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# ECO INFORMATICS AND GREEN IT AS AN INTERDISCIPLINARY ENVIRONMENTAL-COMPUTING-MANAGEMENT DOMAIN: WITH A CASE STUDY OF UNITED KINGDOM PROGRAMS

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Green Computing is an important and valuable tool for the development of sustainable computing and information technological practices. Computing and Information Technology with green technology, management and policy integration is called as Green Computing. This is a combined domain and that deal with several other new policies and equipments. Green Computing is a smaller gradient of Green Information Technology. Around the world Green Computing and its practice are rising. In developing countries also such practices become common for environmental practices. Green Computing is close with cloud computing which helps the virtualization of hardware, software and network devices. Today Green Computing is treated as a domain and field of interdisciplinary nature. In the developed countries Green Computing programs become very much common. In UK most popular Green Computing and allied programs are available in the universities and educational institutes. This is a conceptual paper which explores the areas of Green Computing including its allied and related areas with possible programs. The paper specially highlights UK based programs with contents in brief.

**KEYWORDS:** Green Computing, Green System, Energy Management, Inclusive Development, Social Development, Emerging Technologies, Green Management, Educational Degrees, Eco World

## INTRODUCTION

Green Computing is the latest development in the field of Information and Communication Technology. Green Computing is the designing of computer systems and technologies with proper mechanism. In this, computing devices as well as computing system basically deals with less power consumption with power management principle (Buyya, R., Ranjan, R., and Calheiros, R. N., 2009 and Paul, P.K, 2013). In ICT segment several tools as well as devices are used which include monitor, printers, storage devices, networking devices. It is a fact that many communication systems prepared with several harmful chemical and matters and preparing very minimum or less hazard dealing materials for friendly environments is become core priorities these days. Hence the concept of Green Computing becomes core for the development and sustainable practices in ICT (i.e. Information and Communication Technology). Technological development and educational development, both needs the environmental attention and here Green Computing played a vital role (Clemons, E. K., 1986, Davenport, T. H., and Prusak, L., 1997, Gurbaxani, V., and Whang, S. 1991).

## OBJECTIVE

The objective for which this conceptual paper has been designed are as follows (not limited to)—

- To learn the Green Computing, Green IT including its features and importance in concise mode.
- To explore the concept of Green Information Science with its aim towards mechanical and manual information system designing and building for general organizations along with information foundations.
- To dig out the Environmental hazards as well as technologies that are responsible for ecological fumes.
- To know regarding Green Science related science and technology domains, such as Green Computing, Green Information Technology and Green Information Science with possible programs.

**Eco Informatics and Green Computing: As a Domain:**

Complete success as well as development of each and every aspect many ways depends on Eco Informatics (Calheiros, R. N. et. al 2011, Subashini, S., and Kavitha, V., 2011, Wikipedia, 2016). This is also applicable for the products, tools, as well as technologies. Green Computing practice is only possible when proper education along with training as been provided to the education seekers (Refer Fig: 1). It is important that healthy education and training on Green Computing and technologies are urgently required such as:

- Green Information Technology.
- Green Information and Communication Technology.
- Sustainable and Eco Technology.
- Environmental and Eco Computing.
- Energy Informatics.
- Environmental Informatics and ICT.

The study as well as approach which are associated with tools or direct practicing for greenery in systems and informatics weapon is called Green Computing (Harmon, R. R., and Auseklis, N., 2009, Hooper, A. 2008, Pau1, P.K., K L Dangwal 2014). Today most of the organizations and IT training providers as well as universities are offering programs on Green Computing and similar technologies. An elective paper in the field i.e. Green Computing is also offered in many universities worldwide (Dikaiakos, M. D, et.al. 2006, Foronda, V. R., 2011, Paul, P.K, 2013). Though, module on Green Computing and Informatics are also offered in few programs on IT and Computing. At The Australian National University program on 'ICT Sustainability' offered in their IT and Computing Masters programs. Interestingly the full-fledged PG program on Green Computing comes from Leeds Metropolitan University at UK here the direct nomenclature of M.Sc.- Green Computing offered. The program is available with both fulltime and part time basis.
Few other universities as well as technical institutes offered the Green Computing programs. Watson et.al, 2010 reported such educational opportunities very clearly in their report. Though, apart from Universities and academic institutes some other industrial units also introduced programs and few are depicted in Table: 1 herewith.

**Table 1:** Some corporate and companies offering Green related academic programs**.**

| Name of The Programs | Main Client | Nature of the Program | Offering Institutes |
|---|---|---|---|
| **Certified Green Computing User Specialist** | IT Professional | Taught with Project | Green Computing Initiative |
| **Strata Green IT** | IT Managers | Conceptual and Managerial | CompTIA |
| **Certification in Green IT** | For any one; including common IT Users | Thought with Project | Information System Examination Board |
| **Certified Green IT Professionals** | For Professional | Taught with Project | Singapore Information Technology Foundation |
| **Certificate for Green Technology Strategies** | For IT professional and Knowledge Seekers | Conceptual and Managerial | Australian Computer Society |

These programs are comes with small duration and also depends on module as well as credit. Program offered by the Singapore Information Technology Foundation is a Four day lecture based program. Though, additionally one extra day training normally offered from authorized vendor (Karthikeyan, N., and Sukanesh, R. 2012, Melville, N., Kraemer, K., and Gurbaxani, V., 2004, Paul, P.K, 2013). Though another program called SCS is 3 month based and offered with the

E-Learning / online mode. Whether the names of Green Computing, or Green IT or Green ICT are new but the concept is not fully new. Power management, energy competent computing including other kind of system basically started during designing as well as development of micro processor. During the large scale integration and thereafter in the age of VLIS system the concept of Green Computing emerged rapidly. One another nomenclature started in the year 1992 with 'Energy Star' labeling by US Environmental protection agency. It is an important fact that there after many other organizations have started the uses of 'energy star logo' in their product/ systems to proof their Green and Eco friendly processing system. Afterward power management i.e. the healthy Energy Informatics practice has been launched (Kettinger, W. J et.al. , 1995, Kumar, K., and Lu, Y. H., 2010, Wikipedia, 2016).

Gadgets of electronic nature such as computer as well as display unit, motherboard, processor, networking devices, CPU etc are in many contexts today coming with the sustainable technology and cost effective computing practices. All of these have powered by the standard affiliation of eco friendly organization. USEPA and its energy logo initiation another Swedish organization had offered TCO certification with same motto but with different nomenclature. This has been started for the encouragement of low magnetic electrical discharge from CRT monitors. Today most CSR responsible organizations as well as regulatory organization were emerged with private and government level. 'Organization for Economic Co-Operation and Development' has published that about ninty Government as well as industry related initiations have been occurred after 1992's Energy star logo initiatives (Paul, P.K, et.al. 2014, Schmidt, N. H., 2009, Wang, D., 2008).

In 2006 the model of 'Energy Star' had changed and became much more associated with the computer equipments having ranking system i.e. based on performance and efficiency of the product. About 26 US based organization established the recycling initiative for the waste management of the computer including technological equipments this was happen in 2008. In American Recovery and Reinvestment Act (ARRA) initiated and thereafter US Government had invested about US dollar 90 billion for the Green and eco initiative. Moreover in January, 2010 the US Energy Department also utilized around 47 million US dollar for better and healthy Green Technology for creation of Green and Eco Information Infrastructure building (Paul, P.K., K L Dangwal , 2014, Watson, R. T., 2010).

There are many domains and fields are internationally moving on the areas of Green Computing and Technologies. Few of them have provided here with their characteristics.

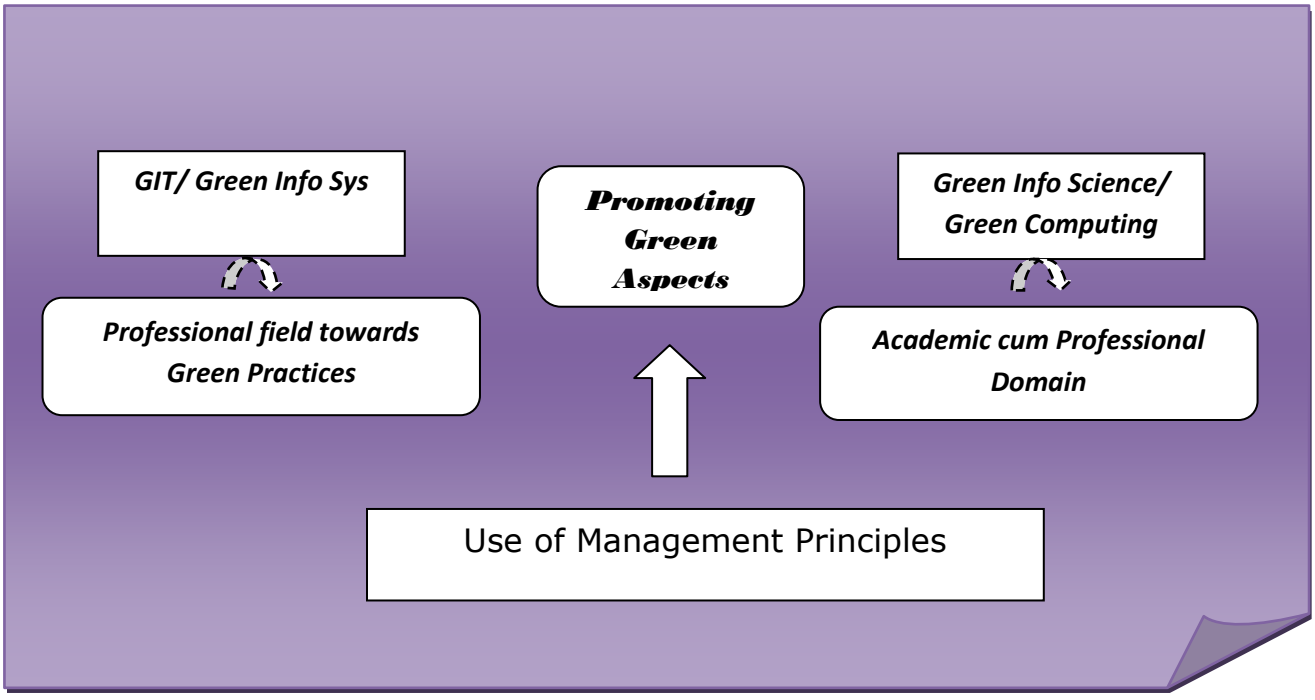


**Fig 1:** Depicted Green Science and Technology and their ultimate role

**Green IT**

Green IT or Green Information Technology is very much related with the Green Computing. Though, it is a fact that it is broader and much interdisciplinary in nature. It is importantly associated with design as well as development of Database system as well as machines. In this regard the web system, machine multimedia system, communication system with a smaller amount power and lowest amount harmfulness to the environment. The Green IT is also engaged for the implementation of the complete computing, hardware, software, networking and multimedia system for the organization along with institutions for the better and healthy power management. Hence it is releases less injurious

chemical as well as gas. It also helps in building of Environment that supports sustainability for better and healthy organizational practice indirectly the need of the society.

**Green Information Science**

Green Information Science may be considered as a broad field than that of Green Computing and Green IT that hold environmental and sustainable policy for better and healthy information world. Green Information Science is the combination of Green Computing as well as Information Science. The GISc shall be dedicated to the sustainable information system building of manual as well as computational information infrastructure building. This domain may consider and applicable in general organizations wherever Information Technology products as well as services including machine are extensively useful. The domain is also deals with the design, development as well as accomplishment of physical and manual information system that supported by the recycling principle as well as sustainable Green Information Science. It also deals with number of large stakeholder in terms of consumer as well as users. Hence this way Green Computing, Green Technology, Green E Business, Green IT, Green ICT as a whole may called as Green Information Science. In United Kingdom most popular and running programs on Green Computing areas have been offered. Most of them called Energy Informatics. A Few program of this category listed in Table: 2. Though few other programs with Universities have also listed.

- **University of Leicester**, MSc- Environmental Informatics with Duration: 1-2 years.
- **Cranfield University**, UK MSc-Environmental Data Science with Duration of 1-3 years.
- **University of Northampton**, UK, MSc-Environmental Informatics with Duration: 1-2 years.

**Table 2**: Some academic programs and their core courses on Eco Informatics running in UK Universities

| University of Leicester | Cranfield University | University of Northampton |
|---|---|---|
| **MSc- Environmental Informatics**<br><br>Focus Courses on *Earth Observation and Remote Sensing, Programming for Spatial Scientists, Ecosystem and Biodiversity Conservation, Environmental Economics* etc | **MSc-Environmental Data Science**<br><br>*Focus Courses on Fundamentals of Environment, GIS Fundamentals, Spatial Data Management, Modeling Environmental Process, Applied Environmental Informatics, Programming with Java, Environmental Resource Survey, Spatial Data and Internet* | **MSc-Environmental Informatics**<br><br>*Focus Courses on Database, Media Technology, Java Programming, Water Resource Management, Energy Resource Management, Sustainable Urban Informatics, Climate Change, Geo Informatics.* |

- **Technical University of Denmark,** UK, MSc-Environmental Informatics offered as 2years program.
- **Indian Institute of Information Technology and Management, Karala** offers a flagship MPhil-Ecological Informatics.
- **University of Technology, Malaysia** offers PhD-Information Technology (Green Computing, 2-5 years.
- **Leeds Beckett University, UK** offers an MSc Sustainable Computing, 1-2 years with Coursework.
- **University of West England, UK** offers MSc Sustainable Development in Practice, 1-2 years.
- **Technical University of Munich, Germany with NTU, Singapore** offers MSc-Green Electronics, a 20 Month program.

**FINDINGS**

- Green Information Science may be considered as a broadest branch while Green Computing and Green IT also very popular term to improve ecological circumstance and to condense toxic material.
- Organizations, institutions and academic units worldwide are functioning for the accomplishment of Eco and Green IT-Computing by reducing energy and power management with full Eco friendly development.
- IT and Computer Manufacturer and producer are designing and preparing several kind of devices which are much efficient along with accurate and many of these are using less and very minimum amount of energy and chemical.
- Moreover organizations as well as manufacturer in the field of IT and Computing are also involving in the field of research activities for better and healthy development of IT products that are less harmful and matter based.

- Awareness and its benefits for the Green Computing and IT is very much restricted in many countries and part in the world and mainly in the developing countries.

## CONCLUSION

We can live in the eco friendly systems and computing environment with the solid integration of cloud-green computing practice into its reality. The bulky quantity of high temperature is destroying the glacier and creating drought. It has also increases the temperature of the earth. Green Computing is most urgent to protect environment and atmosphere and to save power with the operational and functional expenses in current ever more spirited planet. All over the world consumption of electricity from the ICT has increased radically in recent time. Thus universities, research centers and other institutes are offering many courses which are related with the Green Computing and Systems.

## REFERENCES

Buyya R, Ranjan R and Calheiros RN (2009). Modeling and simulation of scalable Cloud computing environments and the CloudSim tool kit: Challenges and opportunities. In High Performance Computing and Simulation, 2009. HPCS'09. International Conference on HPCS-09, 1-11

Calheiros RN, Ranjan R, Beloglazov A,De Rose CA and Buyya, R. (2011). CloudSim: a toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms. Software: Practice and Experience, 41(1): 23-50.

Clemons EK. (1986). Information systems for sustainable competitive advantage. Information and Management, 11(3): 131-136.

Davenport TH and Prusak L. (1997). Information ecology: Mastering the information and knowledge environment. 420

Dikaiakos MD, Katsaros D, Mehra P, Pallis G and Vakali A. (2009). Cloud computing: Distributed internet computing for IT and scientific research. Internet Computing, IEEE, 13(5): 10-13.

Foronda VR. (2011). Integrating Information and Communication Technology into Education: A Study of the iSchools Project in Camarines Sur, Philippines. Journal of Developments in Sustainable Agriculture, 6(1): 101-113.

Green Computing (2016) Official Wikipedia. [Online] available at: www.en.wikipedia.org/Green_ Computing [Accesed 20th June, 2016].

Gurbaxani V and Whang S. (1991). The impact of information systems on organizations and markets. Communications of the ACM, 34(1): 59-73.

Harmon R R and Auseklis N. (2009). Sustainable IT services: Assessing the impact of green computing practices. In Management of Engineering and Technology, 2009. PICMET 2009. Portland International Conference .1707-1717

Hooper A. (2008). Green computing. Communication of the ACM, 51(10): 11-13.

Karthikeyan N and Sukanesh R. (2012). Cloud based emergency health care information service in India. Journal of medical systems, 36(6): 4031-4036.

Kettinger WJ, Lee, CC and Lee S. (1995). Global Measures of Information Service Quality: A Cross-National Study*. Decision Sciences, 26(5): 569-588.

Kumar K and Lu YH. (2010). Cloud computing for mobile users: Can offloading computation save energy?. Computer, (4): 51-56.

Melville N, Kraemer K and Gurbaxani V. (2004). Review: Information technology and organizational performance: An integrative model of IT business value. MIS quarterly, 28(2): 283-322.

Paul PK and K L Dangwal (2014) Cloud Computing Based Educational Systems and iits challenges and opportunities and issues in Turkish Online Journal of Distance Education-TOJDE, 15 (1): 89-98

Paul, PK (2013) Green Information Science: Information Science and its Interaction with Green Computing and Technology for Eco Friendly Information Infrastructure. International Journal of Information Dissemination and Technology, 3(4): 292.

Paul PK, D Chatterjee, R Rajesh and KS Shivraj (2014) “Cloud Computing: Overview, Requirement And Problem In The Perspective Of Undeveloped And Developing Countries With Special Reference To Its Probable Role In Knowledge Network of Academic Field”, in International Journal of Applied Engineering Research, 9 (26): 8970-8974

Schmidt NH, Erek K, Kolbe LM and Zarnekow R. (2009, January). Towards a procedural model for sustainable information systems management. In System Sciences, 2009. HICSS'09. 42nd Hawaii International Conference. 1-10

Subashini S and Kavitha V. (2011). A survey on security issues in service delivery models of cloud computing. Journal of network and computer applications, 34(1): 1-11.

Wang D. (2008, December). Meeting green computing challenges. InElectronics Packaging Technology Conference, 2008. EPTC 2008. 121-126

Watson RT, Boudreau MC and Chen AJ.(2010). Information systems and environmentally sustainable development: energy informatics and new directions for the IS community. MIS quarterly: 23-38.