GREEN INFORMATION TECHNOLOGY MODEL FOR NIGERIA EDUCATIONAL SYSTEM

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Abstract

Technological advancements have ushered in the Information Age in which activities in various fields of human endeavour has been revolutionised by Information Technology (IT). Despite the advantages brought about by IT, one of the issues confronting humankind is the need to ensure ecological sustainability while enjoying the benefits arising from IT utilisation. This need has led to the emergence of Green IT. Another pertinent need is inculcation of Green IT principles. As an educational system is a structure where formal knowledge is transmitted, it is considered to be a good medium for conveying Green IT strategies. In this paper, a Green IT model for an educational system is presented and described with particular focus on Nigerian educational system. The model highlights the rationale for its design, its inputs as well as the enablers, possible environmental influence on the learners who represent the focus for initiating the model. Furthermore, the likely outcomes and suggested control measures for progressive Green IT practice are also contained in the model.

Keywords: Green Information Technology, educational system, curriculum, learners.

Introduction

Man's creativity and ingenuity has brought about technological advancements. Many giant strides have been made across various fields of human endeavour which have brought about significant changes in the way and manner activities are carried out at specific phases of human history. Thus, we have phrases like the Stone Age, the Industrial Era, and most recently the Information Age.

Although the technological innovations earlier acknowledged are judged to be admired and accepted, which can be observed by the way they were and are still embraced, they have left a huge challenge concerning the ecosystem and ecological sustainability. This has brought about the need to look into ways of preventing further damage as well as redeeming the existing situation. United States Department of Agriculture (USDA) (2009) highlighted that environmental sustainability provokes passionate debates, covering a broad range of subjects such as the mining of the natural resources from the earth, the getting rid of toxic waste, and the effect of greenhouse gas emissions (such as carbon dioxide) on the world's climate. This notwithstanding, it is pertinent that continual efforts be made in seeing that the world is in a more habitable situation for all.

Beaming the searchlight on Information Technology (IT), the advent of IT revolutionised activities across various fields of human endeavour. Rapid growth in the IT field, which is the outcome of progressive research and engagement in the field heightened the dynamism and subsequent diffusion of IT products and services. Today, whether on land or sea, disabled or not disabled, in urban or rural settlement, old or young, it could be said that there is hardly anyone that is not under the influence of Information Technology. For instance, mobile telephony is seen to be utilised by all the classes of people earlier mentioned.

Green IT has to do with enjoying the benefits of IT while striving to maintain a balance in the ecosystem. According to Mishra, Yazici, and Mishra (2012), increasing cost of energy, depletion of natural resources, and growing concern for the environment by people generated attention on various issues of green computing. Uddin, Talha, Rahman, Shah, Khader and Memon (2012) asserted that the current condition of global warming, ecological deterioration and the gravity of its possible consequences explain the considerable popularity of environmental initiatives across the world. Thus, Green IT calls for continual assessment and reassessment of the status quo as regards execution of information activities. However, out of 25 software organisations that were involved in a research conducted by Sinha (2011), only 9 have implemented more than two initiatives while the remaining have either implemented one initiative or none at all. This indication calls for more commitment from IT establishments in driving the green technology idea.

The education system of any nation is a fundamental organ through which the intents of the government as regards the values and attitudes expected of citizens are passed on. It is thus appropriate that the education system of Nigeria is a good vehicle for the transmission of sound Green IT practices deemed necessary to be adhered by the populace. Models that have to do with green computing in Nigeria exist (for example, Awodele, Malasowe & Onuiri,

2012; Alkali, Abdul-Azeez, Mansor, Chikaji & Dodo, 2017). However, in this paper, a model for actualising that Green IT is entrenched in the educational system of Nigeria is proposed.

The model

The model is illustrated in Figure 1 and explained thereafter.

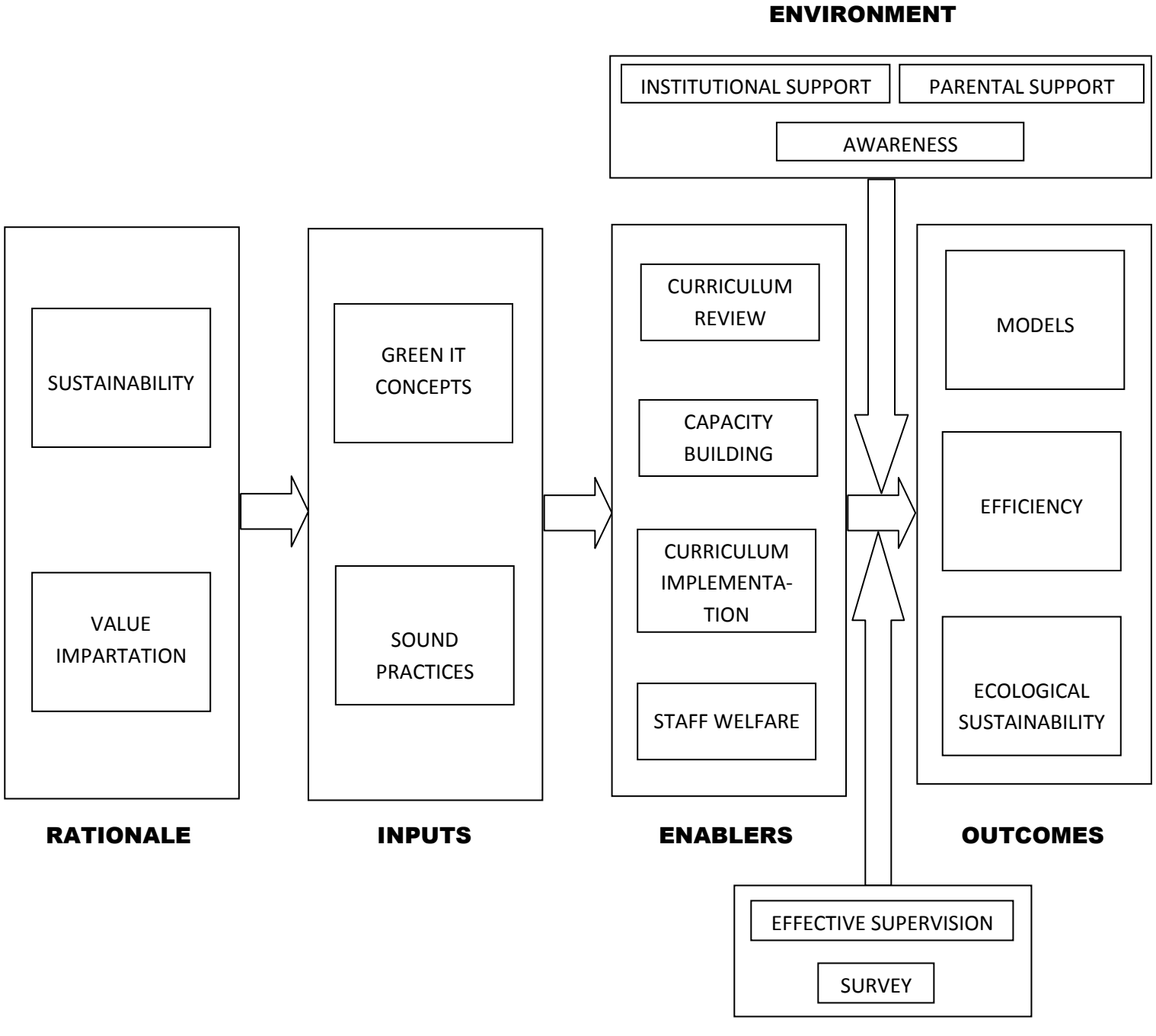

Figure 1: *Green Information Technology Model for Nigeria Educat*

The proposed model is majorly divided into the following:

a) Rationale
b) Inputs
c) Enablers
d) Environment
e) Outcomes
f) Controls

A. Rationale

It is necessary that Green Information Technology is introduced and inculcated as part of the educational experiences to be acquired by learners in the Nigeria educational system. Justification for this exposure is hereby discussed below as given.

i) **Sustainability:** Naturally, living and non-living things exist and support human life. For instance, photosynthesis is the process whereby plants, some bacteria and some protistans make use of the energy from sunlight in association with the green pigment chlorophyll to convert carbon dioxide and water to glucose and oxygen (Royal Society of Chemistry, 2004). The oxygen becomes useful for human beings as they inhale it and release carbon dioxide as waste product which plants and the afore-mentioned organisms use during photosynthesis. However, technological advancement now tends to challenge life sustainability. There is therefore the need to check this unpleasant trend.

Formal education plays a vital role in human development. Planned and unplanned activities in a formal education system aid creative thoughts that often lead to technological innovations. For instance, in educational institutions, basic literacy skills and generally, organised knowledge are offered which aid discoveries, inventions, and particularly scientific and technological progress. Having recognised educational institutions as organs of human development, it is logical that they be used as channels through which caution will be injected on the utilisation of technological products and services.

ii) **Value Impartation:** The educational system of a nation provides a means by which the values the nation desires of her citizens are imparted. Sule and Bawa (2012) posited that the process of developing the individual is carried out through imparting of the selected knowledge, skills, attitudes, interest, aptitudes, competences and cultural norms which the society considers fundamental. Currently, the government of Nigeria has a 9-3-4 system of education which could be interpreted as nine years of basic education, followed by three years of post-basic education that typically prepares the learner for four years of tertiary education. The nine years basic education is designed to be a free and compulsory education scheme which forms a foundation for further pursuits in life be it academic, vocational or otherwise. Since every developing Nigerian citizen is expected to pass through this educational system, values of national interest could

then be passed on to these upcoming citizens through the curricula made available at various stages of the educational system. One of the objectives of Nigeria's Universal Basic Education (UBE) scheme, the educational programme that caters for the nine years of basic education is ensuring the gaining of appropriate levels of literacy, numeracy, manipulative, communicative and life skills in addition to the ethical, moral and civic values essential for laying a solid foundation for life-long learning (Universal Basic Education Commission (UBEC), 2018). Judging from its importance to national and overall global well-being, Green IT is hereby recommended to be one the values of national interest that should be inculcated in the educational systems of Nigeria. Ogwuegbu (2018) stated that the basic education curriculum should contain clearly outlined green computing concepts and practices and that the teaching of Green IT should progress with advancement in level of education up to the tertiary education phase.

B. Inputs

As expected, the inputs to the model are its raw materials. This underlies their importance to the entire model. Thus, they must be carefully and diligently chosen so as to anticipate positive outcomes. Teaching Green IT involves transferring knowledge which the learner is required to imbibe. The knowledge, represented wholly as inputs in the model are further discussed below.

i) **Green IT Concepts:** Some fundamental ideas or principles form the basis on which Green Information Technology is formulated and discussed. Examples include climate change, ozone layer depletion, information technology revolution, deforestation, etc. These and many others will have to be taught particularly highlighting their relevance to Green IT

ii) **Sound Practices:** Ways of implementing Green IT that are considered reliable, beneficial and possibly optimal are crucial. They are to be sought for, identified and taught to learners. These practices should relate to such issues as increasing energy efficiency, reducing green house gas emissions, using renewable energy sources, increasing water conservation, increasing the use of green products, providing environmental friendly waste management procedures, reducing the use of toxic and hazardous chemicals and materials, etc (USDA, 2009).

C. Enablers

Before the desired results can be expected from the model, there is the need to ensure that one or more mechanisms are properly engineered some of which will have particular reference to the model inputs. These mechanisms are regarded as the enablers. They are discussed as given below.

i) **Curriculum Review:** Although curriculum exists at every strata of the educational system, they will need to be reviewed towards injecting Green IT

concepts and practices that the learners will need to have knowledge of. The curriculum review should aggregate and receive inputs from IT experts with bias in Green IT and possibly good background in education as well as various stakeholders in education towards brainstorming to arrive at an acceptable curriculum considered optimal which will address the necessary issues to be taught at every stage of the educational system. Among the salient points expected to be pondered upon by this team of reviewers are what to teach, how to teach, what will be needed for good education delivery and experience, etc.

ii) **Capacity Building:** Green IT is an emerging area in the information technology field. In addition, the dynamic nature of the IT field demands continual update from practitioners so as to be abreast with current trends in the industry. Thus, the capacities of the concerned personnel should be elevated from time to time. The target persons for the capacity enrichment include the teachers (particularly the IT teachers), educational administrators, educational researchers, curriculum planners, inspectors of education, and the policy makers. It is imperative that hands-on minds-on style of training be adopted. In-depth exposure on topics taught during the capacity building training period should take place so as to increase the propensity that enough skills would have been acquired which subsequently should be transmitted to bring about appreciable impact in the lives of the would be learners.

iii) **Curriculum Implementation:** This is sequel to the two points earlier mentioned and discussed in this section. During curriculum review, the methods and materials required for curriculum implementation would have been specified. Similarly, during capacity building sessions, challenges such as proper interpretation of the curriculum and having a positive mindset towards Green IT that could emerge from the teachers and other concerned personnel would have been looked into. However, another point worthy of mention that possibly will affect curriculum implementation is availability of adequate infrastructure and equipment. Even if the curriculum stipulates the expected hardware and facilities needed for teaching and learning, the teacher and students will have to undergo the teaching-learning process using whatever is available.

During curriculum implementation, the teacher should see that the psychomotor, cognitive and affective domains of learning are touched in their right proportions in accordance with the nature of the lesson to be taught. Makewa and Ngussa (2015) pointed out that although many factors exist which influence learning outcomes, teaching is the main school-level decisive factor of school performance. This highlights the importance of proper curriculum implementation in inculcating sound Green IT principles in learners.

iv) **Staff Welfare:** According to Galadima (2018), "a satisfied staff will be a productive worker." A staff member that is psychologically and emotionally balanced is on a good pedestal for acceptable job performance. Human beings are

not machines. Also, they are higher than other living creatures. Welfare of staff (teaching and non-teaching inclusive) must be of importance and should be properly addressed by concerned authority in terms of such things as prompt payment of salaries, allowances and bonuses; provision of working materials in line with respective duties of each staff; and having listening ear to issues bothering staff members.

D. **Environment**

Learners do not exist in isolation. They come from homes, are taught by teachers and mingle with other individuals within and outside the school setting. The people they deal with and events that happen around them deliberately or otherwise are perceived to affect their lives and could influence what happens to them as regards Green IT. It is on this premise that the following are considered regarding how the environment impacts on the disposition of learners towards Green IT.

i) **Institutional Support:** Green IT concepts and sound practices are to be exposed to the learners by their teachers. Normally, the learners will expect the teachers to be role models in implementing Greet IT ethics. Furthermore, they possibly will expect to receive support from other personnel within the school system such as non-teaching IT personnel and school administrators. Failure in this regard could demoralise the learners towards putting in practice whatever they may have learnt.

ii) **Parental Support:** Parents or guardians influence the lives of their wards positively or negatively. If their wards are aware that their parents/guardians have knowledge of any Green IT practice, the former would like to see the latter put their knowledge into practice even when it may not be convenient to do so. In addition, if they are not aware of some Green IT practices but their wards are and get them exposed to such, these wards would like to see their parents/guardians put the new knowledge gained into practice.

iii) **Awareness:** Green IT is an emerging area in the information technology field. As such, the Nigerian populace may not have satisfactory exposure on what may be expected of them towards contributing to enhance the condition of the environment while indulging in information activities. Furthermore, Ogwuegbu (2018) declared that awareness should encompass all areas of concern in green computing and that since knowledge evolves, obligatory periodic trainings, seminars and workshops on latest developments in green computing at various degrees of expertise and professionalism should be carried out. When these occur, the learners are offered more conducive environment to put Green IT strategies they would have been taught in school into practice.

E. Outcomes

When the models inputs have passed through the outlined enablers under the positive influence of the environment, some results are expected which shall be discussed below.

i) **Models:** When the informed, educated and compliant set of learners passes out from the school system where they would have acquired Green IT experience, they are expected to become role models to any environment they find themselves in. It is anticipated that they would positively influence the people they come in contact with in their environment towards upholding Green IT ideals.

ii) **Efficiency:** One of the major benefits of Green IT is efficiency – less resources used to bring about satisfactory results. Examples include lower power consumption by using energy efficient hardware, using virtualization technology to run multiple virtual machines on a single physical server, replacing cathode ray tube monitors with liquid crystal display alternatives, etc. (Shinder, 2008). When Green IT approaches are taught and they are put into practice, information activities are expected to be carried out more effectively.

iii) **Ecological Sustainability:** Sustainability as regards ecology has to do with the capability to be maintained at a stable level without depleting natural resources or bringing about severe ecological damage ("Ecological Sustainability", n.d.). A key reason for Green IT is to minimise the degradation of the eco-system while enjoying the benefits of IT. The future of any society (including Nigeria) is the youths. A sizable portion of Nigeria youths are expected to pass through the nation's organised educational system. When they acquire Green IT knowledge, apply them and pass on their experiences to others reduction in degradation of the system is expected to receive a boost.

F. Controls

The essence of control is to ensure that desired outcomes are achieved. These shall be looked into as discussed under the points specified below.

i) **Effective Supervision:** This should be carried out both internally and externally by the concerned personnel devoid of favouritism of any kind. The supervisors are expected to have some knowledge of what Green IT entails for satisfactory supervision to be anticipated.

ii) **Survey:** This could be carried out periodically to find out the extent at which Green IT objectives are achieved. Established approaches used to carry out survey research could be employed and the research may well be either quantitative or qualitative in nature. Results of the survey should be

interpreted and appropriate measures taken to ensure progress regarding Green IT practice in the nation.

Recommendations

The following recommendations are hereby made with the view to strengthening the advocacy for inculcating Green IT Nigeria educational system:

i) **Periodic Review:** The aforementioned curriculum review should be handled reasonably periodically bearing in mind the dynamic nature of the information technology industry and the need to bring to the knowledge of the learners latest trends as regards Green IT concepts and sound practices.

ii) **Improvisation:** Where inadequacy is noticed regarding materials for teaching Green IT, the teacher should endeavour to go the extra mile in improvising likely alternatives.

iii) **Green IT Research:** Research on Green Information Technology should be encouraged in Nigeria educational system. This will help in bring about indigenous Green IT strategies that will appropriately address challenges peculiar to the country.

Conclusion

Currently, the world is still in the Information Age. A rise in the demand for IT products and services will supposedly bring about an increase in the need for Green IT. Exposing Green IT to the segment of the nation's population, the youths, most of whom are expected to pass through the country's educational system is viewed to be a noble idea which should be pursued with earnestness for the betterment of the nation in particular and the world as a whole.

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