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Environmental Impact of IT: A Review

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***Abstract**: Examining and understanding the role of IT (Information Technology), both as a 'Producer' of negative effects and as an 'Empowering influence' to check the impacts, we can think of ideas and advancements for sustainable improvement. Green ICTs are those that positively affect natural execution and environment, either directly by reducing physical and energy contributions to their generation, use, disposal and reusing, or indirectly through their more extensive application and use in other equipment and systems. For instance, decreases in greenhouse gas emissions related with ICT applications to improve energy proficiency in buildings, transport frameworks or electricity distribution must be balanced against increased outflows resulting from their development, production and operation and environmental degradation associated with their uncontrolled disposal. We present our forecast of the green world 2021 based on analysing our work. The key goal of green computing is to estimate the effect of mobile devices such as PDA (personal digital assistants), laptops and mobile phones or smartphones on environment.*

Keywords— Sustainable Development, Green IT, Free air cooling, Photonics, Solar Paneled Window.

I. INTRODUCTION

The top priority for all economies is to inculcate a sustainable economic growth. However, the rates of global consumption and production is ascending due to economic and demographic growth. This has led to an increased demand of the internet and related technologies which impact the environment in various ways and on different levels. Information technology has an impact on the environmental, economic and social aspects of a country. These impacts can be both positive or negative, direct or indirect. Hence, sustainable and innovative modes of production are required to cope with environmental challenges, and ICTs can and will play an important part in handling these challenges. The following are the effects of Information Technology:

First Order Impact. The primary effects of IT are to give direct outcomes towards the encompassing surrounding. Among the effects that are evaluated as the primary equest are the production of IT gear, like, PCs, cell phones, fringe gadgets and satellites. Inside each item, are various extra segments used to produce many types of gear. Most factory procedures for these which pollute the earth. One of the instances of the contamination is the production of semiconductors that releases risky gases tor the air, for example, corrosive exhaust. Another urgent request is the utilization of vitality by the ICT gear. To give a gist, its direct effect is the consistent expansion in electronic waste (e-squander). These equipment are arranged off when the owner buys new and progressively evolved gear. Inappropriate e-squander the executives will lead to contamination because of hole of toxic metals and other harmful materials from the e-waste tor the landfill. For instance, cathode beam tubes whenever spilled will discharge overwhelming metal filtering to the water bodies.

Second Order Impact. The secondary effects of ICT industry are generally keen to the encompassing. Most likely accompany the reality how ICT improvement is figured out how to build the economy through the utilization of data innovation. The development economy is because of the change to use thoughts contrasted with vitality and material. For instance, the economic development in the United States in 1995-1998 was a direct result of IT organizations. IT likewise figured out how to change the anner in which item and administration is structured, delivered, disseminated and worked. The innovation figured out how to complete a reproduction of these procedures and along these lines give bits of knowledge into the final products of the procedures even before they are begun. Through its use, the expense to finish these procedures can be decreased fundamentally. The following are a few instances of how ICT can improve the procedures of making items:

• Intelligent generation forms: Through cautious PC helped structure of creation offices and exact control of activities amid generation made conceivable by broad sensors and computerized controls

• Intelligent structure and activity of items: empowered by PC supported, reproductions of item execution result in 'lighter' items with utilization of lesser materials to influence work all the more effectively; productive sensors and controls guarantee administrations/capacities are conveyed proficiently when and where they are required.

II. LITERATURE SURVEY

Information technology has an impact on the social, economic and the environmental aspects of a country. These impacts can be both positive or negative, direct or indirect. Therefore, we require more sustainable and innovative forms of production to deal with environmental challenges and ICTs are the key to addressing these challenges. [1] discusses the best methods, purchases, repair strategies and results. With respect to these strategies, four product groups have been defined, namely: Personal Computers, Mobile phones, Televisions and frequency converters. Among these, there were two products included in terms of the expectations for technological innovation in the future. The

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environmental effects of any new technology belonging to either of the aforementioned four product groups were assessed in order to determine the most ideal environmental choice between the following scenarios: Buy a new product and dispose off the old one or Prolong the life of the product through repair. Various remarkable techniques toward green mobile networks, targeting mobile cellular networks and future research opportunities and design challenges are discussed [2]. Current research projects related to green mobile networks, along with the taxonomy of energy-efficiency metrics are summarized. Decision-making tools in the scope of management are crucial to address some of the limitations in implementing conventional Life Cycle Assessment. The assessment for lead-free solder alternatives [3] is a more convoluted case study to further develop the methodology through the integration and modification of various quality management, decision aid and statistical tools. I2-EFD methodology is utilised as a decision-making support tool to this complex case study involving the evaluation of lead-free solder alternatives, in order to avoid any ambiguity in the interpretation of environmentally conscious product improvement efforts. This is done during product design in order to provide decision makers a systematic way to obtain information from several sources.

Detailed elementary analysis of various mobile phones to obtain fundamental information about their metal content helps us assess the environmental and economic impacts with a view to optimizing end-of life scenarios [4]. Mobile phones contain an abundance of various metals including gold, copper, nickel, barium and indium. However the recycling system is imperfect, and hibernating mobile phones are a hidden resource. [9] discusses state-of-the-art technologies, trends and tools to make smart-phones green. The objective is to analyse the current usage patterns of the smartphones for the emission of greenhouse gases (GHG). Based on our analysis, we forecast the future and present our findings for the green world in 2021. The main objective of green computing is to analyse the effect of mobile devices such as PDA (personal digital assistants), laptops and mobile phones or smartphones on the environment. With a systematic study of several strategies, approaches and practices of green and energy efficient computing, in context to the growth and impact of the IT industry on environment in the recent years. The plans towards a greener IT industry should include new electronic products and services [5] with optimum efficiency and all possible options solutions towards energy savings. Sustainable IT involves a core set of principles to guide sustainable IT service design, which involves the integration of green computing practices such as power management, virtualization, cooling technology, recycling, electronic waste disposal, and optimization of the IT infrastructure [6]. The focus of the first wave of sustainable IT initiatives has been on strategies to increase data centre efficiency. Therefore infrastructure, power, workload management, product design, virtualization and cloud computing strategies have assumed primacy in terms of both strategic and tactical focus. The second wave of sustainable IT services is nascent and much more difficult to define and implement. It involves defining the role of the IT organization in an enterprise's overall CSR strategy and looking at the present trends, challenges and future impacts of Green Computing [7]. Equipment recycling, reduction of paper usage, virtualization, cloud computing, power management, Green manufacturing are the key initiatives towards Green computing.[8] carries out a survey of several important current researches related to the field of green computing which emphasises the importance of green computing for sustainable development. The following are the various areas where research in green computing is being carried out: Energy Consumption; E-Waste Recycling; Data Centre Consolidation and Optimization; Virtualization; I.T Products and Eco-labelling. It proposes an optimization framework for managing green data centres using multilevel energy reduction techniques jointly. [10] applies a whole-life assessment approach to estimate the environmental impact of the user of ICT of an individual within the UK over a one-year period. By estimating the energy and data consumption of an average user's use of a typical device, and estimating the associated energy usage (and thus CO2 produced) of each stage in the data chain, we are able to calculate the summed CO2 value for embodied carbon of an average device. Algorithmic designs have been implemented to assess transportation vulnerability. [11] approach uses an open source transportation simulator to enable assessment of link disruptions at various times during a scenario. It describes an approach to model transportation network vulnerability in order to assess the impact of disruptions on travel time, fuel consumption and carbon emissions by modifying an open source transportation network simulation tool to systematically consider many potential disruption scenarios. [12] helps understand and ensure the grid's normal functionality, without overcharging it during the year, while reducing the energy loss, primary energy consumption and the GHG emissions. The technical block includes three main functions which calculate the EVs consumption, the solar energy production and, finally, executes the load flow, using the Newton-Raphson method, for the entire grid. Different criteria which were affecting the WEEE recycling practices as a green computing approach separately.

III. PROPOSED METHODOLOGY

3.1 Free Air Cooling

Energy consumption costs make up for about 30% to 40% of the total costs incurred by any data centre. This includes the cost of energy spent on processing, storage and the HVAC (heating, ventilation and air conditioning) system. The simplest source of cooling for any data centre is free air. Free air cooling is the process of using cool air from the outside to regulate the temperature inside data centres. Of late, most data centres are beginning to operate at a viable temperature of around 26-27 degree Celsius. So, free air cooling can become a viable option. A filtering and humidity monitoring system can be used along with the free air cooling to ensure that the data centres remain dust-free and that the humidity in the air is just the right amount.

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Using this solution can help reduce the energy usage of data centres in the cooler regions as the traditional method is no longer used for the same.

3.2 Photonics

Utilizing photons as opposed to electronics (electrical connections), this innovation utilizes microscopic lasers to send more bits of data through an optical fibre, thus, reducing the use of copper wires and sparing huge amounts of energy to power and cool those frameworks. These optical fibres are additionally thinner, making space effectiveness and physical establishment easier. Since data centres have to be maintained at an optimal temperature, and since copper wiring gives off too much heat, using optical fibres would help reduce the cost spent on cooling these data centres.

3.3 Solar Panelled Window

The greater part of the present IT organisations and firms are housed in high rise skyscrapers. These buildings have large glass panes for windows. These gigantic glass windows can be exploited by utilizing them as photovoltaic solar panels. These windows can be designed so that they can let in enough light for ventilation yet additionally capture a decent amount of it for recharging the photovoltaic cells. The photovoltaic cells utilized here are transparent and are embedded inside an natural coating of pentane to shield them from extreme weather conditions. The major concern for green IT today is regulation of excess energy usage. The solutions proposed above are aimed at increasing the energy efficiency of IT infrastructure:

- Photonics helps to reduce the consumption of energy used by the power grid by using optical fibres. • Free air cooling is a solution that can effectively eliminate the energy used by cooling systems.
- Solar panelled windows not only help the organisations save energy but also reduces the dependency on external power supply systems.

REFERENCES

[1] Legarth, J.B., Salter, I. and Willum, O., 2003, May. Repair or buy a new one? The environmental consequences for electronics. In IEEE International Symposium on Electronics and the Environment, 2003. (pp. 209-213). IEEE.

[2] Wang, X., Vasilakos, A.V., Chen, M., Liu, Y. and Kwon, T.T., 2012. A survey of green mobile networks: Opportunities and challenges. Mobile Networks and Applications, 17(1), pp.4-20.

[3] Zhou, X. and Schoenung, J.M., 2008, May. An integrated impact assessment and weighting methodology: Evaluation of the environmental consequences of lead-free solder alternatives. In 2008 IEEE International Symposium on Electronics and the Environment (pp. 1-6). IEEE.

[4] Takahashi, K.I., Tsuda, M., N. akamura, J., Otabe, K., Tsuruoka, M., Matsuno, Y. and Adachi, Y., 2009, May. Elementary analysis of mobile phones for optimizing end-of-life scenarios. In 2009 IEEE International Symposium on Sustainable Systems and Technology (pp. 1-2). IEEE.

[5] Agarwal, Shalabh, Datta, Arnab and Nath, Asoke. (2014). IMPACT OF GREEN COMPUTING IN IT INDUSTRY TO MAKE ECO FRIENDLY ENVIRONMENT. 5. 5-10.

[6] Soomro, Tariq and Sarwar, Muhammad. (2012). Green Computing: From Current to Future Trends.

[7] Harmon, Robert and Auseklis, Nora. (2009). Sustainable IT services: Assessing the impact of green computing practices. PICMET: Portland International Center for Management of Engineering and Technology, Proceedings. 1707 - 1717. 10.1109/PICMET.2009.5261969.

[8] Saha, Biswajit. (2018). Green Computing: Current Research Trends. INTERNATIONAL JOURNAL OF COMPUTER SCIENCES AND ENGINEERING. 6. 10.26438/ijcse/v6i3.467469.

[9] S. Zahoor, M. A. Shah and A. Wahid, "The green 2020: Impact of smartphones on the environment in present and future," 2017 International Conference on Communication Technologies (ComTech), Rawalpindi, 2017, pp. 91-97.

[10] P. Cooper, T. Crick, T. Tryfonas and G. Oikonomou, "Whole-Life Environmental Impacts of ICT Use," 2015 IEEE Globecom Workshops (GC Wkshps), San Diego, CA, 2015

[11] V. Shekar, L. Fiondella, S. Chatterjee and M. Halappanavar, "Quantifying economic and environmental impacts of transportation network disruptions with dynamic traffic simulation," 2017 IEEE International Symposium on Technologies for Homeland Security (HST), Waltham, MA, 2017