

CHAPTER – 5

FINDINGS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the findings based on the data analysis of the questionnaire based survey and the in-depth interviews presented in chapter-4. These findings are later used to make some concrete recommendations in respect of important Green IT aspects.

5.2 Findings of the Research

Questionnaire survey and in-depth interviews were two important data collection methods used for the current research. Questionnaire is primarily close ended questions to get pinpointed answers. Interviews are more of verbose informal discussion. However they have been very useful to get an insight that the management has about any particular Green IT aspect. It also helped to understand how the management has recognized Green IT and how they want to respond. The findings from both the methods have been illustrated in two sections. The first section includes findings based on questionnaire survey and the second section includes findings based on in-depth-interviews.

5.2.1 Findings based on Questionnaire Survey

The findings of the research based on questionnaire survey have been categorized into the following areas:

- A. Organizations' and Respondents' Profile
- B. Green IT Drivers
- C. Green IT Concern Areas
- D. Green IT Governance
- E. Green IT Policy
- F. Green IT Practices - Awareness
- G. Green IT Practices - Implementation

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- H. Green IT Implementation - Employee Perspective
- I. Green IT Benefits
- J. Comparison of Management and Employees' Perception about Green IT Implementation
- K. Green IT Barriers

The findings with respect to these categories are presented below:

A. Organizations' and Respondents' Profile

Section 4.2.1.1 - A and B has presented the analysis of organizations' and respondents' profile which is depicted in table no: 4.1, 4.3 and 4.4. Section 4.2.1.2 - B has presented the analysis of employees' profile which is depicted in table no: 4.164. Findings from this analysis are enumerated below:

1. 21% of the organizations are small IT organizations. 46% of the organizations are medium sized IT organizations and 33% of the organizations are large IT organizations.
2. Majority (Large: 80%, Medium: 79.2% and Small: 54.5%) of the IT organizations are service based IT organizations.
3. Majority (76.5%) of the respondents are at middle level management in large IT organizations. Majority (Medium: 50% and Small: 81.8%) of the respondents are at senior level management in medium sized and small IT organizations.
4. Majority of the employees are software developer (25%), senior software developer (25%) and project lead (24%).

Thus the research focuses on different size of the IT organizations, majority of which are service- based IT organizations. Management and employees at different levels are considered as respondents.

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B. Green IT Drivers

Section 4.2.1.1- C has presented the analysis of Green IT drivers which is depicted in figure no: 4.4. Findings from this analysis are enumerated below:

1. Reducing cost of IT, corporate strategy and environmental consideration are the top three drivers for Green IT implementation.
2. Vendors' pressure, employees' pressure, competitors' action and clients' pressure have not so far emerged as motivators for Green IT adoption in the IT organizations.
3. Large IT organizations tended to perceive the importance of social acceptance, maturity of Green IT industry, governmental regulations, Green IT taken up by more organizations and governmental incentives relatively more as compared to medium sized and small IT organizations.

Reducing cost of IT, corporate strategy and environmental consideration dominates rest of the factors as depicted by the study. Other driving factors such as pressure from vendors or employees etc. have yet to influence Green IT adoption. As reported by Sayeed & Gill (2008), Molla (2009a), Molla et al. (2009b), Sarkar & Young (2009), Wati & Koo (2010) and Info~Tech (2009), cost is most important driving factor for Green IT. These studies are either based on surveys conducted on IT and business professionals and decision-makers or interviews conducted with IT organizations as depicted in section 2.3.1.

India, being at nascent stage with respect to Green IT implementation, IT organizations are still not clear as to how this initiative has to be addressed in a systematic way with the first step as identification of the motivational factors. The current research studied the drivers prevalent in Indian context.

C. Green IT Concern Areas

Section 4.2.1.1- D has presented the analysis of Green IT concern areas which is depicted in figure no: 4.5. Findings from this analysis are enumerated below:

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1. Cost of powering IT infrastructure, IT energy consumption and e-waste management are the top three concern areas.
2. There is relatively less concern regarding suppliers' and clients' environmental footprint amongst all the IT organizations.
3. Large IT organizations are relatively more concerned about all the Green IT issues.

Cost of powering IT infrastructure, IT energy consumption and e-waste management leads rest of the issues or concern areas as illustrated by the study. Other issues such as suppliers' and clients' environmental footprint have yet to emerge as areas of concern. As reported by Molla (2008), Molla et al. (2009a), Molla et al. (2009b), Sivasubramaniam (2009), Sheikh (2010), Wati & Koo (2010), Hanne (2011), energy consumption and e-waste management are the important Green IT issues. These issues are described in section 2.3.2.

Indian organizations still not have a clear understanding of these issues. Hence the current research focused on the Green IT issues prevalent in Indian context.

D. Green IT Governance

Section 4.2.1.1- E.1 has presented the analysis of Green IT governance parameters (measured on 5 point scale) which is depicted in figure no: 4.6. Findings from this analysis are enumerated below:

1. Large IT organization are promoting Green IT by encouraging their employees to attend seminars, forming Green IT club, sharing information on their website, having clear roles and responsibilities, setting target to reduce their carbon footprint, hiring Green IT expert, analyzing the IT energy bill separately and auditing the power efficiency of existing IT systems.
2. Large IT organizations are taking more efforts whereas medium sized and small IT organizations have a long way to strengthen their Green IT governance in their organizations.

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Section 4.2.1.1- E.2 has presented the analysis of Green IT governance parameter (measured on nominal scale scale) which is depicted in table no: 4.37 to table no: 4.47. Table 5.1 summarizes the extent of efforts taken by IT organizations for Green IT governance from this analysis.

Table 5.1: Extent of efforts taken for Green IT governance parameters

Green IT governance parameters	Size of the organization		
	Large	Medium	Small
Budget Allocation	■	■	■
Association with any Green IT group	■	■	■
Green advocate coordinating all green activities	■	■	■
Green IT compliance required from customers	■	■	■
Enforce Green IT compliance on IT suppliers	■	■	■
Green IT advisory team	■	■	■
Green IT metrics	■	■	■
Green IT auditing practice	■	■	■
Tangible benefits from government agencies	■	■	■
Green IT feedback system	■	■	■

Initiatives taken to a great extent
 Some efforts taken
 No Focus

Findings from this analysis are enumerated below:

1. Large IT organizations are more serious in implementing Green IT by allocating budget, having Green advocate who coordinates Green IT activities, discussing their Green IT implementation with their Green IT advisory team as compared to medium sized IT organizations. Medium sized IT organizations are making their effort in the above mentioned areas whereas small IT organizations are not focusing on them.
2. Large IT organizations are taking some efforts to use Green IT metrics for evaluating their Green IT credentials, improve their Green IT implementation in the form of feedback system, audit their Green IT implementation and enforce Green IT

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on their suppliers. Medium sized and small IT organizations are not focusing on them. These findings are consistent with Molla et al. (2009), where organizations had no clear metrics to assess Green IT.

3. Irrespective of the size of the IT organization, there is no association with Green IT groups that help to promote Green IT implementation in the organizations.
4. Irrespective of the size of the IT organization, there is no Green IT compliance required from customers. Green IT adoption has not yet become imperative from customers' side.
5. Irrespective of the size of the IT organization, organizations are getting very less tangible benefits from government agencies. This indicates that government agencies are not making enough efforts to promote Green IT.
6. C-suits (CEO, CTO, CIO), owner, chairman, partner and IT department drives Green IT implementation in all the IT organizations. Other departments like finance, marketing department etc. have not yet involved in Green IT implementation.

Overall Green IT governance is relatively stronger in large IT as compared to medium sized and small IT organizations. This could be mainly because large IT organizations are more environmental conscious and have the capability to invest in such initiatives as compared to medium sized and small IT organizations. But parameters like Green IT audit, formal feedback system, Green IT metrics, and association with Green IT promoting groups are not focused much, indicating that the evaluation of Green IT implementation is not done and hence there is no formal and systematic approach to improvise and review Green IT implementation.

The current research has supplemented parameters such as creating Green IT awareness through encouraging employees to attend Green IT seminars, forming Green IT club in the organization, formal feedback mechanism and association with Green IT promoting groups apart from the existing parameters reported in the literature.

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E. Green IT Policy

Section 4.2.1.1- F has presented the analysis of Green IT policy which is depicted in table no: 4.48 to table no: 4.53. Findings from this analysis are enumerated below:

1. Large IT organizations have mature Green IT policy (88.2% have Green IT policy). They give importance to all five parameters: Environmental friendly IT purchasing (64.7%), IT equipment usage reduction and energy efficiency (88.2%), IT use to reduce environmental impact (76.5%), Data center optimization (76.5%) and E-waste management (76.5%). They also focuses on parameters for IT purchase, IT use and IT disposal. This indicates that large IT organizations have well framed policy which includes all the five policy parameters along with parameters that are considered at various stages of IT.
2. Medium sized and small IT organizations consider some of these parameters for IT purchase, IT use and IT disposal. Majority of medium sized (62.5%) and small IT (81.8%) organizations do not have Green IT policy and hence these parameters are not implemented systematically through policy framing. Organizations may or may not consider these parameters as these are not included in the form of Green IT policy.
3. Irrespective of the IT organization, IT equipment usage reduction and energy efficiency is very important parameter of the Green IT policy that is considered.
4. Energy efficiency, printer optimization, rightsizing IT equipment , energy efficiency and travel reduction technologies and IT reuse are important parameters that are considered at different stages of IT –purchase, use and disposal. Vendor evaluation is the least focused parameter.

Majority of large IT organizations have mature Green IT policy. Majority of medium sized and small IT organizations do not have Green IT policy although they consider some of the parameters at different stages of IT– purchase, use and disposal. The apparent reason is that awareness about Green IT is more in large IT organizations and they operate in a systematic way, where standards and guidelines are set for effective implementation of any process. The awareness in medium sized and small IT

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organizations is comparatively less and Green IT policy framing may not be on their priority list.

In addition to five important parameters, the current research has explored parameters at different stages of IT which can lead to a well framed policy that guides an IT organization in successful Green IT implementation.

F. Green IT Practices: Awareness

Green IT practices are categorized in to five categories. Findings regarding awareness about Green IT practices under these categories are illustrated below:

F.1 Environment friendly purchasing practices

Section 4.2.1.1- G.1 has presented the analysis of awareness about environment friendly purchasing practices which is depicted in table no: 4.54 to table no: 4.62. Table 5.2 pictorially summarizes the awareness level of these practices amongst IT organizations from this analysis.

Table 5.2: Awareness level of environment friendly purchasing practices

Environment friendly purchasing practices	Size of the organization		
	Large	Medium	Small
Preferring IT suppliers that offer take-back options	■	■	■
Preferring IT suppliers that have green track record	■	■	■
Giving weightage to environmental considerations	■	■	■
Preferring laptop over PC	■	■	■
Preferring LCD monitor over CRT monitor	■	■	■
Preferring recycled printer cartridge	■	■	■
Preferring ink jet printer over laser printer	■	■	■
Preferring multifunction devices	■	■	■
Preferring LED over CCFL LCD monitor	■	■	■

Highly/Much Aware
 Fairly Aware
 Somewhat Aware

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Findings from this analysis are enumerated below:

1. Irrespective of the size of the organization, awareness is high for preferring laptop over PC, preferring LCD monitor over CRT monitor, preferring recycled printer cartridge, multifunction devices and preferring LED over CCFL LCD monitor.
2. Medium sized and small IT organizations are fairly aware of the preferring IT suppliers that offer take-back options, giving weightage to environmental consideration and preferring ink jet printer over laser printer.
3. The awareness is low for preferring IT suppliers that have green track record in medium sized and small IT organizations.

Overall awareness for environment friendly purchasing practices is relatively more in large IT as compared to medium and small IT organizations. The apparent reason is that large IT organizations are more conscious about environment and they create awareness about these practices through various forums like Green IT club, seminars and workshops and intra organization portals. Environment friendly purchasing is one of the areas, where large IT organizations are focusing.

F.2 Practices for IT equipment usage reduction and energy efficiency

Section 4.2.1.1- G.2 has presented the analysis of awareness about practices for IT equipment usage reduction and energy efficiency which is depicted in table no: 4.63 to table no: 4.75. Table 5.3 pictorially summarizes the awareness level of these practices amongst IT organizations from this analysis.

Table 5.3: Awareness level of practices for IT equipment usage reduction and energy efficiency

Practices for IT equipment usage reduction and energy efficiency	Size of the organization		
	Large	Medium	Small
Enforcing PC power management	██████████	██████████	██████████
Enforcing double side printing	██████████	██████████	██████████
Enforcing draft printing	██████████	██████████	██████████

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Practices for IT equipment usage reduction and energy efficiency	Size of the organization		
	Large	Medium	Small
Sharing printer	■	■	■
Printing only what you need	■	■	■
Reducing font size for printing	■	■	■
Using print preview before printing	■	■	■
Secure printing	■	■	■
Preferring document sharing services	■	■	■
Enforcing data de-duplication	■	■	■
Enforcing telecommunication strategies	■	■	■
Enforcing removal of screen savers	■	■	■
Enforcing removal of software bloats	■	■	■

Extremely Aware
 Highly/much Aware
 Fairly Aware

Findings from this analysis are enumerated below:

1. Irrespective of size of the IT organization, awareness is high for PC power management, double side printing, draft printing, sharing printer, printing only what you need, using print preview before printing, preferring document sharing services, data de-duplication, telecommunication strategies, removal of screen savers and removal of software bloats.
2. The awareness about secure printing is relatively more in large IT organizations as compared to medium sized and small IT organizations.

Overall awareness for practices related to IT equipment usage reduction and energy is high in all IT organizations. The apparent reason could be the fact that IT usage is the most important and primary stage where Green IT practices can be applied. Employees play an important role in operationalizing these practices.

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F.3 Practices for use of IT (IT as an enabler) to reduce environmental impact

Section 4.2.1.1- G.3 has presented the analysis of awareness about practices for use of IT which is depicted in table no: 4.76 to table no: 6.83. Table 5.4 pictorially summarizes the awareness level of these practices amongst IT organizations from the analysis.

Table 5.4: Awareness level of practices for use of IT

Practices for use of IT	Size of the organization		
	Large	Medium	Small
Remote conferencing			
Remote support/ online services			
Server consolidation & virtualization			
Storage consolidation & virtualization			
Desktop virtualization			
Power down systems			
Thin clients			
Cloud computing			

Extremely Aware
 Highly/much Aware
 Fairly Aware

Findings from this analysis are enumerated below:

1. Irrespective of the size of the IT organization, awareness is high for remote conferencing, remote support/ online services, server consolidation & virtualization, storage consolidation & virtualization and cloud computing.
2. The awareness about thin client is relatively more in large IT organizations as compared to medium sized and small IT organizations.
3. The awareness about desktop virtualization and power down systems is relatively more in large and medium sized IT organizations as compared to small IT organizations.

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Overall awareness for practices related to use of IT is relatively more in large and medium sized IT organizations as compared to small IT organizations. The apparent reason is that use of IT is one of the areas, where large IT organizations are focusing. They are exploring technologies that reduce the impact of IT on environment. They create awareness about these practices through various forums like Green IT club, seminars and workshops and intra organization portals.

F.4 E-waste management practices

Section 4.2.1.1- G.4 has presented the analysis of awareness about e-waste management practices which is depicted in table no: 4.84 to table no: 4.86. Table 5.5 pictorially summarizes the awareness level of these practices amongst IT organizations from this analysis.

Table 5.5: Awareness level of e-waste management practices

E-waste management practices	Size of the organization		
	Large	Medium	Small
Disposing IT in an environmentally friendly way			
Donating IT equipment			
Refurbishment of IT equipment			

Highly/much Aware
 Fairly Aware

Findings from this analysis are enumerated below:

1. Irrespective of the size of the IT organization, awareness is high for donating IT equipment and refurbishment of IT equipment.
2. The awareness about disposing IT in an environmentally friendly way is relatively more in large and medium sized IT organizations as compared to small IT organizations.

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Overall awareness for e-waste management practices is high in all IT organizations. This could be mainly due to the fact that e-waste management is very important and basic area to focus.

F.5 Data center specific practices

Section 4.2.1.1- G.5 has presented the analysis of awareness about practices for data center which is depicted in table no: 4.87 to table no: 4.94. Table 5.6 pictorially summarizes the awareness level of these practices amongst IT organizations from this analysis.

Table 5.6: Awareness level of practices for data center

Data center specific practice	Size of the Organization		
	Large	Medium	Small
Blade server	■	■	■
Airflow management	■	■	■
Hot aisle/ Cool aisle data center layout	■	■	■
Airside/Waterside economizer	■	■	■
Install more energy efficient lights	■	■	■
Localized cooling	■	■	■
Free Cooling	■	■	■
Upgrade to more energy efficient transformers and UPS	■	■	■

Highly/much Aware
 Fairly Aware

Findings from this analysis are enumerated below:

1. Irrespective of the size of the IT organization, awareness is high for installing more energy efficient lights, localized cooling and upgrading to more energy efficient transformers and UPS.

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2. The awareness about blade server, airflow management, hot aisle/ cool aisle data center layout and airside/waterside economizer is relatively more in large IT organizations as compared to medium and small IT organizations.
3. The awareness about free cooling is relatively more in large and medium sized IT organizations as compared to small IT organizations.

Overall awareness for data center specific practices is relatively more in large IT organizations as compared to medium sized and small IT organizations. This could be mainly because of the fact that large IT organizations have big data centers which consume lot of energy. It is primary area where IT organizations can save lot of energy by implementing Green IT practices.

G. Green IT Practices: Implementation

Green IT practices are categorized in to five categories. Findings regarding implementation of Green IT practices under these categories are illustrated below:

G.1 Environment friendly purchasing practices – Management and Employee Perspective

Section 4.2.1.1- H.1 has presented the analysis of implementation of environment friendly purchasing practices by management which is depicted in table no: 4.95 to table no: 4.103. Section 4.2.1.2- C.1 has presented the analysis of implementation of environment friendly purchasing practices by employees which is depicted in table no: 4.165 to table no: 4.173.

Green IT purchasing practices are governed by management. Majority of the employees are not involved in purchasing decision. The below table pictorially summarizes the extent of adoption of these practices amongst management and employees (those involved in purchasing decisions) of IT organizations from this analysis.

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Table 5.7: Extent of adoption for environment friendly purchasing practices

Environment friendly purchasing practices	Size of the organization					
	Large		Medium		Small	
	M	E	M	E	M	E
Preferring IT suppliers that offer take-back options						
Preferring IT suppliers that have green track record						
Giving weightage to environmental considerations						
Preferring laptop over PC						
Preferring LCD monitor over CRT monitor						
Preferring recycled printer cartridge						
Preferring ink jet printer over laser printer						
Preferring multifunction devices						
Preferring LED over CCFL LCD monitor						

M - Management

E - Employee

Implemented all the times

Implemented fairly regularly

Implemented sometimes

Implemented rarely

Findings and comparison from this analysis are depicted in the table 5.8 below:

Table 5.8: Findings and comparison of extent of adoption for environment friendly purchasing practices

Sr. No	Management	Employee
1	Preferring laptop over PC, preferring LCD over CRT monitor and preferring LED over CCFL LCD monitor are the most widely adopted practices by all the IT organizations	Preferring LCD monitor over CRT monitor, preferring multifunction devices and preferring LED over CCFL LCD monitor are the most widely adopted practices in all the IT organizations

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Sr. No	Management	Employee
2	Preferring IT suppliers that offer take-back options, giving weightage to environmental considerations, preferring recycled printer cartridge, preferring ink jet printer over laser printer, preferring multifunction devices are adopted relatively more in large IT organizations as compared to medium sized and small IT organizations.	Preferring IT suppliers that offer take-back options, giving weightage to environmental considerations, preferring laptop over PC, preferring recycled printer cartridge and preferring ink jet printer over laser printer, are adopted relatively more in large IT organizations as compared to medium sized and small IT organizations.
3	Preferring IT suppliers that have green track record is regularly adopted practice in large IT organizations but it is the least adopted practice in medium sized and small IT organizations.	Preferring IT suppliers that have green track record is regularly adopted practice in large IT organizations but it is the least adopted practice in medium sized and small IT organizations.

A slight difference in the level of adoption is observed for environment friendly purchasing practices amongst management and employees as depicted in table 5.7. These practices are mentioned below:

- **Large IT organizations:** Preferring LCD monitor over CRT monitor
- **Medium sized IT organizations:** Preferring laptop over PC and preferring multifunction devices
- **Small IT organizations:** Preferring recycled printer cartridge, preferring i ink jet printer over laser printer and preferring multifunction devices

Overall the extent of adoption for environment friendly purchasing practices by management and employees is relatively more in large IT organizations as compared to

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medium sized and small IT organizations. This could be due to more awareness about Green IT purchasing practices amongst large IT organizations as compared to medium sized and small IT organizations.

Not much difference has been observed amongst management and employees with respect to extent of adoption for environment friendly purchasing practices.

G.2 Practices for IT equipment usage reduction and energy efficiency- Management and Employee Perspective

Section 4.2.1.1- H.2 has presented the analysis of implementation of IT equipment usage reduction and energy efficiency practices by management which is depicted in table no: 4.104 to table no: 4.116. Section 4.2.1.2- C.2 has presented the analysis of implementation of IT equipment usage reduction and energy efficiency practices by employees which is depicted in table no: 4.174 to table no: 4.186. Table 5.9 summarizes the extent of adoption of these practices amongst management and employees of IT organizations from this analysis.

Table 5.9: Extent of adoption for IT equipment usage reduction and energy efficiency practices

Practices for IT equipment usage reduction and energy efficiency	Size of the organization					
	Large		Medium		Small	
	M	E	M	E	M	E
Enforcing PC power management						
Enforcing double side printing						
Enforcing draft printing						
Sharing printer						
Printing only what you need						
Reducing font size for printing						
Using print preview before printing						
Secure printing						
Preferring document sharing services						

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Practices for IT equipment usage reduction and energy efficiency	Size of the organization					
	Large		Medium		Small	
	M	E	M	E	M	E
Enforcing data de-duplication						
Enforcing telecommunication strategies						
Enforcing removal of screen savers						
Enforcing removal of software bloats						

M - Management

E - Employee



Implemented all the times



Implemented fairly regularly



Implemented sometimes



Implemented rarely

Findings and comparison from this analysis are depicted in the table 5.10 below:

Table 5.10: Findings and comparison of extent of adoption for IT equipment usage reduction and energy efficiency practices

Sr. No	Management	Employee
1	PC power management, double side printing, draft printing, sharing printer, printing only what you need, using print preview before printing, document sharing services, telecommunication strategies and removal of screen savers are the most widely adopted practices in large and medium sized IT organizations. The adoption of these practices is comparatively less in small IT organizations	Using print preview before printing is widely adopted practice in all the IT organizations. PC power management, double side printing, sharing printer, printing only what you need, document sharing services, data de-duplication, telecommunication strategies, removal of screen savers and removal of software bloats are the most widely adopted practices in large and medium sized IT organizations. These practices are adopted rarely by employees in small IT organizations

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Sr. No	Management	Employee
2	Reducing font size for printing, secure printing, data de-duplication and removal of software bloats are adopted relatively more in large IT organizations as compared to medium sized and small IT organizations	Draft printing and secure printing are the least adopted practices in medium sized and small IT organizations

A slight difference in the level of adoption is observed for IT equipment usage reduction and energy efficiency practices amongst management and employees as depicted in table 5.10. These practices are mentioned below:

- **Large IT organizations:** Enforcing PC power management monitor, printing only what you need and reducing font size for printing
- **Medium sized IT organizations:** Enforcing draft printing, secure printing, enforcing data de-duplication and enforcing removal of software bloats
- **Small IT organizations:** Using print preview before printing and preferring document sharing services

Overall the extent of adoption for practices related to IT equipment usage reduction and energy efficiency is relatively more in large IT as compared to medium and small IT organizations. This could be due to more awareness about Green IT practices at IT use stage amongst large IT organizations as compared to medium sized and small IT organizations. Also large IT organizations are more serious about Green IT initiative and hence assure its implementation by strong governance.

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Not much difference has been observed amongst management and employees with respect to extent of adoption for IT equipment usage reduction and energy efficiency practices.

G.3 Practices for use of IT (IT as an enabler) to reduce environmental impact - Management and Employee perspective

Section 4.2.1.1- H.3 has presented the analysis of implementation of practices for use of IT by management which is depicted in table no: 4.117 to table no: 4.124. Section 4.2.1.2- C.3 has presented the analysis of implementation of practices for use of IT by employees which is depicted in table no: 4.187 to table no: 4.194. Table 5.11 summarizes the extent of adoption these practices amongst management and employees of IT organizations from this analysis.

Table 5.11: Extent of adoption of practices for use of IT

Practices for use of IT	Size of the organization					
	Large		Medium		Small	
	M	E	M	E	M	E
Remote conferencing						
Remote support/ online services						
Server consolidation & virtualization						
Storage consolidation & virtualization						
Desktop virtualization						
Power down systems						
Thin clients						
Cloud computing						

M - Management

E - Employee

 Implemented all the times

 Implemented fairly regularly

 Implemented sometimes

 Implemented rarely

Findings and comparison from this analysis are depicted in the table 5.12 below:

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Table 5.12: Findings and comparison of extent of adoption for practices for use of IT

Sr. No	Management	Employee
1	Remote conferencing, remote support/ online services and server consolidation & virtualization are most widely adopted practices amongst all the IT organizations	Remote conferencing, remote support/ online services and server consolidation & virtualization are most widely adopted practices amongst all the IT organizations
2	Storage consolidation & virtualization is adopted more in large and medium sized IT organizations as compared to small IT organizations	Storage consolidation & virtualization is adopted more in large and medium sized IT organizations as compared to small IT organization
3	Desktop virtualization, power down systems, thin clients and cloud computing is adopted relatively more in large IT organizations as compared to medium sized and small IT organizations	Desktop virtualization, power down systems, thin clients and cloud computing is adopted relatively more in large IT organizations as compared to medium sized and small IT organizations

A slight difference in the level of adoption is observed for use of IT practices as depicted in table 5.11. These practices are mentioned below:

- **Large IT organizations:** Remote conferencing, remote support/ online services and storage consolidation & virtualization

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- **Small IT organizations:** Desktop virtualization

Overall the extent of adoption for practices related to use of IT is relatively more in large IT as compared to medium sized and small IT organizations. This is apparent due to the fact that large IT organizations are exploring technologies to reduce impact of IT on environment. Also large IT organizations are more serious about Green IT initiative and assure its implementation by strong governance.

Not much difference has been observed amongst management and employees with respect to extent of adoption for use of IT practices.

G.4 E-waste management practices – Management and Employee Perspective

Section 4.2.1.1- H.4 has presented the analysis of implementation of e-waste management practices by management which is depicted in table no: 4.125 to table no: 4.127. Section 4.2.1.2- C.4 has presented the analysis of implementation of e-waste management practices by employees which is depicted in table no: 4.195 to table no: 4.197.

Majority of the employees are not involved in e-waste management decision. Table 5.13 summarizes the extent of adoption of these practices amongst management and employees (those involved in e-waste management decision) of IT organizations from this analysis.

Table 5.13: Extent of adoption for e-waste management practices

E-waste management practices	Size of the organization					
	Large		Medium		Small	
	M	E	M	E	M	E
Disposing IT in an environmentally friendly way						
Donating IT equipment						
Refurbishment of IT equipment						

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M - Management

E - Employee

 Implemented fairly regularly

 Implemented rarely

 Implemented sometimes

Findings and comparison from this analysis are depicted in the table 5.14 below:

Table 5.14: Findings and comparison of extent of adoption for e-waste management practices

Sr. No	Management	Employee
1	Refurbishment of IT equipment is the most widely adopted practice amongst all the IT organizations	Refurbishment of IT equipment is the most widely adopted practice amongst all the IT organizations
2	Disposing IT in an environmentally friendly way and donating IT equipment are adopted relatively more in large IT organizations as compared to medium sized and small IT organizations	Disposing IT in an environmentally friendly way and donating IT equipment are adopted relatively more in large IT organizations as compared to medium sized and small IT organizations

A slight difference in the level of adoption is observed in case of **small IT organizations** amongst management and employees for disposing IT in an environmentally friendly way as depicted in table 5.13.

Overall the extent of adoption for e-waste management practices is relatively more in large IT as compared to medium sized and small IT organizations. This could be due to the fact the e-waste management is one of the primary concern for large IT organizations. Awareness about these practices is more in large IT organizations.

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Not much difference has been observed amongst management and employees with respect to extent of adoption for e-waste management practices.

G.5 Data center specific practices

Section 4.2.1.1- H.5 has presented the analysis of implementation of data center specific practices which is depicted in 4.128 to table no: 4.135. Table 5.15 summarizes the extent of adoption of these practices amongst IT organizations from this analysis.

Table 5.15: Extent of adoption for practices specific to data center

Data center specific practices	Size of the organization		
	Large	Medium	Small
Blade server			
Airflow management			
Hot aisle/ Cool aisle data center layout			
Airside/Waterside economizer			
Install more energy efficient lights			
Localized cooling			
Free Cooling			
Upgrade to more energy efficient transformers and UPS			

Findings from this analysis are enumerated in the table below:

1. Upgrading to more energy efficient transformers and UPS is the most widely adopted practices in IT organizations.
2. Installing more energy efficient lights is also most adopted practices in large and medium sized IT organizations. The adoption is comparatively less in small IT organizations.
3. Blade server, airflow management, hot aisle/ cool aisle data center layout, airside/waterside economizer, localized cooling and free cooling adopted relatively

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more in large IT organizations as compared to medium sized and small IT organizations.

Overall the extent of adoption for data center specific practices is relatively more in large IT as compared to medium sized and small IT organizations. Large IT organizations have big data center and consume lot energy. These organizations are more aware of practices specific to data center and hence the extent of implementation comparatively high.

H. Green IT Implementation -Employee Perspective

Section 4.2.1.2- D.1 has presented the analysis of Green IT implementation parameters (measured on 5 point scale) which is depicted in figure no 4.27. Findings from this analysis are enumerated below:

1. Majority of the employees, irrespective of the size of the IT organization, feel that IT equipment contribute to greenhouse gas emission but IT has the capability also to reduce a business's total carbon footprint. They also feel that IT professionals can play an important role in reducing business's carbon foot print.
2. Large IT organizations are promoting Green IT by providing guidelines for observing Green IT practices, encouraging their employees to attend seminars, forming Green IT club, sharing information on their website, having Green IT policy and having clear roles and responsibilities. They are making their efforts to have feedback mechanism system through which employees can provide their suggestion regarding Green IT.

Section 4.2.1.2- D.2 has presented the analysis of Green IT implementation parameters (measured on nominal scale) which is depicted in table no: 4.209 to table no: 4.212. Table 5.16 summarizes the extent of efforts taken for these parameters from this analysis.

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Table 5.16: Extent of efforts for Green IT implementation parameters

Green IT implementation parameters	Size of the Organization		
	Large	Medium	Small
Budget allocation			
Green advocate coordinating all green activities			
Target setting			
Green IT advisory team			

Initiatives taken to a great extent
 Some efforts taken
 No Focus

Findings from this analysis are enumerated below:

1. Large IT organizations are more serious in their Green IT implementation by allocating budget, having green advocate, target setting and having Green IT advisory team.
2. Medium sized IT organizations are making their efforts on these parameters whereas small IT organizations are not focusing on it.

Thus large IT organizations are taking more efforts to improve their Green IT implementation whereas medium sized and small IT organizations have a long way to strengthen Green IT implementation in their organizations.

I. Green IT Benefits

Section 4.2.1.1- I has presented the analysis of Green IT benefits which is depicted in figure no: 4.18. Findings from this analysis are enumerated below:

1. Energy efficiency, saving money, reduced office space, easier maintenance of IT systems and positive impact on the environment are the top five benefits experienced by IT organizations due to Green IT implementation.
2. Large IT organizations have also started experiencing other benefits like increasing staff morale, meeting regulatory requirements, becoming more competitive, have

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stronger brand image, increased customers, greater customer satisfaction, healthy relation with vendor and attracting investors and business partners.

Thus apart from energy efficiency, saving money, reduced office space, easier maintenance of IT systems and positive impact on the environment, large IT organizations tended to experience other benefits relatively more as compared to medium sized and small IT organizations. This is primarily due to the fact that large IT organizations are more serious in promoting Green IT adoption and hence they have experienced more benefits as compared to medium sized and small IT organizations.

J. Green IT Barriers

Section 4.2.1.1- J has presented the analysis of Green IT barriers which is depicted in figure no: 4.19. Findings from this analysis are enumerated below:

1. Cost of Green IT solutions, inadequate skills and training on Green IT, inadequate funding and lack of government incentives are the most prominent inhibiting factors for medium sized and small IT organizations.
2. Lack of support from the management and employees are not the barriers for Green IT implementation.

Thus large IT organizations tended to have relatively less barriers as compared to medium sized and small IT organizations. This is apparent due to capability of large IT organizations to invest in such initiatives. They can afford to invest in promoting Green IT and therefore face fewer barriers.

K. Comparison of Management and Employees Perception about Green IT Implementation

Section 4.2.1.1- E, F and G has presented the analysis of Green IT governance, policy and practices from management perspective, which is depicted in table no: 4.29 to 4.33, 4.37, 4.39, 4.43, 4.47 and 4.48. Section 4.2.1.2- C and D has presented the analysis of

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Green IT practices and overall Green IT implementation from employees’ perspective, which is depicted in table no: 202 to 4.212. Section 5.5.1- G has presented the extent of adoption of Green IT practices by management and employees, which is depicted in table no: 5.7 to 5.14. Table 5.17 summarizes the comparison of management and employees perception about overall Green IT implementation with respect to three Green IT dimensions-governance, policy and practices in their organization from this analysis. This comparison has been made with the intention to find the gap or mismatch (if any) that exists between the organization’s vision about Green IT and that perceived and practiced by the employees.

Table: 5.17: Comparison of management and employees perception about Green IT implementation

Green IT Dimension	Management	Employee
Green IT Governance	Large IT organizations are taking more effort with respect to Green IT governance parameters as compared to medium sized and small IT organizations	Large IT organizations are taking more efforts whereas medium sized and small IT organizations have a long way to strengthen their Green IT governance in their organizations
Green IT Policy	Large IT organizations have mature Green IT policy. Majority of medium sized and small IT organizations do not have it	Large IT organizations have mature Green IT policy. Majority of medium sized and small IT organizations do not have it

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Green IT Dimension	Management	Employee
Green IT Practices	The extent of adoption for environment friendly purchasing, IT equipment usage reduction and energy efficiency, use of IT and e-waste management practices is relatively more in large IT organizations as compared to medium sized and small IT organizations	The extent of adoption for environment friendly purchasing, IT equipment usage reduction and energy efficiency, use of IT and e-waste management practices is relatively more in large IT organizations as compared to medium sized and small IT organizations

Findings from this analysis are enumerated below:

There is no difference in the perception of management and employees in all IT organizations with respect to Green IT dimensions – governance, policy and practices. There exists no mismatch between the organization’s vision about Green IT and that perceived and practiced by the employees. The reason could be that employees in IT organizations are well conversed with the Green IT initiatives in IT organizations.

5.2.2 Findings Based on In-depth Interviews

The findings below are based on in-depth interviews conducted with 22 representatives from senior management such as CEO, Founder, and Sustainability Head etc. of the IT organizations (Large: 4, Medium: 12, Small: 6).

A. Green IT Drivers

Section 4.2.2 - 1 has presented the analysis of Green IT drivers which is depicted in table no: 4.213. Findings from this analysis are enumerated below:

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1. The most prominent driving factor for implementing Green IT in large IT organizations is environmental considerations, though cost factor is also one of the important reasons.
2. For medium sized and small IT organizations, cost factor is the most important driver. Although medium sized IT organizations show their concern for the environment, environment consideration remains the second priority.

Thus large IT organizations are driven by environmental considerations and medium sized and small IT organizations are considering cost as an important driver.

B. Green IT Concern Areas

Section 4.2.2 - 1 has presented the analysis of Green IT concern areas which is depicted in table no: 4.213. Findings from this analysis are enumerated below:

1. IT energy consumption and cost of powering IT infrastructure are important concern areas for all the IT organizations. In addition to these areas, large IT organizations are also concerned about e-waste management and data center optimization.
2. Green IT is an area of concern for all the IT organizations. Large IT organizations are consciously trying to improve their Green IT implementation. Medium sized IT organizations are making efforts to promote it but for small IT organizations it's not on priority at this moment.

Thus IT energy consumption and cost of powering IT infrastructure are crucial areas where all the IT organizations are focusing.

C. Green IT Governance

Section 4.2.2 - 2 has presented the analysis of Green IT governance which is depicted in table no: 4.214. Findings from this analysis are enumerated below:

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1. Majority of the governance parameters such as creating awareness amongst employees, budget allocation, clear defined roles and responsibilities, target setting, consulting experts, annual reporting etc. are considered by large IT organizations. Medium sized IT organizations are making efforts to create more awareness amongst employees, forming volunteers to promote Green IT, allocating budget but these organizations are not having formal system of defining clear roles and responsibilities, monitoring authority and advisory team. They don't have auditing practice, annual reporting, and formal feedback system in place. These parameters are not focused at all in small IT organizations.
2. Although Green IT governance seems to be much mature in large IT organizations but parameters like association with green IT groups, Green IT assessment through Green IT metrics, Green IT auditing and formal feedback mechanism require more focus.

Overall Green IT governance is relatively stronger in large IT as compared to medium and small IT organizations. Medium sized IT organizations are making their efforts whereas small IT organizations are not focusing on them.

D. Green IT Policy

Section 4.2.2 - 3 has presented the analysis of Green IT policy which is depicted in table no: 4.215. Findings from this analysis are enumerated below:

1. Large IT organizations have mature Green IT policy, consisting of all important parameters for IT purchase, use and disposal. Majority of medium sized and small IT organizations do not have Green IT policy but they consider vital parameters like energy efficiency, e-waste management. Vendor evaluation is the least focused parameter by all the IT organizations.
2. Very few medium sized IT organizations have Green IT policy but it is not detailed enough to guide the organizations in a systematic way.

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Thus Green IT policy is mature in large IT organizations whereas medium sized and small IT organizations are yet to focus on it.

E. Green IT Practices

Section 4.2.2 - 4 has presented the analysis of Green IT policy which is depicted in table no: 4.216. Findings from this analysis are enumerated below:

1. Large and medium sized IT organizations are implementing majorly all the practices at various stages: IT purchase, IT use and IT disposal. Small IT organizations are implementing commonly adopted Green IT practices like remote conferring, printer optimization, virtualization etc.
2. Large IT organizations not only focus on IT related Green IT practices but also taking initiatives in other areas like water and waste management, environmental friendly building construction, supply chain management etc. To promote Green initiatives, medium sized IT organizations are observing other initiatives like planting trees and celebrating environment day.

Based on the findings of the study from questionnaire and in-depth interviews, four clusters have been identified. These clusters typify the level of Green IT adoption. These four clusters have been represented as **Green IT seekers, Green IT explorers, Green IT enhancers and Green IT experts**. Green IT experts show the highest level of Green IT adoption and Green IT seekers show the lowest level of Green IT adoption. Table 5.18 shows the characteristics of these clusters.

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Table 5.18: Characteristics of 4 clusters

Parameters	Cluster 1: GREEN IT Seekers	Cluster 2: GREEN IT Explorers	Cluster 3: GREEN IT Enhancers	Cluster 4: GREEN IT Experts
Most important driver	IT cost reduction	IT cost reduction	corporate strategy and environmental considerations	corporate strategy and environmental considerations
Clarity of Green IT	Some understanding of Green IT	Fair understanding of Green IT	Complete clarity of Green IT	Complete clarity of Green IT
Green IT dimensions- governance, policy and practices	Ad-hoc implementation in Green IT practices and governance	Initiatives taken in all Green IT dimensions	Initiatives taken in all Green IT dimensions	Initiatives taken in all Green IT dimensions
Extent of adoption of Green IT practices	Moderate	Moderate	High	High
Salient Green IT governance parameters	Spread Green IT awareness	Spread Green IT awareness, responsibility allocation and encouragement of employees for more initiatives	Target setting for carbon reduction, budget allocation, Specific role creation and training programs	Green IT implementation measured, reviewed and updated through Green IT metrics, Green IT auditing, Green IT reporting and feedback mechanism

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Parameters	Cluster 1: GREEN IT Seekers	Cluster 2: GREEN IT Explorers	Cluster 3: GREEN IT Enhancers	Cluster 4: GREEN IT Experts
Sample	63%	6%	25%	6%
Size of the Organization	Small: 100% Medium:79% Large:18%	Medium:8% Large:6%	Medium:13% Large:59%	Large:18%

The findings from the above table validate the fact that Green IT implementation as a whole lacks systematic and holistic approach. It can be observed from the above table that 63% of the sample has some understanding of Green IT and implement it in an ad-hoc manner. Green IT governance parameters such as responsibility allocation, encouragement of employees for more initiatives, Green IT metrics, formal feedback system, Green IT audit and association with Green IT promoting groups are not focused in cluster 1, where majority of sample lies. This indicates that the evaluation of Green IT implementation is not done and hence there is no formal and systematic approach to improvise and review Green IT implementation. The reasons could be that medium sized and small IT organizations are have yet not kept Green IT on their radar. They are adopting some of the practices in an ad-hoc manner.

5.3 Recommendations

Green IT is experiencing an exponential growth in terms of its relevance. Though many initiatives have been reported by IT industry, but it still lacks a holistic approach for successful adoption. It needs to be implemented in a systematic manner so that it not only meets the regulatory requirements and achieve financial and other benefits but also make IT organizations more environmentally sustainable. In order to make the current research more effective, the researcher has suggested the recommendations according to the size of the IT organizations.

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5.3.1 Recommendations for Medium and Small sized IT organizations

The following suggestion has been made to medium sized and small IT organizations:

1. IT organizations can spread more Green IT awareness by
 - Encouraging their employees to attend seminars/workshops on Green IT
 - Forming Green IT club to suggest, identify and spread Green IT practices
 - Discussing Green IT at social networking sites/ blogs/intranet
 - Publishing Green IT information on organization's website
2. IT organizations can allocate responsibility by having Green IT volunteers or Green IT head as sustainability manager or sustainability head to administer Green IT initiatives.
3. Medium sized organizations which looks beyond spreading awareness, can strengthen their Green IT governance by having clear roles and responsibilities, target setting to reduce their carbon footprint, hiring Green IT experts, conducting training programs for employees, analyzing the IT energy bill separately and auditing the power efficiency of IT systems.
4. There is a strong need to have stringent guidelines in the form of policy that includes policy parameters along with parameters considered at various stages of IT so that they can channelize their efforts and results in effective implementation of Green IT.

5.3.2 Recommendations for Large IT Organizations

The following suggestion has been made to large IT organizations:

1. Large organizations can focus more on Green IT governance parameters like conducting Green IT audit, existence of formal feedback mechanism, using Green IT metrics, and getting associated with Green IT promoting groups.
2. Other Green IT governance parameters like reward system for employees can be introduced to motivate employees and Green IT compliance can be enforced on

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suppliers to improvise and review their Green IT implementation for optimal performance.

5.3.3 General Recommendations

1. In order to promote and strengthen Green IT in IT organizations, government should also take initiatives in terms of law enforcement and government incentives.
2. The organization can assess their Green IT maturity based on the maturity model proposed in this research which is presented in the subsequent chapter.

Summary

This chapter has presented in detail the findings and recommendations of the research with respect to various dimensions of Green IT. Findings were based on data collected from questionnaires and in-depth interviews. Findings of the study indicate that the extent of Green IT adoption with respect to three dimensions- governance, policy and practice is relatively more in large IT organizations as compared to medium and small IT organizations. Medium sized IT organizations are making efforts to promote and improve their Green IT initiatives in all the three Green IT dimensions. For small IT organizations, Green IT will be an area of concern in future but currently it's not their priority.

Recommendations were made from the findings of the research. For medium sized and small IT organization, there is a strong need to spread more awareness and to have stringent guidelines in the form of policy. Large IT organizations on the other hand can focus more on Green IT governance parameters.