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Research paper



Challenges and issues faced by IT industries to maintain environmental sustainability

Ms. Sarita Rathi [1] *, Prof. Dr. Shyamalendu Niyogi [2], Dr. Jasvinder Kaur [3]

[1] Ph.D., Research Scholar Department of Management Studies, Amity University, Noida
[2] Advisor, Director and Professor Department of Management Studies, Amity University, Noida
[3] Assistant Professor Department of Computer Science and Application PDM University, Bahadurgarh
**Corresponding author E-mail: rathisarita@gmail.com*

Abstract

Green should be implemented not only at the disposal stage of a computer and laptop but it should also be implemented at manufacturing and consumption stages. Companies like IBM, HP, HCL, Microsoft, Wipro, Cognizant etc. are working on the green design of a computer. HCL is taking many initiatives such as Green Edge, green services and green peace to reduce the effect of toxic chemicals and hazardous materials. Green Edge is a framework on which HCL is working to improve the manufacturing process of products to make them green and economically viable. TCS is reducing the impact of their and their customer's activities by adopting the 3-R strategy, which helps to reduce, reuse and recycle the waste produced by them. The goal of TCS is to achieve zero wastage till 2020. Cognizant's initiative is Go Green. Go Green is launched in 2008; its main purpose is to recycle the waste and to save and reduce energy consumption. While taking these initiatives IT industries are facing many issues and challenges to produce toxic free products. Some of those challenges and issues are discussed in the paper.

Keywords: *Green Products; Eco-Friendly; Environment; ITS Industries; Initiatives.*

1. Introduction

(Crede, 1995) Computer plays a very important role in our life as it is very useful to make life easy but most of the users are not aware of the adverse part of a computer. With the excess use of computer; health and environment risks are associated. Like as at the manufacturing stage, it pollutes air and ground water. The computer may also cause acid rains, greenhouse gas effects, ozone layer depletion and generate many toxic chemicals as waste which pollutes water, air, and soil pollution.

Computers are polluting environment not only at disposal stage but they are also polluting the environment at manufacturing and usage stage. Therefore, at first stage it is the responsibility of designers to design an environmental friendly product, with the use of minimal resources and optimal utilization of resources. Green production and green consumption both are equally important for the sustainable environment. Many IT companies are working on green implementation.

(Suryawanshi & Narkhede, 2013) Green should be implemented not only at the disposal stage of a computer and laptop but it should also be implemented at manufacturing and consumption stages. (Goldberg, 1998) Companies like IBM and HP are working on the green design of a computer. As the power consumption of a computer is an environmental concern, so the need for a computer which consumes fewer resources and generates less waste is increasing.

2. Concept of eco-friendly products

(Kuo & Tsou, 2015) Schaltegger and Sturm first presented the concept of eco-efficiency in 1990; eco-efficiency is increasing the development with minimal effect on the natural resources. Later on, in 1992, The World Business Council redefined this concept for Sustainable Development. (E. Grenchus, Johnson, & McDonnell, 2001) To support and improve ecological enactment, Global Asset Recovery Services (GARS) institute of IBM has merged some key components of the reverse logistic system. The reverse logistic system is a process, which moves a product from its last usable stage to dismantling, where the product's valuable parts are reused, and proper disposal is proposed. Reverse logistic prescribes that after use of a product, how it should be handled like dismantling, refurbishing, redesigning, reusing, and product take-back schemes etc.

To maintain balance of Bionetwork need for the following is increasing:

(Nazari, Karim, Regional, & Co, 2012) Green should be implemented everywhere, green design, green product, green manufacturing, green usage and green disposal of a product. The green initiative can help to make environment sustainable.

1) Green Computer

A computer, which consumes fewer resources, generates less waste, and which is easy to recycle is known as a green computer. In other words, a computer which minimaly harms ecosystem is a green computer.

2) Green Planning

Planning the product life cycle in eco-friendly way is known as green planning that includes reusable, recyclable and energy effi-

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cient devices. It helps to preserve the environment and natural resources for future use.

3) Green Design

Green design is to use recyclable material for easy and environment-friendly disposal of a product. It is the blueprint of a product which is sustainable and environmentally sound. It does not waste resources and pollute the environment.

4) Green Manufacturing/Production

Green manufacturing is manufacturing a product in such a way that does not emit pollution and generate waste resources. In green manufacturing, renewable resources are used while producing a product to save environment.

5) Green Packaging

Green packaging is using the recyclable material to wrap the product. Packaging material holds a dynamic part in products life, as it is the visible side of a product. Green packaging material does not harm the environment.

6) Green Marketing

Presenting, promoting or advertising a product or service in front of customers in an environment friendly way is known as green marketing.

7) Green Distribution

To maintain the green or eco-friendly environment, organizations are finding the ways to save resources and trying to lower the pollution. Organizations are managing the distribution channels to reduce the transportation cost and pollution.

8) Green Purchase

Purchasing a product which does not have any adverse effect on the environment, human being and animals are called green purchase. The decisions related to green purchase depend upon green products. As green purchase is only possible, if a consumer finds a green product which meets his requirements.

9) Green Usage/Consumption

Using a product or service in a sustainable, optimal and environment friendly manner is known as green consumption.

10) Green Maintenance

Green maintenance of every product is required to increase its usability for a long time. Using the renewable resources to repair or to keep a product in working condition helps the environment.

11) Green Disposal

Dumping or dismantling a product in an environment-friendly way. It is necessary to review a product before its disposal. In this review, the products parts and their effect on the environment are measured. After this process disposal decision is taken. Green products disposal is easy, as the waste generated through a green product is reusable or biodegradable.

12) Green Organization

An organization which produces green products to save the environment is called the green organization. Any company which has successfully adopted a green or environment friendly way of production may be considered as green.

13) Literature Review

(Morisio & Torino, 2014) To reduce the negative impact of a computer system, many things from manufacturing to dispose-off of a system needs to be changed. Organizations are working to make environment-friendly parts of computer system. Not only the hardware part is concerned, however, the software being used in the computers also need energy efficiency. Green production and green consumption both are equally important for the sustainable environment. Many IT companies are working on green implementation. (Sari & Firmanzah, 2011) Environmental friendly products are expensive as the raw material which is used in manufacturing process of these products is costly and making process of these green products is also very difficult, time-consuming and neee highly skilled labour. Due to the high cost of green product only upper-class consumers can afford them. High-cost of green products make them difficult to accept by local markets. (Sari & Firmanzah, 2011) Demand for green products in the market is low due to their high price. The raw material and the manufacturing process of green products are expensive, so the price of green products is also high.

(Hobby et al., 2012) Organizations are going green to add value to their business, as customers now prefer environmental friendly products. (Hersh, 1998) System based approaches to support green design such as design for environment (DFE), lifecycle analysis (LCA), total quality environmental management (TQEM), eco-fusion etc. are also being used by IT industries to maintain environmental sustainability. (Kirby, Mann, Pitts, & Sanwald, 1995) Manufacturers of electronic and electrical equipment have added many new features to the products like parts labelling, take back options, disassembling of equipment's after its end life, to make the product more valuable. Manufactures disassemble the equipment and sell valuable parts to the service operators.

(Aznar-Márquez & Ruiz-Tamarit, 2016) Sustainability can be achieved with optimal use, efficient work, innovative technology, and resource saving techniques, reuse of products and formal disposal of waste. To achieve appropriate conditions for sustainability, the contribution of government is required to promote use of green product, energy efficient campaigns, encourage society to use eco-friendly products and regulations for end life of the product.

Initiatives Taken by IT Industries to maintain Environmental Sustainability

(Calwell & Ostendorp, 2005) IT companies are working: to reduce the energy consumption of a product at manufacturing, usage and disposal stage, an extension of a product's life, improvement of take-back policies, recycling products, and disassembly products before disposal. (Hobby et al., 2012) To provide guidance for users and IT companies, TCO development has launched TCO certification program, it focuses on energy efficiency, environment management, CSR, minimization of hazardous waste, recycling of products, lifetime of a product and safety of human health and environment.

(Ed Grenchus, Keene, & Nobs, 1997) IBM has designed an environmentally sound and safe disposal process for IT equipment's. This process named "The Endicott's de-manufacturing process" helps to manage the computer scrap. Researchers have also discussed challenges and actions for e-waste management. IBM has saved approximately 50 million dollar by reusing systems and their parts.

(Joseph, 2007) Waste management strategies used in India like take back policy for producer, more devotion to new product design, ban on hazardous substances, restriction on cross border e-waste and increase in public awareness are also initiated.

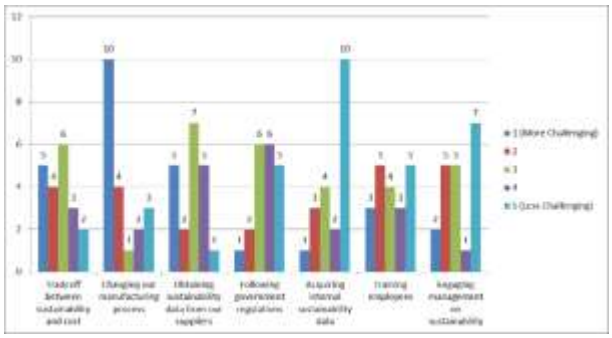
3. Research methodology

Data from both primary and secondary sources have been collected. To analyze the data from primary sources i.e. questionnaire, independent sample t-test is used to determine the statistical importance between means of two unrelated groups. Many other statistical calculations such as percentage, mean, frequency, and standard deviation have also been calculated with the help of SPSS.

4. Results and discussion

To know the top challenges or issues faced by companies to maintain environmental sustainability some challenges were listed down in the questionnaire and defendants were requested to rate the challenges on a scale of one to five; to know, that which are the top most challenges or issues in the way of environmental sustainability.

Listed challenges and issues faced by IT industries are trade-off between sustainability and cost, changing manufacturing process, obtaining sustainability data from suppliers, following government regulations, acquiring internal sustainability data, training employees and engaging management on sustainability.



Statistics shows that respondents have said that acquiring internal sustainability data is a most challenging issue to most of them. Engaging management on sustainability is second most challenging issues for them to maintain environmental sustainability. The third most challenging issue is training employees and following government regulations. The fourth most challenging issue is to change their manufacturing process followed by a tradeoff between sustainability and cost and obtaining sustainability data from our suppliers. All the listed issues are challenging for the organization, but their ranking varies according to the organizations. Industries found difficult to maintain environmental sustainability as they have many challenges and issues related to managing it.

To compare the means of IT hardware and IT software companies and in order to determine whether there is statistical evidence or not that there is any significant difference between type of company and challenges and issues faces by these companies Independent Sample t-test is used. Following are the results of Independent Sample t-test.

Group Statistics

	Type of company	N	Mean	Std. Deviation	Std. Error Mean
Trade-off between sustainability and cost	Hardware	5	1.40	.894	.400
	Software	15	3.07	1.163	.300
Changing our manufacturing process	Hardware	5	1.00	.000	.000
	Software	15	2.60	1.595	.412
Obtaining sustainability data from our suppliers	Hardware	5	1.40	.894	.400
	Software	15	3.20	1.014	.262
Following government regulations	Hardware	5	4.20	.837	.374
	Software	15	3.40	1.183	.306
Acquiring internal sustainability data	Hardware	5	4.40	1.342	.600
	Software	15	3.67	1.345	.347
Training employees	Hardware	5	2.00	.707	.316
	Software	15	3.47	1.457	.376
Engaging management on sustainability	Hardware	5	4.20	1.304	.583
	Software	15	3.00	1.414	.365

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Trade-off between sustainability and cost	Equal variances assumed	.508	.485	-2.911	18	.009	-1.667	.573	-2.870	-.464
	Equal variances not assumed			-3.332	8.965	.009	-1.667	.500	-2.799	-.535
Changing our manufacturing process	Equal variances assumed	19.208	.000	-2.203	18	.041	-1.600	.726	-3.126	-.074
	Equal variances not assumed			-3.886	14.000	.002	-1.600	.412	-2.483	-.717
Obtaining sustainability data from our suppliers	Equal variances assumed	.182	.674	-3.525	18	.002	-1.800	.511	-2.873	-.727
	Equal variances not assumed			-3.765	7.756	.006	-1.800	.478	-2.909	-.691
Following government regulations	Equal variances assumed	1.059	.317	1.389	18	.182	.800	.576	-.410	2.010
	Equal variances not assumed			1.656	9.859	.129	.800	.483	-.278	1.878
Acquiring internal sustainability data	Equal variances assumed	.327	.575	1.056	18	.305	.733	.694	-.725	2.192
	Equal variances not assumed			1.058	6.908	.326	.733	.693	-.910	2.377
Training employees	Equal variances assumed	5.865	.026	-2.139	18	.046	-1.467	.686	-2.907	-.026
	Equal variances not assumed			-2.984	14.844	.009	-1.467	.492	-2.515	-.418
Engaging management on sustainability	Equal variances assumed	.059	.812	1.671	18	.112	1.200	.718	-.309	2.709
	Equal variances not assumed			1.744	7.426	.122	1.200	.688	-.408	2.808

Two output tables came by performing Independent sample t-test: group statistics and independent sample t-test.

Group measurements provide basic evidence about group: sample size, mean, standard deviation and standard error mean. In this test there are 5 hardware and 15 software companies, mean, standard deviation and standard error mean for all the companies are displayed with respect to various challenges and issues.

Next table is independent sample t-test; it has two parts. One is Levene's Test for Equality of Variances and second is Independent Sample t-test or t-test for Equality of Means. Levene's test shows that to perform independent sample t-test which row should be considered. If p-value of Levene's Test is small in than equal variance not assumed row should be considered for the Independent Sample t-test and if the test result shows p-value is greater than alpha value then the equal variances assumed row should be considered in Independent Sample t-test.

It is clear from the results of independent sample t-test that trade-off between sustainability and cost, changing manufacturing process, obtaining sustainability data from suppliers and training employees has significant results as p-value is less than alpha value. It concludes that there is a statistical significance difference between the means of two unrelated groups i.e. hardware IT industries and software IT industries. They both are facing different issues related to environmental sustainability. Following are some common issues faced by them:

- Major causes of environmental degradation are population growth, urbanization, energy consumption and industrialization.
- Increase in Greenhouse Gas effect due to increase in use of IT.
- There is a great requirement of new and efficient technology to build green products.
- Green disposal policies are required as e-waste contains many hazardous substances and their disposal produces toxic gases, which damages eco-system by polluting air, water and soil.
- E-waste is giving birth to harmful and incurable disease like cancer.
- Increasing use of technology is giving birth to new social, mental, physical and environmental health problems like Loneliness, Nonexistence of Communal Skills, Plumpness, Unhappiness, Poor Sleep Behaviours, Pollution, Anxiety, Neck and Head Ache, Harm of Hearing and Eyesight etc.
- Need for good recycling and environmental friendly process is increasing as the use of IT products is increasing at a rapid speed.
- How many of the IT companies are using green solutions to protect environment Extraneous use of electronic and electrical products are generating e-waste.
- To implement green logistics, it is difficult and economically costly to change manufacturing processes.

5. Conclusion and suggestions

Improper handling of e-waste is impacting human health by entering in water cycle and food chain through landfills – Increasing e-waste is creating danger for living creatures. IT companies should take help from formal recyclers to dispose of IT products and should use techniques that can help in increasing life of a product like reuse, refurbish, resale etc. to control e-waste.

To implement green logistics it is difficult and economically costly to change manufacturing process – initially it may cost high for the IT companies to change their manufacturing process for green production however later on it will help them and environment too or they may choose some intermediate alternatives that will cost less and also lessen the negative effects from environment.

Price of green product is discouraging the customers to purchase green products, as the price of green products is very high and unreasonable. So the study has suggested IT companies to lower the prices of eco-friendly products to promote their use.

The lifecycle of a computer or laptop depends on occupation, age, education and family income of the user – company should provide attractive offers to the users so that they will become ready to recycle their products after completion of product's life.

How many of the IT companies are using green solutions to protect environment and does the percentage of usage is increasing every year - there should be some government organizations, third parties or other bodies who should keep an eye on IT companies to audit them time to time to check are they following the environmental rules or not and is there any progress in their efforts.

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