for change is high, organizational members are more likely to initiate change, exert greater effort, exhibit greater persistence, and display more cooperative behavior resulting in more effective implementation [9]. In the context of IT adoption, motives are defined as “the desire that initiates the activities of an organization to adopt an innovative system such as an IT enabled information system” [10]. Motives can be seen in terms of their locus (source) or types (focus). The locus can be either internal or external to an organization [11], (Internally, motives are embedded in missions, beliefs and value systems of an organization [12]. Externally, motives emanate from the intervention of formal (such as government) and informal (such as markets) institutions.

two forms of institutional interventions which are influence and regulation are described by [13] Influence initiatives can be achieved without direct use of force and by providing resources while regulatory actions which have the purpose of directly affecting the behavior of entities under their jurisdiction via directives or actions that limit options and modify behaviors.

Rahim [11] classify the motives for the adoption of inter-organizational systems into two broad categories techno-economic and socio-political. Techno-economic motive refers to the adoption of technologies and systems to improve organizational and market performance, whereas socio-political motive refers to the adoption of systems either because of the influence of external forces or to create socio-political pressure on others.

G. Organizational motivation theory in eco sustainability

While several authors describe organization motivation aspect in different viewpoints, few have taken attempts to identify motivation factors in the context of ecological sustainability. Chen et al [14] describes three eco motivations which are,

- 1) Eco-efficiency - desire to deliver “competitively priced goods and service. while progressively reducing ecological impacts”
- 2) Eco-equity equal rights of people to environmental resources” and a business’s “social responsibility for the future generations”
- 3) Eco-effectiveness aims to stop contamination and depletion by directing individual and organizational attention to the underlying and fundamental factors of environmental problems through a fundamental redesign of the system”.

In the context of environmental responsiveness, Bansal and Roth [15] identified three motives-competitiveness, legitimating and social responsibility.

- 1) Competitiveness refers to the desire to achieve profitability by reducing cost and improving efficiencies.
- 2) Legitimating refers to the desire to satisfy government regulations and stakeholders and comply with environmental norms and standards.
- 3) Social responsibility refers to the desire to “do well” to the environment out of a sense of social obligation.

The widely discussed and the Green IT motivation grid which identifies four categories of motivations by Molla [8]

		Locus of motivation	
		Internal	External
Focus of Motivation	Economic	Eco-efficiency	Eco-responsive
	Regulatory/ Normative	Eco-effectiveness	Eco-legitimacy

adopted in this paper, is Based on a wide review of the literature

and principal component analysis.

Table 1:Green IT Motivation Grid

H. Drivers of green IT

Current drivers of Green IT are internally as well as externally located and are focused on environmental considerations that help a business to brand itself as a concerned entity of global and local communities. Olson postulates that rather than hard dollar gains, softer benefits such as employee morale and good corporate citizenship motivate adoption [16]. Another similar study of the adoption of environmental technologies identified better corporate image and the pressure of regulation as the main reasons for adoption [17]. Porter and Kramer, points out, Businesses’ use of Green strategies can set the Green norms of competition and motivate others to follow suit [18]. Also Damanpour and Schneider recognize the influence of market forces in facilitating adoption either through the effects of network externalities or through creating a critical mass of users [19]. In contrary to the above, findings of Molla, does not appear to support these theses, as eco responsiveness does not appear to have any significant influence on Green IT uptake [8]. In the view of previous innovation literature the discrepancy in the results can be explained by the argument ‘the factors that facilitate innovation in its early phase could be the reverse of those facilitating later phases [20].

As Green IT can be considered at the early stage of development in Sri Lankan context, it remains to be questioned, if economic concerns continue to dominate as the primary reasons for Greening IT or if other considerations have started to play in. According research done by Molla [8] of the four Green IT motivation factors, eco-efficiency and eco-effectiveness are identified as the most relevant in organization’s decision to Green IT. Also the researchers have found that the majority of respondents indicate that the main motivations for Greening IT are business strategies that emphasize not only environmental consideration but also cost savings whilst pursuing corporate responsibility as concerned entities of global and local communities for Greening IT.

Market forces such as competitors’, IT vendors’ and client’s pressure have not so far emerged as motivating Green IT uptake. Most of the existing Green regulations and legislations are non-binding. As a result, a significant number do not yet see government regulations or incentives as driving their Green IT strategy.

I. Awareness on Green IT

To predict the readiness of IT industries to implement green IT strategies and the success of implementations it is important to analyze the awareness of IT professionals about Green IT.

The survey based research which was done in Indonesia among cross sectional study population consisting of 105 Indonesian IT professionals from different industries has some enlightening findings. Results demonstrate that 41% have

purposefully attempted to attend a seminar or workshop on green IT and 85% are willing to gather more information about green IT issues [21].

J. Global trends in motivation for green IT European commission

The European Commission has stipulated in its Code of Conduct on Data Centers Energy Efficiency takes into consideration two dimensions of data centers. Firstly IT Loads which concerns the energy consumption of IT equipment itself, and secondly facility loads which concerns those elements supporting the IT equipment; such as cooling systems and air-conditioning. It aims to minimize the energy consumption of ICT by committing all parties including the data center owners and operators as well as the suppliers and service providers [21].

1) United states

In the United States, The Environmental protection Agency has launched its Environmentally Preferable Purchasing Program (EPP) since 1993 which helps the federal government "buy green," and in doing so, using the federal government's enormous buying power to stimulate market demand for green products and services. EPP supports IT equipment suppliers who have fulfilled the green standards applied by EPA and promotes Software to measure the energy consumption and efficiency of data centers and IT supplies [21].

2) Australia

The Australian government is also proactively participating in the role of popularizing green IT. Based on the information shared by the Department of Finance and Deregulation on the website of the Australian government (2010), the Australian government has developed some guidelines for the private and public sector. The main priorities listed include some basic changes like the usage of black screens or static screen savers instead of active screensavers or the necessity to provide automatic shutdown of desktop and laptop fleet after hours. But many more practical but very efficient power saving mechanisms have been introduced. As part of an important change in the policies and strategy of companies and governments, a recent study published by www.thegreenitreview.com (2010), showed that 18.8% of the ICT carbon footprint in Australia in 2009 came from data centers. This report, developed by Connection Research for the Australian Computer Society (ACS) showed details of the energy consumption and carbon footprint of ICT usage in Australia plus an examination of how ICT can act as a low carbon enabler. It emphasizes the way to improve energy efficiency using, for example, the support of the Australian Information Industry Association (AIIA). Moreover, the report offers advice on the emergence of new competitors and the need in the near future to create strategic alliances and build stronger and more reliable programs [21].

3) Singapore

Survey findings from Spire Research & Consulting show "Recycling paper and reducing the use of electricity are the

most important Green policies implemented by Singapore-based companies and the others include reducing carbon dioxide emissions, switching to more environmentally-friendly machines or products, as well as conscious efforts to work with like-minded organizations. Of the 20% of firms that have not engaged in Green activity yet, only one-third plan to begin such activities in the next five years" [21].

"For companies in Singapore, these measures have been taken primarily for reasons of cost-saving and so as to align the company with industry and market trends. Corporate social responsibility (CSR) motivations do not figure strongly. This is in line with the other countries in the region, save for Korean firms which tend to be motivated more by CSR considerations."

K. Motivation for Green IT in Sri Lankan Context

The Central environment Authority of Sri Lanka has commenced 'National Green Awards', since 2011 to motivate the public as well as private organizations who have initiated Green practices. The awards are categorized according to the industry type and ranked gold, silver, Bronze and Merit. During the last two award ceremonies number of organizations was felicitated for their green achievements [22].

II. METHODOLOGY

This descriptive study focuses on identifying the factors which drives Sri Lankan organizations to engage in eco-sustainable practices directly targeting IT.

A. Preliminary study

Four or more 20-30 min in depth interviews will be carried out with CIO or similar level Personals from four enterprises that are at different levels of green IT adoption.

- 1) An enterprise which has already implemented green IT and awarded by the government
- 2) An enterprise which has implemented green concept in other areas but not adopted green IT
- 3) An enterprise which is taking initiatives to implement green IT
- 4) An enterprise which has not yet considered green IT adoption

Company	Rank of the Person Interviewed	No: Staff	No: Servers	No: Computers	Nature of the business
A	Global Network Architect	>500	300	Roughly 6500	IT Service Provider
B	IT Manager	>500	200	Roughly 700	Apparel Industry
C	Manager - PR & Corporate Communications	>500	200	Roughly 700	IT Service Providers
D	Director IT	300<	150	Roughly 300	Agriculture

Table 2: Preliminary Survey

Table 2 depicts the basic background data regarding the four organizations which were considered during the preliminary survey. Two are IT service providers while the other two are from non IT industries (textile and agriculture). The interviews were mainly focused on capturing their knowledge attitudes on green IT, level of green implementations in the organizations, motivation factors, draw backs while implementing and reasons for not implementing. Interviewees also mentioned about their policies. Practices & technologies of each process in general and those that is unique to their departments.

Interviewees also mentioned about their policies. Practices & technologies of each process in general and those that is unique to their departments.

Server Virtualization	Desktop Virtualization	Storage Virtualization	Power Management	Travel Reduction	Motivation factors
Implemented	Implemented	Implemented	Server room ,Desktop, Printer ,Educating their employees, Clear policies	Video Conferencing, VOIP technology is used	Saving cost, Market sustainability, Market expansion, Competition from the market
Implemented	Not implemented	Not implemented	Not Implemented due to inadequate infrastructure	Video Conferencing, VOIP technology is used	Market sustainability
Implemented	Implemented	Not implemented	Planning on implementing Policies ,Educating their employees well, Instead of a desktop giving a Laptop	Highly using Video Conferencing and VOIP	Saving cost, Environmental friendly, Mother company influence, To be represented in Europe market

Table 3: motivation factors from preliminary survey

Data Collection Instruments

The main data collection instrument used to answer the main research question and to successfully achieve the research objectives.

To collect the necessary data on the awareness and knowledge on Green IT and motivation factors questionnaires will be used. Unstructured interviews will be used as the primary source to develop the questionnaire in which the researcher is planning to seek data mainly under the following.

The research will be dealing with two major constructs-organizational motivation and Green IT adoption. The Green IT motivation grid [8], green IT initiatives identified by Info tech research group was used to develop the conceptual framework (figure1)

Data Sample

This exploratory survey will be carried out using a Questionnaire based survey. The study population will consist of all 48 public and government organizations excluding the schools , which received national Green awards by central environment authority in the years 2011 and

3.5 Measurement of Variables

The research deals with two sets of variables; Green IT initiatives and organizational green IT-motivations. There are a number of technologies and practices that can be considered as Green IT and can be categorized under four main domains [8] [2]. They are Virtualization and Consolidation, Energy Efficiency, Travel Reduction and Asset Disposal.

The green initiatives addressed in the research varies from data center specific technologies such as server and storage virtualization, end user technologies such as desktop

virtualization and practices such as policies for environmentally responsible IT procurement and disposal and for using IT to manage emission.

These technologies are identified based on the survey findings of Molla [8] and Info tech [2]. These two surveys have indicated that server and storage virtualization and consolidation are the most widely used technologies to improve the energy efficiency of IT infrastructure. The other three items are adopted from Molla [8] and Chen [14] and refer to product stewardship issues focusing on IT lifecycle management from procurement to end of life IT management.

Respondents were asked to indicate the extent to which they have implemented each of the technologies and practices on a five point scale.

1=Yes, 2=Yes halfway through, 3=Still Planning, 4=we don't have a Plan, 5 =we don't have a requirement on Green IT Initiatives. Thirteen green IT motivation factors which was adopted from the Green IT motivational Grid [8] and preliminary survey were identified.

All items were assessed on a five point Likert scale with one we have implemented and five we don't have a requirement.

Green IT motives

- 1) Cost of server energy consumption
- 2) Efficiency of powering our ICT infrastructure
- 3) Cost of desktop energy consumption
- 4) The organization's sustainability strategy
- 5) Corporate Social Responsibility
- 6) Senior management commitment
- 7) The actions of our competitors
- 8) Pressure or marketing from ICT vendors
- 9) Market incentives
- 10) Government energy efficiency regulations
- 11) Encouragement from industry associations
- 12) Greenhouse gas regulations
- 13) Regulations on discarding e-waste

In addition to the two main constructs, data were collected about the profile of respondents and their organization such as size, industry classification, and scale of IT operations (such as installed server base, and number of personal computers). Except questions related to the demographic characteristics of sampled firms, all the items were measured using a five point Likert type scale with only the extreme points anchored with labels.

3.6 Plan for collecting data

The list of green awarded organizations (2011, 2012), were obtained by directly contacting the director of CEA. There were forty five organizations which were awarded gold, silver , bronze or merit category awards for the years 2011 and 2012 consecutively excluding schools which were awarded Green. The head of IT or equivalent level personnel of each organization was contacted via phone and explained about the research and its objectives. The individuals who consented to participate for the research were sent a detailed email requesting to fill the online questionnaire. After three rounds of reminders forty completed questionnaire. The privacy of the participating organizations will be always secured and the completed questionnaires will only be seen by the researcher. Data will be analysed using spss 17 software

III. RESULTS

In this study 70.3% of Sri Lankan Green awarded organizations claim that they have a clear vision and mission on achieving green award.



Fig 3: organizational Distribution on clear vision and mission achieving Green Award

The results highlight that, majority of the organizations which have a clear vision and mission achieving a green award also have a Green Management System in place (ISO 14001 or other formal process), a dedicated internal position responsible for managing Green initiatives, set measurable goals and targets for improving environmental and social performance, regularly measure and report publically on sustainability performance and educate employees on Green concepts.

	Have a Clear vision and mission achieving a Green Award(Yes, and Yes Halfway through)
Green Management System in place	78.70%
Dedicated internal position responsible for managing Green initiatives	78.70%
Set measurable goals and targets for improving environmental and social performance	81%
Regularly measure and report publically on our sustainability performance	72.90%
Educate our employees on Green concepts well	78.70%

Table 4: Cross tabular representation with Green processes

Table 5 elicits the percentage of Sri Lankan Green awarded organizations which have already implemented or initiated green IT practise relevant to all four domains of green IT which include Virtualization and Consolidation, Energy Efficiency, Travel Reduction and Asset Disposal.

It is worthy to appreciate; More than 70% of our respondents are concerned about educating their employees on power management. The least initiated green practices is desktop virtualization (13.5%), followed by server room power management (29.7%) systems. Only 29.7% of organizations have set policies on IT related power management, though 67.7% have set policies for ICT departmental asset disposal.

More than 40% of the organizations have made technical advancements such as use of VOIP and Video conferencing to minimize their travelling budgets.

Green IT Initiatives	Value (%)
We have implemented server virtualization implementation	43.2
We have implemented Desktop virtualization implementation	13.5
We have consolidated the storage	45.9
We have implemented Server Room Power management	29.7
We have implemented End user computer power management	56.8
We have implemented Printer power management	43.2
We are educating employees on power management	70.3
We have well set of policies in place on IT power management	29.7
We are using video conferencing to reduce travel expences	45.9
We are using VOIP to reduce travel expences	40.05
We have a policy on asset disposal	67.6
We are recycling IT equipments	45.9

Table 5: Green IT Initiatives

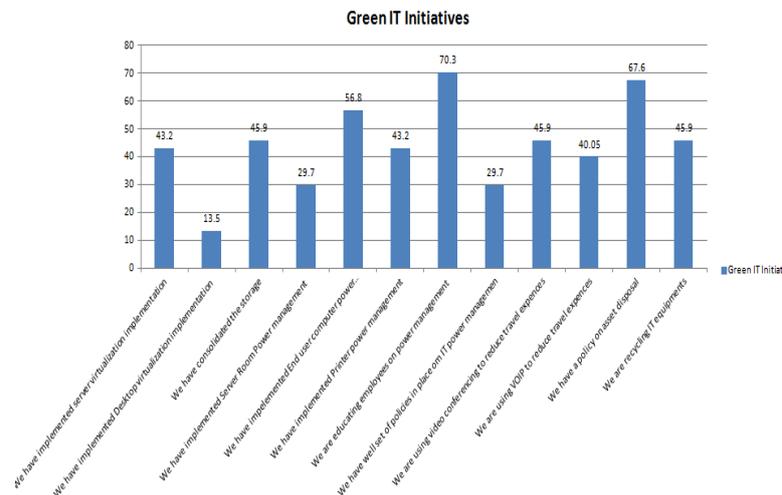
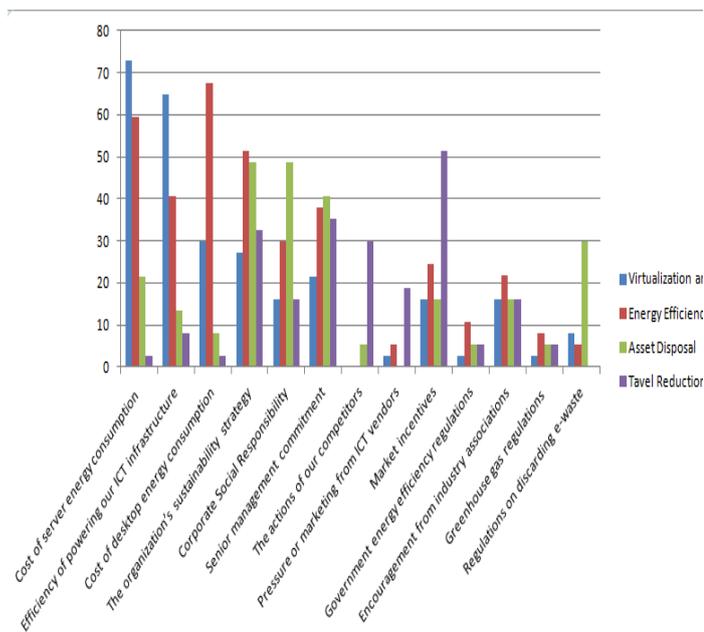


Fig 4: Representation of Green IT Initiatives among green awarded organizations

Motivation Factors	Green IT Initiatives			
	Virtualization and Consolidation	Energy Efficiency	Asset Disposal	Tavel Reduction
Cost of server energy consumption	73	59.5	21.6	2.7
Efficiency of powering our ICT infrastructure	64.9	40.5	13.5	8.1
Cost of desktop energy consumption	29.7	67.6	8.1	2.7
The organization's sustainability strategy	27	51.4	48.6	32.4
Corporate Social Responsibility	16.2	29.7	48.6	16.2
Senior management commitment	21.6	37.8	40.5	35.1
The actions of our competitors	0	.0	5.4	29.7
Pressure or marketing from ICT vendors	2.7	5.4	0	18.9
Market incentives	16.2	24.3	16.2	51.4
Government energy efficiency regulations	2.7	10.8	5.4	5.4
Encouragement from industry associations	16.2	21.6	16.2	16.2
Greenhouse gas regulations	2.7	8.1	5.4	5.4
Regulations on discarding e-waste	8.1	5.4	29.7	0

Table 6: Motivation vs. Green IT Initiatives



The above representation it depicts, The actions of competitors, Pressure or marketing from ICT vendors, Market incentives, Government energy efficiency regulations, Encouragement from industry associations, Greenhouse gas regulations has minimal effect on motivating organizations on achieving green. Organizational motivation towards different Green IT initiatives varies significantly. Cost consumption and the efficiency of powering ICT infrastructure are the main reasons for energy efficiency and virtualization and consolidation initiatives. In addition to the above organization sustainability strategy is a motivating 51% organization towards energy efficiency measures. Asset disposal initiatives are mainly driven on organizations sustainability strategy and corporate social responsibility. The market incentives are identified as main motivational factor for travel reduction practices of 51% participants.

IT.CONCLUSION

This study shows that Green awarded organizations who has a clear vision and mission are more focused and it will help them to retain green concepts and green processes. Defining a vision & mission will help an organizational management to educate their employees and motivate towards participating in greening their IT processes.

Green IT initiatives taken by majority of the green awarded companies have aimed at cost minimization while government energy efficiency regulations, Encouragement from industry associations, Greenhouse gas regulations Regulations on discarding e-waste shows very low impact on motivating organizations towards achieving green IT.

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