A survey on Sustainability in IT-Management and Environment Management

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Abstract: *Green is the new color in Management. This paper advice the practices that can engage educators enabling Green to be applied everywhere in their day to day life starting from home to office, classroom, research laboratory. This paper has examined role of different recourses in increasing global warming and how different technologies will help in decreasing carbon footprint through optimal use of resources. The research also inspects the role of materials and other devices in reducing energy requirements and e-waste respectively. Study and supporting data of each reported technique is given. This cogitation is provided as technological, economical and environmental evidence for the benefits of "Save Green," and to recommend Sustainability everywhere in the world. Some solutions are provided to implement green computing and sustainability. The vital role of resource saving have been focused and various fields of Management have been discussed in which sustainability is required.*

Keywords: *Sustainability, e-waste, Green Management, Recourse utilization, Energy saving*

I. Introduction

Globalization and industrialization is driving the world. The service sector is increasing at a continuous rate. The most important factor in achieving the goal of "Vashudahiav Kutumbkam" is Management, which is derived by the human beings and various technologies associated with them."Sustainable development" firstly discussed at the United Nations Conference on the Human Environment in1972 in Stockholm. The World Commission on Environment and Development in 1987 published "Our Common Future" report. Sustainable development is seen as: "to meet the needs of the present without compromising the future generations to meet their own needs. [1] ". A Worldwide environmental campaign is starting to save Earth from man's unsafe actions that have resulted in reckless use of our natural resources, pollution of air, water, and soil, disturbance of the delicate ecological balance in many places, catastrophic deforestation, destruction of the ozone layer, acid-rain damage to fresh water lakes, and overall deprivation of the environment. Due to mismanagement and lack of preparation we are not able to see the direct consequences of uncontrolled economic development and the effects of policies and technologies forced today on future generation [2]. The capacity of earth to soak up pollution and waste is limited and there are rising signs of ecology deprivation and fall down and all the renewable resources such as water, soil, forests, fish and biodiversity are under increasing pressure, so environmental policy formulation should be done in keeping all these effects in mind [3]. The Organization supporting sustainable development should have policy and commitments like sustainable development, regulatory compliance, pollution prevention and public reporting on environmental performance [3].

II. Roots of Sustainability

Sustainability is driven by three wheels named economy, society and environment. All the three wheels are interdependent and incomplete without each other. The 2005 World Summit on Social Development identified sustainable development goals, such as economic development, social development and environmental protection [4]. This has been shown in figure. [5]
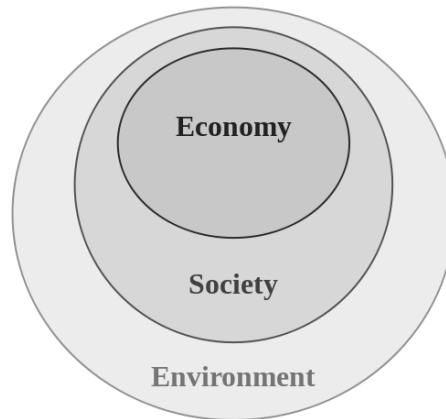
Figure: 1 Three pillars of Sustainability [5]

III.   Need of Sustainability

Emission of CO2 is increasing every year [6]

According to GlobalCarbonProject.org global CO2 emission details are as follows:

- In 2013, global CO2 emissions due to fossil fuel use (and cement production) were 36 giga tonnes (GtCO2); this is 61% higher than 1990 (the Kyoto Protocol reference year) and 2.3% higher than 2012.
- In 2014, global CO2 emissions are projected to increase by an additional 2.5% over the 2013 level.
- CO2 emissions were dominated by China (28%), the USA (14%), and India (7%)--with growth in all of these states.
- The 2013 carbon dioxide emissions (fossil fuel and cement production only) breakdown is: coal (43%), oil (33%), gas (18%), cement (5.5%) and gas flaring (0.6%).
- Emissions from land use change accounts for 8% of total CO2 emissions; the data suggests an overall decreasing trend in land use change emissions particularly since 2000

Data for Global Carbon Emissions

(Fossil fuels, cement, land-use change)

Year Carbon Emissions

2013   9.9 billion metric tonnes
2012   9.7 billion metric tonnes
2011   9.47 billion metric tonnes
2010   9.19 billion metric tonnes
2009   8.74 billion metric tonnes
2008   8.77 billion of metric tonnes
2007   8.57 billion metric tonnes
2006   8.37 billion metric tonnes

IV.   Steps for Sustainability

With the increase in use of renewable energy recourses and wise use of limited recourses we can implement sustainability in our daily life. We can enjoy the gifts of nature and help our resources to restore for future with the help of sustainability [7].

A. Always purchase recyclable products

B. Recycle paper, Plastic and glass

C. Use real cup at home and office

D. Increase use of reusable products in your daily habits and donate them when not needed

E. Reduce meat consumption

F. Reduce e-waste with proper dispose-off policy

G. Use all the energy consumption devices very wisely like while listening music switch off monitor of computer as it consumes maximum electricity

H. **Save papers** by reducing unnecessary printing, spacing between the characters and words, line spacing, the font size. Use both sides of the paper for printing. Save information in the form of soft copy instead of hard copy. Read news and books online and cancel newspaper subscriptions. Share your e-books, e-magazines, e-notes, e-study material etc and after reading pass them on to someone needy. Always take e-ticket for movies

and e-boarding passes for travelling by train or planes. Pay your electricity bill, phone bill, water bill and premium of your policy online and keep their receipt in the form of soft copy. Frugality is the best policy for saving papers.

I. **Resource sharing**

Resources can be shared among networks to make optimum use of resources. This will also help in hardware, software and energy saving. For example a single printer can be shared among various computers.

There are many areas were sustainability is required like Traffic Management, City Planning, Green buildings Management, IT- Management, Resource Management, Environment Management etc. This paper discussed about IT- Management and Environment Management. How the increasing use of IT is detrimental for environment and the environment resources are being misused. So sustainability is the main point to discuss at this stage for a safe future.

V. Environment Management

We can never repay the debt of our earth but can increase the life of resources provided by this with optimum use. To save our environment we should follow the policies of sustainability.

Solutions

A. Forest Management To put into effect sustainability in forest management or to check sustainability guidelines implementation in forest management as projected by the International Tropical Timber Organization (ITTO), information on terrain, forest, and tree characteristics is needed. Among others, systems should be available to monitor logging activities and to detect illegal logging, allowing timely action to be taken. Because cloud cover severely limits the application of aerial photography [8], the use of airborne radar is proposed as an appropriate alternative. Enterprise Energy Management Systems is also a way to implement sustainability [9].

B. Agricultural development To increase economic and social development, agricultural planning and policy making is very important by Monitoring agricultural crop conditions, weather and climate situation and ecosystems, and providing decision support for agricultural planning and policy-making are critically important for the development of agriculture to support economic and social development [10].

C. Water Resources As the resources are limited and demand is increasing day by day so the surface water such as rivers or lakes is not sufficient to cover the increasing demands for fresh water. Therefore, exploitation of groundwater resources has greatly increased on a worldwide scale during the second half of the 20th century. Thus Sustainable management of groundwater resources is of essential weight for regions where freshwater supply is naturally limited [11]. Increasing population and climatic variation driven by climate change has led to water scarcity across world. As cited in United Nations Environmental programme 2002, by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity about two-third of the world population, mainly in developing countries will face moderately to high water stress and half of the population will face problem due to water scarcity. Ongoing mismanagement of resources and wasteful behavior in India has led to the overexploitation of water resources, particularly groundwater. A large part of India fall under the category of physical water scarcity where availability of natural water resources is not enough to ensure the future water needs hence they need to increase their efficiency of water use and wisely maintain their available water resources. The concentration of water related problems will be more in urban settlements where quantity of available water reducing day by day. The potable water as a commodity is highly delicate and vulnerable to pollution and contamination. As such it has to be handled with a high degree of care.

D. Tourism Industry Now the sustainable development cloud is covering Tourism Industry also. The progress of tourism relates to such factors economy and environment, its survival and development impacts on national economy, social and environment enormously. These facts are alluring people towards sustainable development in tourism, to obtain sustainable economic and non-economic benefits. Sustainable development is taking tourism industry to a bright future [12].

E. Enterprise Management The enterprise technological innovation risk management facilitates enterprises to reduce the loss of technological innovation risk, and it can decrease or remove the damage to the entire economy, thus facilitating the sustainable development of enterprises. The technological innovation risk management potential of enterprise has become one of the key elements that can determine the survival and sustainable development of enterprises [13].

F. Mineral Resources The mining companies are now using sustainable development tools, operations and processes for mining to reduce damage to mineral resources and strengthening management practices to utilize mineral resources optimally. [14].

G. Information Technology Information Technology is the key requirement of today's world. From day to night all the tasks are being performed with computer only. Our government is also talking about digital India. Instead of travelling miles now days we prefer to do video conferencing for our business. However it also has

detrimental effect on our environment so the technologies should be made by keeping environment in mind. Companies are now giving ideas to reduce E-waste. Also it could be a model to achieve sustainable development goals and solve many problems of New Urbanism [15].

H. Carbon foot Prints Internet-service provider companies are gradually paying attention towards sustainability, by making use of green and renewable gases and solar electricity of data centers. The challenge here is the difficulty in immediately balancing of energy supply and demand. Large-scale batteries, can resolve this complexity, but it is still very expensive [16]. The geographical location of data centers has been proposed to integrate green energy into data centers, [17],[18] by directing more data centers towards the locations having abundant amount of renewable energy and weather locations are also favorable for the storage of data.

I. Technology Sustainable technologies like Smart Grid are being invented which generates and distributes electricity more effectively, economically, securely, and in eco friendly manner. It also combines various technologies, products, services, from generation, transmission and distribution all the way to and from consumer appliances and equipment using advanced sensing, communications, and control technologies [19].

J. Solar System Solar heating systems are well famous technology and generally used to heat domestic hot water, swimming pool water, or for space heating. They consist of solar thermal collectors, a fluid system to move the heat from the collector to its point of usage, and a reservoir or tank for heat storage and subsequent use [20]. This heat can be used for multiple purposes like industrial applications or as an energy input for other uses such as cooling equipment [21]. Depending upon the climates, a solar heating system can offer a very high percentage (50 to 75%) of domestic hot water energy. Energy received from the sun by the earth is that of electromagnetic radiation. Light ranges of visible, infrared, ultraviolet, x-rays, and radio waves received by the earth through solar energy. The highest power of radiation comes from visible light. Solar power is problematical in use because it is not available all the time as at night or changes in seasons.

VI. IT-Management

Computers are now shaping the society and the thinking process of everyone by providing information of events and research done and going on across the world. Computers help us in developing the virtual world scenario which helps us in solving real world problems though optimized path by developing various alternatives. Most of the humans, using this development tool, are unaware about the detrimental effects of using this. A like at Facebook, sending a mail, searching at Google even all small activities on computer creates pollution in direct and indirect form. Computers are also one of the main sources of pollution. Pollution and sustainability is the centre of the development activities across the world. In Computer science there are positions who promote Green Computing, to encourage environmental use of technology so they should organize green computing awareness camps all over the world, distribute knowledge among schools and advertise green on TV, newspapers and magazines to reach to hoi polloi.

Vendors should be trained about green computing so that they can convince the buyers for buying non toxic products. Resource sharing can also help in reducing toxicity as single printer can serve multiple computers. Wiring can be reduced by using Bluetooth connections among peripherals. Instead of using contemporary input output devices mini pocket tablets can be used in which no external peripherals are required. Green can make a huge impact on the environment if everyone contributes a little bit.

Power consumed by a system in various modes

The focus on power savings is not just to cut electricity bills or less battery life of tablets and laptops but, also for sustainable future as it reduces global warming. A system consumes different amount of electricity and produces heat in different. The various modes of a system are – Power on, power off, sleep, hibernate and hybrid sleep. The power consumption in different modes is different.

During **Power on**, the system utilizes maximum energy among all of the four modes. In this mode, the monitor amounts to the maximum usage, even more than the processor.
The **Sleep Mode** is a power saving mode, in which the system saves all the open applications and files in the RAM. This mode is very useful when one wants to pause work for a short duration of time, since the boot up is faster.
The **hibernate mode** is similar to the Sleep Mode, only that the power consumption is less because the system saves all the open documents and applications in the hard drive. The only disadvantage being that the boot up is slow.
The **Hybrid Sleep** mode is a balanced mode, a combination of Sleep Mode and Hibernate, in which the power consumption is also less, while the boot up is also faster.
The **Power-Off** Mode consumes the least amount of power since all applications are shut [22].

Solutions

A. Recyclable products

With the use of recyclable products e-waste can be reduced and resources and be utilized optimally.

B. Coal free data centers

For supporting sustainable computing data centers should be designed in areas where climate facilitate natural cooling and renewable electricity is voluntarily available.

C. Virtualization

With the help of virtualization a single machine can be converted into multiple virtual machines. There is no need to buy additional software or hardware for each allocation. A new virtual machine can be prerequisite as needed without the need for an additional hardware purchase

D. Bluetooth

This technology helps in reducing the need of wiring as it makes air a medium for transmission.

E. Shift to use clean and renewable energy to power computer

Solar or renewable energy should be used to supply power to computers.

Goal of green computing in IT- Management

Because of sprouting human population composition of atmosphere is changing due to emission of pernicious gases in large amount so it's the time to go green to save our earth. Although green seems to be expensive in the starting but, they pay off in the long term and result in being cheaper than paying electricity bills. In curtail the global warming green computing can help by reducing electricity consumption, emission of green house gases, effects of climate changes on the environment and pollution. In point of fact, it is very economical to go green as we are using technology at the cost of our earth. The goal of green computing is to save the environment while maximizing profits and attenuate costs. It will optimize the usage of available resources and minimize the e-waste generated from contemporary computer systems. It can also help in achieving sustainability via reducing HVAC (heating ventilation air conditioning) requirements for labs and computer data centers. Micro climate of the spaces where computers are used can also be ameliorated by green computing. Green computing must be thrifty and accessible to all. Instead of being lavish while buying a system everyone should act like a prodigal as buy a monitor according to your obsession because it dissipate a large amount of energy.[23]

Green Computers

1. Computers with maximum energy saving stars
2. Computers with green algorithms
3. Computers with green databases
4. Computers using green electricity such as generated by solar
5. Computer with display size according to the usage
6. Virtual Machines

VII.   Conclusion

A system user has to change pretty much everything about usage of the system; from the way he uses that machine to dispose of the waste to become sustainable. Systems have to be more like living organisms that take care of themselves, if they don't start taking care of themselves now; they are liable to face difficult and dubious future and will deteriorate the living conditions of living species.

It is hard to replace all existing machines with green one's but one can keep it in mind that while purchasing a new machine, go for an energy efficient one for example Prefer LCD monitor rather CRT monitor.

VIII.   Future scope

Much like a living organism, a computer has energy and resources flowing in, and waste and pollution flowing out. The key here is to try to recycle that waste energy to become part of the energy and resources stream which in turn can serve as a resource to computer, thereby closing the loop of the energy metabolism. Like in mobile phones, which use solar energy, self rechargeable computer batteries can be developed which can recharge themselves from the heat energy generated by systems.

References

[1]   United Nations. 1987."Report of the World Commission on Environment and Development." General Assembly Resolution 42/187, 11 December 1987. Retrieved: 2007-04-12

[2]   Yacov Y**.** Haimes, "Sustainable Development: **A** Holistic Approach to Natural Resource Management" IEEE TRANSACTIONS ON SYSTEMS, MAN, AND CYBERNETICS, VOL. 22, NO. 3, MAYIJUNE 1992, pp. 413-417.

[3]   Rory Sullivan**,** "Being sustainable...be specific" IEEEENGINFERING MANAGEMENT JOURNAL OCTOBER 2002, pp. 220-225.

[4]   United Nations General Assembly (2005). 2005 World Summit Outcome, Resolution A/60/1, adopted by the General Assembly on 15 September 2005, Retrieved on: 2009-02-17.

[5]   Forestry Commission of Great Britain. Sustainability, Retrieved on: 2009-03-09.

[6]   "Global Carbon Emissions", http://co2now.org/Current-CO2/CO2-Now/global-carbon-emissions.html"Accessed: Jan 18, 2015.

[7]   "Sustainability in Every Day Life" Available: http://fcgreenhouse.net/tips.pdf

[8]   J. P. Gastellu-Etchegorry, "Cloud cover distribution in Indonesia," Int. J. Remote Sensing, vol. 9, no. 7, pp. 1267–1276, 1988.

[9]   John C. Van Gorp, "Enterprising Energy management" IEEE power and energy magazine,2004.

[10]   S. Chaudhary, V.Sorathia, and Z. Laliwala, "Architecture of sensor based agricultural information system for effective planning of farm activities," in Proc. 2004 IEEE Int. Conf. Services Comput., 2008, pp. 1–8.

[11]   Tobias Siegfried et al., "Multi-objective Groundwater Management Using Evolutionary Algorithms"IEEE Transactions On Evolutionary Computation,Vol. 13, No. 2, 2009, pp. 229-242.

[12]   Li Tian-yuan , "Study of tourism sustainable Development in China", Tianjin: Nankai University Press, March 2004 first edition, pp.66-67.

[13]   Wang, Xiangwei, "Research on the Technological Innovation Risk Management in Promoting Enterprise Sustainable Development" IEEE 2008.

[14]   Xifengru et al. "Discussion in the mining industry of ecology and sustainable development" IEEE 2011, pp.81-83

[15]   ErfanAghasian, FarzinCharehjoo , "Electronic City A Key to Achieving Sustainable Development" IEEE Fourth International Conference on Information and Computing, 2011, pp.451-456.

[16]   YuanxiongGuo et al. "Energy and Network Aware Workload Management for Sustainable Data Centerswith Thermal Storage" IEEE Transactions On Parallel And Distributed Systems, Vol. 25, No. 8, August 2014, pp.2030-2042.

[17]   Z. Liu, M. Lin, A.Wierman, S. Low, and L. Andrew,''GreeningGeographical Load Balancing,'' in Proc. ACM SIGMETRICS, 2011, pp. 233-244.

[18]   Z. Liu, M. Lin, A. Wierman, S. Low, and L. Andrew,''Geographical Load Balancing with Renewables,'' in Proc. GreenMetrics, 2011, pp. 1-5.

[19]   Pier Nabuurs, "The Future of Electricity Networks Smart Grids". SICEM 2009, KEMA, June, 2009.

[20]   Solar water heating energy.gov

[21]   "Solar assisted air-conditioning of buildings". Iea-shc.org. Retrieved2010-07-08

[22]   www.redbooks.ibm.com/redpapers/pdfs/redp4798.pdf

[23]   www.epa.gov/climate**change**/glossary.htm