Green ICT for sustainable development-a higher education perspective: policies and challenges

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Abstract: Today one of the most important anxieties in ICT is how to maintain environment whereas keep running our government initiatives on Green ICT which concludes that initiatives tend to concentrate on the greening ICT. The SMART 2020 report revealed 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.Supaporn Chai-Arayalert, Keiichi Nakata has reviewed the concept of Green ICT. The study analyzed the evolution of Green ICT practices in UK Higher Education Institutions based on web based data collection in 2009 and 2011and10.

Key words: SMART 2020, Information Communication Technology, sustainability

Introduction

Many universities are embracing the use of Information Communication Technology for more competent and competitive processes both in delivery of services as well as in administrative processes. The role of ICT involves both positive and negative impacts of ICT on sustainability. Sustainable development demands transformational changes regarding both technology and behavioural. As there is need to conduct research on how to educate academician and students that ICT is not only for sustainable development but ultimately for the sustenance of our future. In line with this there is primary need to identify what are the barriers in implementation of sustainable ICT practices at higher education institutions. An extensive literature review pertaining to Green ICT and sustainable development was carried out

and around 10 barriers were summarized. This paper is an attempt to analyze the barriers of Green ICT implementation which would help the policy makers as well as decision makers to define Green strategies.

Green ICT

Nevertheless the existing studies on Green ICT describe it at varied point of views and perspectives. The authors studied the definitions suggested and proposed by Molla A, Mingay ,San Murugesan3 and Unhelkar devised it as individual or collective, efficient and effective efforts with no impact on surroundings .We defined Green ICT as follow based on rigorous literature review. "Green ICT is an pioneering way of using ICT that consists of policies and practices which deal with environment sustainability by minimizing carbon footprint, ICT waste and by optimizing

energy consumption and by conserving natural resources for cost effectiveness, sustenance of ICT and to save planet"

Green ICT at Higher Education Institution:

Global environmental problems due to climate change are affecting directly many countries energy and industrial policies. Now a day's higher education institutions and universities are under high pressure to adopt more sustainable approaches to ICT use. This force has initiated from government, from stakeholders and general society. Over the years, there has been a significant increase in number of colleges and students enrolled in Higher Education across the nation, with more than a hundred colleges and institutes affiliated to some universities. Hence green ICT implementation at institute has developed as key factor to attain the cost effective solutions and sustenance of ICT.

Literature Review

In the last few years global warming and climate change was catapulted to the front of society and became a common subject of discussion in global society. In this context, Green ICT has emerged as one of the key management issues. Green ICT is comprised of initiatives and strategies that reduce the environmental footprint of technology. The higher education institutions have profound moral responsibility to increase awareness, knowledge, skill and values needed to create a just sustainable future. The higher education is playing crucial responsibility in turning society towards sustainability. But at the same time they are facing some barriers in implementation of Green ICT practices. Green ICT is large subject and increasingly important as more people understand the role of ICT is enabling sustainable practices only.

Yasuyuki Sugiyama described Green research and development activities for reducing environment impact of society by reducing the impact of ICT installations in telecommunication centers, datacenters and customer offices and homes (Green of ICT) and by reducing the impact of society as a whole by providing various kinds of ICT services (Green by ICT) To really educate students to become the ICT engineers our future needs, there is a need to transform education, with sustainability and a sustainable society as the main objective rather than a patch-on

Evolution and Implementation of Green ICT Practices

Today one of the most important anxieties in ICT is how to maintain environment whereas keep running our government initiatives on Green ICT which concludes that initiatives tend to concentrate on the greening ICT. The SMART 2020 report revealed 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.Supaporn Chai-Arayalert, Keiichi Nakata has reviewed the concept of Green ICT. The study analyzed the evolution of Green ICT practices in UK Higher Education Institutions based on web based data collection in 2009 and 2011and10. Preminda Fernando, Atsuko Okuda has studied the Green ICT in multiple meltdowns considering Least Develop Countries (LDC) in Asia and pacific region. The study found that approximately 7.8 Gt CO2 (Gigatonnes of CO2) emission can be reduced by 2020 through proper ICT deployment as well as the many countries in the Asia and

pacific region may not have taken into consideration environmental impacts in designing, implementing and evaluating ICT policies and initiatives in the region. The government has a significant role to play in promoting green and cool ICT policies and initiatives against environmental concerns including Greenhouse Gas emissions reductions.

The ECAR Research team, Mark C. Sheehan, Shannon D. Smith, has conducted a quantitative web based survey of EDUCAUSE member institutions in the United States and Canada to examine environmental sustainability (ES) practices followed by higher education institutions and found that only half of institutions had completed a strategic plan for ES as well as ES committee .The ES practices followed by these institutions were adopt to virtual class room, convert to digital documents, video conference to reduce travel, comply with US Green Building Council's LEED standards for new construction , adopt alternative clean sources of electrical Power

Barriers for Green ICT Practices :

Luis Velazquez, Nora Munguia, M. Sanchez carried out a study to explore some of the factors that obstruct the implementation of sustainability initiatives in higher education institutions and identified several failures as a way to anticipate solutions for overcoming institutional barriers. The constraints that hampered the development of Green schools in China including outmoded conventions of educators, shortage of equipment, finance and trained 45 teachers, inadequate environmental teaching methods and also suggested strategies to foster Green schools in China.

Jonathan Taylor and Laura Bache declared that meeting targets for saving energy, reducing waste or increasing recycling can be tougher for many organizations. By the end of year 2009, nearly a third of United Kingdom government departments were missing their CO2 emission reduction targets. Rather than relying solely on technology, organizations needs to influence the staff behaviour means the workforce staff need to be motivated towards Green Behaviour to meet the targets15. Several challenges remaining within education on sustainable

development has been addressed by K.F. Muldar.

On the basis of literature review carried out, it can be concluded that there is lack of empirical studies in India on barriers for Green ICT implementation. However, the studies identify problems but proactive explanation to predict failures are not found in literature. The Green ICT as a vital area is only now starting to resonate with top management people. The hidden energy costs, many times, the faculties and students have no clue how much energy their operations are consuming as well as they may not even keen to know electricity bill of consumed energy cost. However no formal mandate is a good excuse for not acting. The faculties, staff and

students are lacking motivation to go green in their approach of using ICT like by reducing print volumes and using conference calls to reduce unnecessary travel and so on. There is necessitating willingness to save our Planet from environmental issues 17. The constraints that act as barriers in implementation of Green ICT is identified which was outcome of extensive literature review and are listed out in table 1.

Table 1. Barriers for GICT implementation at Higher Education

Sr. No.	Particulars of Barrier
1	Lack of adequate funding and support from top management
2	Lack of participation from necessary Students/Staff/Faculties
3	Environmentally unconcerned institutional cultural
4	Lack of Awareness of Green ICT
5	Lack of education or training from Institutes
6	ICT's environmental impacts are not considered as significant
7	Lack of motivation among faculty/staff/student of institutes.
8	Lack of Government strict Regulation
9	Lack of good procurement practice at education institutes
10	Inadequate Research & Development Activities

Methodology:

The most important challenge faced is to determine methodology which is best opted for the research. The paper endeavor is to investigate barriers in Green ICT implementation at higher education institution. Therefore survey methodology is employed. The primary data is collected from the stakeholders of professional institutes affiliated to universities in Pune district in India. The reason, for selecting Pune as the area of survey, is that Pune has emerged as an education hub in India having several professional institutes which is feasible and valuable for survey purpose.

Data Collection:

A structured questionnaire was developed to analyze evolution and barriers of Green ICT implementation. The questionnaire was designed for four categories of stakeholders of the educational institute like Director/Dean, Faculty, Student, and Non-Teaching Staff Members. The intensity of questionnaire was different as per the level of responsibility and role of stakeholder in an institute. The scaling method used in the design of questionnaire is Liker five-point scale 18. Primary data were obtained through a survey. The data for the current research work is obtained through questionnaire filled by four categories of respondents like irector/Dean, Faculty, Student, and Non-Teaching Staff Members of selected higher education institutions in Pune from July 2013 to March 2014. The data was collected from 903 respondents of selected institutions.

Hypothesis:

The hypothesis for the current research work to be tested is as follows:

H0: Lack of motivation and rational for adopting green policies among implementers is hurdle in Implementation of GICT. The further section provided detailed analysis of hypothesis testing.

Results and Analysis

The findings from current empirical research are overwhelming. The results of this study are based on a quantitative analysis of the responses provided by selected higher educational institutes. This section focuses on directors, faculties, staff members and students responses on barriers of Green ICT implementation at higher education.

Barriers of Green ICT:

All the participants were asked about their opinion on the barriers of Green ICT i.e. lack of motivation and rational for adopting green policies. The

responses collected from all respondent on the barrier and cumulative analysis

of the same is described in Table 2.

Table 2. Barrier for GICT implementation at Higher Education institutions: All Responses

Barrier of Green ICT Total	Strongly Agree	Agree	Partially Agree	Disagree	Strongly Disagree
Count	302	276	128	193	5
Percentage	33	31	14	21	1

From figure 1, it is observed that there are 33% respondents who strongly agreed, 31% respondents who agreed and 14% respondents who are partially agreed on different barriers of GICT. Further there are 21% respondents who disagreed and only 1% respondents who are strongly disagreed on different barriers of GICT

Testing of Hypothesis:

To test above mentioned hypothesis considering barriers together, the researcher has considered the score of each respondent on barriers. For statistical analysis the data is coded like Strongly Agree = 2, Agree = 1, Partially Agree = 0, Disagree = -1 and Strongly Disagree = -2.Here, under null hypothesis the score need to be zero or less and under alternative hypothesis the score need to be greater than zero. The statistical hypothesis corresponding to

the above hypothesis (as provided in section 3.3) with all barriers together is stated as below:

H0: The average score is zero.

H1: The average score is greater than zero.

To decide whether to use parametric or non-parametric test, there is need to test the normality of the data using normal probability plot. The researcher used Anderson Darling's Test for Normality. This test is used to check whether the score of respondents is normally distributed or not. In order to test the above hypothesis one sample 'Wilcoxon Test' for median of the score was thought to be the most appropriate test as the data do not follow normal distribution . This test is non-parametric test and is used to test whether the average score is zero or not. The result of the test is tabulated below in the table 3.

Table 3 Result of Wilcox on Test:

Category	N for test	Median	Wilcox on Test Statistics	P-Value	Decision
Director's / Dean's	45	2.5	695.0	0.023	Reject H0
Faculty	382	4.0	62375	0.000	Reject H0
Students	300	4	42840	0.000	Reject H0
Staff	142	3	8027.0	0.000	Reject H0

As P-value of the test is less than 0.05, here the researcher has rejected the null hypothesis H0 and concluded that the average score of the Dean/Director's, Faculty, Students and Staff is greater than zero. This implies that, their agreements on mentioned barriers in

implementation of GICT are statistically significant. Hence, the above mentioned hypothesis is validated and tested. It is concluded that lack of motivation and rational for adopting green polices among the implementers is truly hurdle in implementation of GICT.

Conclusion : Overall, this study leads to conclude that the Green ICT is for the sustenance of ICT in future and also it is an innovative way of using ICT related to the environment safeguard. The study revealed that few faculties, staff and students who are lacking motivation to go green in their approach of using ICT like by reducing print volumes and using conference calls to reduce unnecessary travel. The study validated that the lack of motivation and rational of adopting green policies are the real hurdles in implementation of Green ICT. This paper would help policy makers in framing polices and strategies for ICT sustainable development which would finally bring benefit to their stakeholders, communities, states, nations and world.

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