

Going Green with Information and Communication Technologies in Universities for Sustainable Development

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Abstract:

In the context of Education, Green ICT (Information and Communication Technology) refers to the use of computers and other communication systems as eco friendly practices in the educational institutions that lowers negative impact on the environment which in turn relates with sustainable development. It has been observed that universities and colleges are the major users of several techno-pedagogical equipments that are energy-consuming devices. From past few years, there is an increase pressure for employing sustainable practices in educational institutions. It is vital that certain policies and procedures need to be followed by universities in India in order to reduce their carbon footprints. In this article, energy conserving strategies and recycling methods related to ICT use in the Higher Education Institutions have been discussed. Further some topics for Green ICT curriculum at graduate level and suggestions for stake holders have been given.

Keywords: Green Computing; Green ICT; Environmental Sustainability; Eco friendly practices; Green Universities

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I. INTRODUCTION

Rapid expansion of Information and communication technologies (ICT) worldwide has drastically intensified energy consumption in various sectors which is also accompanied with the increased emission of greenhouse gases causing severe problems in the environment. Use of Information Technologies affect the surrounding environment in several ways. For instance “each stage of a computer’s life, from its production, throughout its use and into its disposal presents environmental problems”(Murugesan,2008). This demands the application of Green computing strategies to minimize the carbon footprint, reduce harmful effect on the environment and to bring sustainability in the environmental(Ranbhise, 2014).The term ‘green’ is concerned with improving environmental practices by the usage of new products and new technology that have a sustainable impact on the environment (Karjaluo et al., 2009). Green ICT refers to the use of information and communication technologies in a manner that has minimum negative impact on the environment. Green IT, also known as green computing, is defined as the study and practice of designing, manufacturing, using and disposing of computers, servers, and associated subsystems – such as monitors, printers, storage devices, and networking and communications systems – efficiently and effectively with minimal or no impact on the environment (Murugesan,2008,2010). Green IT “enhances the sustainability of computing through manufacturing lower impact materials and products, reduced energy consumption of data centers and computers, and better recycling and end of life management”. (Center for Sustainable Systems, 2011).

ICT have the potential to steer green growth and to help decouple this growth from ecological damage (Cecere et al.,

2014). The recent SMART 2020 report indicates that ICT’s unique ability to monitor and maximize energy efficiency both within and outside of its own sector can lead to emission reductions five times the size of sectors own footprint. However it was also observed that there are many barriers that relates to personal and organizational aspects such as lack of awareness among ICT users , ineffective leadership within organizations, political aspects such as laws and regulations that leads to negative impact of ICT on the environment. Chowdhury et al (2015) suggests that the policies and practices need to cover power usage, reduction of paper consumption and recommendations for new equipments and recycling machines. As Green ICT aims to apply such sustainable management practices to achieve efficiency hence can be applied in education sector which regularly make use of computers and ICT services for its teaching and official works. Higher Education Institutions can play an important role by taking several initiatives in this regard. In the educational sector energy-consuming devices and tools are increasingly being used to deliver the curriculum content. Therefore curriculum contents have a relationship with energy, and this view should be considered in the curriculum for future careers(Samuel and Rajadorai; 2011).Several Universities and Colleges around the world (University of Colorado , Boulder; University of Texas, Arlington; Cornell University; University of San Francisco etc) published on their respective websites about their individual efforts related to green ICT and also various ways being followed to reduce carbon footprints. Department of Electronics and Information Technology, Government of India started the Green IT initiative by awarding a major project for development of ICT Technologies for smart buildings with low carbon emissions to C-DAC Chennai and C-DAC Bangalore (<https://meity.gov.in/content/green-it>).

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A project to develop technologies for achieving power optimization in HPC systems was also initiated at C-DAC, Pune. The growth and developments in this regard was found to be at slow pace in Indian Universities in comparison to other nations. Hence a need was felt to study about the benefits of using Green ICT to the Universities, approaches to green ICT and suggestions for stake holders.

II REVIEW OF RELATED STUDIES

Verdecchia et al (2017) conducted systematic literature review to study the trends, problems and research gaps to uncover the green ICT research activities. The researchers concluded that Green ICT as a relatively new field of research study and the interest of researchers in this area is persistently increasing. According to the researchers, the related studies being heterogeneous in nature had led to various research gaps. The literature review was mainly related to direct effects and optimization effects and large number of other aspects of Green ICT remain to be revealed. The researchers felt that further studies are required to develop precise framework in order to evaluate the possible impacts of Information and communication technologies on our environment.

Suryawanshi & Narkhede (2015) conducted a survey and attempted to identify the barriers of Green ICT use existing at higher education level in India through sampling technique. The researchers explored that rational for adopting green polices and moreover lack of motivation among implementers was a hurdle in the implementation of sustainable ICT in the institutions.

Wabwoba et al (2013) observed that "the level of green ICT readiness is lower in developing economies. There was a significant relationship between ICT personnel variables and green ICT preparedness dimensions. Based on the established significant relationships, it proposed an extended G-readiness model from the initial Molla's model for establishing the level of green ICT readiness for an organization".

Sheehan and Smith (2010) attempted to examine the eco-friendly and sustainable practices followed by higher education institutions through a web based survey. The survey was carried on EDUCAUSE member institutions in Canada and the United States. It was revealed that only fifty percent of the institutions had well developed plan for Environmental sustainability. They also constituted Environmental sustainability committees. The environmental friendly practices followed were to adopt to virtual class rooms, usage of digital documents, conducting video conferences to cut off travel expenses, comply with LEED standards of US Green Building Council for any new constructions and also to adopt alternative mechanism for saving electrical power.

Fernando and Okuda (2009) in a study observed that approximately 7.8 Gigatonnes of CO₂ emission can be reduced by 2020 through efficient use of ICT. The researchers also opined that many countries in the Asia and pacific region may not have taken into consideration environmental impacts in designing, implementing and evaluating initiatives and policies related to Information and Communication Technologies..

Molla et al. (2008) developed green ICT readiness framework encompassing five dimensions namely attitude, practice, policy, technology and governance. The investigators revealed that the attributes of the framework are vital to bring environmentally sustainable ICT practices in any organisation.

The review of related studies indicates that very few research studies have been conducted especially relating to the use of Green ICT in higher Education Institutions. By make use of review of related literature, the researcher addressed some important questions and attempted to find out solutions that can be employed in the Higher Education Institutions.

1. What are the benefits of using Green ICT in higher education Institutions?
2. What are the procedures Universities need to follow to reduce their carbon footprints at departmental levels?
3. What can individual computer users at Universities and Higher Education Insitutions do to reduce their personal carbon footprints associated with ICT use?
4. What are the aspects that come under Green ICT Curriculum?

III RESEARCH METHODOLOGY

Secondary data was used to study various Green ICT initiatives and approaches in various institutions around the world. Various research papers and articles published in national and international journals, E-books, government policies etc. were reviewed to address the problem.

IV. BENEFITS OF USING GREEN ICT IN UNIVERSITIES

- Employing Green ICT techniques in the institutions can automatically reduce energy usage
- It lowers carbon emissions and carbon footprints.
- It reduces operational cost.
- Encourages the use of eco-friendly sources of energy in the departments.
- Green ICT encourages recycling techniques which can be employed by administrators, faculties, students and non teaching employees.
- Reduces the risk existing in the usage of old ICT devices and non disposal of old batteries which is hazardous as it cause damage to nervous system, impede immune reactions and even cancer in human beings.

V. STRATEGIES THAT CAN BE EMPLOYED IN THE UNIVERSITIES

There are several strategies for conserving energy as well as recycling methods that can be employed in the Higher Education Institutions.

1. Choose ICT products with energy-efficient certification

Regulating bodies like UGC need to provide instructions to the Universities and Colleges to use Computers and ICT products certified as energy efficient.

2. *Make environmentally sound purchase decisions*

“Purchase Electronic Product Environmental Assessment Tool registered products. EPEAT is a procurement tool promoted by the nonprofit Green Electronics Council to:

- Help institutional purchasers evaluate, compare and select desktop computers, notebooks and monitors based on environmental attributes.
- Provide a clear, consistent set of performance criteria for the design of products.
- Recognize manufacturer efforts to reduce the environmental impact of products by reducing or eliminating environmentally sensitive materials, designing for longevity and reducing packaging materials”. (Chowdhury et al, 2015)

3. *Conserve energy*

Proper instructions need to be given to departments to conserve energy like

- Replacing the older desktop computers with newly designed desktop computers which use the same components as laptops.
- To turn off the computer when not in use for an extended period of time, selecting the right-sized monitor as larger monitors consume more energy with in-built function of auto-sleep mode.
- Use of Computers with ‘Turn on’ power management allows it to enter low-power states when sitting idle. Power management tactics like sleep mode can save energy and help protect the environment.
- Buy ICT devices “compliance to relevant green standards”. Universities need to recognize such energy efficient products through setting up of purchasing committees at administrative level.
- Nowadays Universities are carrying out research and teaching learning activities through online mode to maintain social distancing in this period of crisis due to COVID-19 pandemic. Video conferences and Webinars are being held in various universities worldwide. The same can be carried forward in future by employing video conferencing and Webinar techniques for giving guest lectures, paper presentations etc. to cut off travel as it has a great impact on fuel consumption patterns. One can save energy and also reduce carbon footprint.

4. *Reduce Paper Consumption*

In Indian Universities, print outs are generally used for official use for interdepartmental communication and with higher administration. This need to be minimized. There are many simple ways to reduce paper consumption through the use of electronic resources like e-mail, electronic archiving, cloud computing etc. All such procedures should be carried out Online and therefore training need to be given for both teaching faculty and non teaching employees for efficient use of technology devices. Research supervisors need to be given training of how to make the best use of ICT services in order to guide their research scholars as well as avoid print materials. The procedure of sending documents as e-

mail attachments rather than printed form, need to be made compulsory in higher educational institutions.

5. *Follow Recycling Methods*

Inefficient desktop computers with older versions are often used in offices of Indian universities. Older computers and ICT devices need to be recycled and ensured that they are replaced by eco-friendly ones. Safe disposal techniques of ICT products which are not in use need to be followed in every institution. It is commonly found in Computer centers, departments and other academic centers that a large number of unusable ICT products are left as such for many years without proper disposal. Universities need to take strict measures in this regard as it is very hazardous. Proper disposal of batteries and other e wastes are required urgently.

VI. APPROACHES TO GREEN ICT CURRICULUM AT GRADUATE LEVEL

Students need to be aware of green ICT techniques and sustainability, hence topics related to Green ICT need to be compulsorily taught at the graduate level most preferably incorporating in their EVS paper. Following topics can be included.

- Green ICT :Concept, benefits and challenges
- Global ICT and Carbon footprint
- Green Computing and its benefits
- Global initiatives regarding Green ICT
- Estimation of carbon footprint of the ICT operations in an Institution
- Social and environmental impact of Green ICT
- Measures to improve organizational efficiency regarding carbon footprints
- Green cloud computing

Assignments, case studies, Group discussions can be employed apart from Lecture method accompanied with PPT presentations to deliver the above said topics in the class room. Both theoretical and Practical experiences are to be provided to the students.

VII STUDY IMPLICATIONS

- In India Green ICT is being taught only as a part of Technical Education or Engineering courses. It should be a part of curriculum wherein topics regarding Green ICT need to be included in Environmental Studies at Graduate and PG level courses
- Teaching materials and textbooks need to be developed after incorporating the topics as there is lack of reference books in this regard.
- Establishing Green ICT Committees in the Universities having faculty and students as its members for carrying out different programmes.
- Organising Seminars, Conferences and Workshops at National and International level for teaching faculties.
- Carrying out community outreach programmes regarding e-waste and its harmful effects.

- Developing training programs for capacity building of teachers in the field of Green ICT. Cloud computing has become the new trend that make use of virtual servers which is also an efficient technology. Students and teachers need to be trained regarding cloud computing technologies.
- Through SWAYAM, subject Refresher course on Green ICT for capacity building of faculties in Higher education institutions need to be started by developing Modules on Green Computing Technologies, Green ICT strategies, sustainable practices, Green cloud computing etc.
- Higher administrative bodies like UGC and AICTE need to take initiatives such as instructing the Universities to take Green ICT initiatives.
- Indian Universities need to publish information on their websites about their efforts to make their university green related to ICT.
- UGC need to fund research projects for teaching faculties to conduct researches in the field of green ICT for bringing innovations.

VIII. CONCLUSION

Indian Universities need to focus on the application of energy-saving and green technologies, by doing so, can instill eco friendly habits among teachers and students such as conserving energy as well as cutting down e waste. It also has a positive impact on their health. The government has a significant role to play in promoting green and cool ICT policies and initiatives against environmental concerns including Green house Gas emissions reductions (Fernando and Okuda, 2009). Green ICT is the need of the hour to safeguard our environment and therefore Higher Education system also needs to play an important role in this regard.

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