Awareness Level of Green Computing among Computer Users in Kebbi State, Nigeria

A. Mubarak, A. I. Augie

Abstract—This study investigated the awareness level of green computing possessed by computer users in Kebbi state. Survey method was employed to carry out the study. The study involved computer users from ICT business/training centers around Argungu and Birnin Kebbi areas of Kebbi state. Purposive sampling method was used to draw 156 respondents that volunteer to answer the questionnaire administered for gathering the data of the study. Out of the 156 questionnaires distributed, 121 were used for data analysis. In all, 79 respondents were from Argungu, while 42 were from Birnin Kebbi. The two research questions of the study were answered with descriptive statistic (percentage), and inferential statistics (ANOVA). The findings showed that the most of the computer users do not possess adequate awareness on conscious use of computing system. Also, the study showed that there is no significant difference regarding the consciousness of green computing possesses among computer users in Argungu and Birnin Kebbi. Based on these findings, the study suggested among others an aggressive campaign on green computing practice among computer users in Kebbi state.

Keywords—Green computing, awareness, information technology, Energy Star.

I. INTRODUCTION

COMPUTERS, personal computers (PCs), laptops, mobiles phones and other computing devices, have become an essential part of our lives at work, at home and even in transit. While computers have helped to reduce the millions of tons of paper and other assets spent on lasting hard storage of information, computers and associated products are causing their own environmental concerns [1]. Green computing reduces the use of materials that lead to hazards and also maximize effectiveness of energy during the product's lifetime. It promotes the recyclability or biodegradability of defunct products and factory waste [2]. In 1992, the U.S. Environmental Protection Agency propelled Energy Star, a volunteer labelling program that is designed to promote and identify effectiveness of energy in monitors, climate widget equipment, and other technologies. This resulted in the pervasively adoption of sleep mode among consumer electronics [3].

The term "green computing" was undoubtedly coined shortly when the Energy Star program originated; many USENET posts dating back to 1992 used the term in this manner. Presently, the Swedish organization TCO (native

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name: Tjanstemannens Central Organisation) Development launched the TCO Certification program to support low magnetic and electrical emissions that result from Cathode-Ray Tube (CRT) based computer displays; this program was further expanded to include standards on energy consumption, ergonomics, and the use of hazardous materials in construction [4].

When PC disposal arises, it is necessary to know the whole thing in order to be involved in green computing. Basically, the whole green side was discovered relatively a few years before now, it has been observed by people that the environment was not secured and for that reason, they started assimilating in order to protect their environment/or atmospheres. The effective use of computers and computing devices is what green computing is all about. This means manufacturers create computers that are eco-friendly. The idea is to make computers from beginning to end a green product [5].

Green computing was defined as the efficient use of computing resources. It is the name attached to the vitality which represents an ecologically responsible way of computing through impecunious faculty consumption. It also consociates with the appropriate use of computing resources and thereby addresses the role of minimizing their hazardous impact on leaving environment [4], [5].

Two indispensable issues associated with recent computing are; reduction that holds energy consumption and pollution control. These can be achieved by; appropriate use of electronic goods and being ripening of energy efficient and less power consuming hardware, the latter can be achieved through their reduced use. Recycling policies can also be help minimizr the achievement of less toxic substances in manufacturing the equipment [6].

In this paper, we are focusing on green computing that concerns desert management and recycling thereby maximizing the economic viability by ensuring the sustainability. Its aims to achieve economic viability and improve the way computing devices are used. Green IT practices are the development of environmentally sustainable production practices, energy efficient computers and improved disposal and recycling procedures [6], [5]. To promote green computing ideas at all possible levels, the following four corresponding approaches are engaged:
- Green use: Reducing the electricity consumption of computers and their peripheral devices and using them in an eco-friendly way
- Green disposal: Re-creation of an existing computer or appropriately or recycling unwanted computing

equipment
- Green design: To mark out energy-efficient computers, servers, Tablets, projectors and other digital electronic devices.
- Green manufacturing: Diminishing waste during the manufacturing of computers and other subsystems to reduce the environmental impact of these activities [5], [6].

In Nigeria, there has been little or no response towards encouraging green computing due to poor awareness and poor prioritizing. While many companies in Europe and the US are trying to minimize the amount of carbon dioxide emissions, some business people in African countries are looking at making business out of the situation. In technology, it has been happening that some Nigerian traders encourage the importation of used computers which emit more carbon dioxide rather than new PCs [7].

US semiconductor firm (Intel) threw their weight behind a massive scheme in order to reduce carbon dioxide (CO_2) emissions. The scheme was expected to reduce emissions of CO_2 by million tons within a year (equivalents to 11 million cars or 20 coal-fired power plants) in order to amend the amount of energy computers devour. Hewlett-Packard (HP), Dell and Microsoft have all signed up to the campaign [2], [4].

Computers and other computing devices have been accused for instigating as much global warming as the airline industry. Lack of knowledge about green computing and the amount of energy it consumes explains why some users will leave their system working when not in use [4]-[6].

This study was achieved by understanding level of awareness about green computing possesses by Computer users, ICT Business/Training centers. The research will contribute to both theoretical knowledge as well as development practice of the computer users, the ICT Stakeholders in Kebbi State, and the academia.

II. METHODOLOGY

A. Research Design

This study used descriptive research design to investigate the level of green computing awareness in Kebbi state. Descriptive research designs aid to provide solutions to the questions of who, what, when, where, and how associated with a particular research issues; a descriptive study cannot convincingly establish answers to why. Descriptive research is used to obtain details concerning the current status of the conditions in a situation.

B. Target Population

Target population is the full set of cases from which the sample is taken and which the researcher wants to generalize results. Due to lack of accurate database of active computer business centers, ICT centers (for institutions, schools, government organizations) and computer training centers, the researcher visited some business centers and ICT Training centers within the target region.

This study selected Kebbi state and chose Argungu and

Birnin Kebbi towns, since it had a large number and a good mix of sizes of computer users as the target population. The researcher proceeded to the field and visited the towns and contacted some of the computer business centers and computer training centers. As a result of this exercise, 13 computer business centers and 5 computer training centers were visited in the two towns, as Table I shows.

The target population was the computer users of the computing environments in Argungu and Birnin Kebbi in Kebbi state.

TABLE I
VISITED AREAS

S/No	Name of Computing Environment	Location (Town)	No. of Active Users
1	MK Computer Business Center.	Argungu	5
2	Basiru Artist computer Business Center.	Argungu	6
3	King Bani's Computer Business Center.	Argungu	5
4	Brain Work Computers.	Argungu	5
5	Zangina computer Business Center.	Argungu	3
6	Marhaba Computer Business Center.	Argungu	6
7	Hanan Computers.	Argungu	3
8	N'ima Computer Business Center.	Birnin Kebbi	7
9	Argungu LG ICT Training Center.	Argungu	25
10	MB Gulma computer Business Center.	Argungu	1
11	UD Computer Training Center.	Argungu	15
12	Adept Computer Academy.	Argungu	10
13	BK Integrated Global Solution.	Birnin Kebbi	20
14	Poly Cafe.	Birnin Kebbi	11
15	ML Tech Cyber Cafe.	Birnin Kebbi	13
16	Amtech Computer Business Center.	Birnin Kebbi	4
17	Gamji Computer Training Center.	Birnin Kebbi	13
18	Hikma Computer Business Center.	Birnin Kebbi	4
	Total		**156**

C. Data Collection Method

The study used a questionnaire to collect data from computer users from the two towns. This study utilized self-administered questionnaires. According to [4], [5] with a self-administered questionnaire (SAQ), respondents answer questions by completing the questionnaire themselves. As there is no interviewer in the administration of the self-completion questionnaire, the research instrument has to be especially easy to follow and its questions have to be particularly easy to answer.

The instrument of the study contained two sections, the first section requests for respondents' profile. The second section comprises of ten items on respondents' awareness of green computing. The respondents were asked to select an option that ranges from "YES", "NO", and "I DON'T KNOW" to these items.

D. Data Collection Method

For this study descriptive statistics and inferential statistics methods were used, and the descriptive statistics used were the mean, standard deviation, frequency and percentage distribution and inferential statistics used was one-way ANOVA.

III. RESULTS AND FINDING

A. Demographic Information

This section presents the descriptive statistics and information regarding the demographic and general data derived from the questionnaires. Town of respondents; gender of respondents; age of the respondents; and highest level of education

B. Town of the Respondents

The study results showed that about 65.3% of the respondents were from Argungu and 34.7% were from Birnin-Kebbi. The results are presented in Fig. 1.
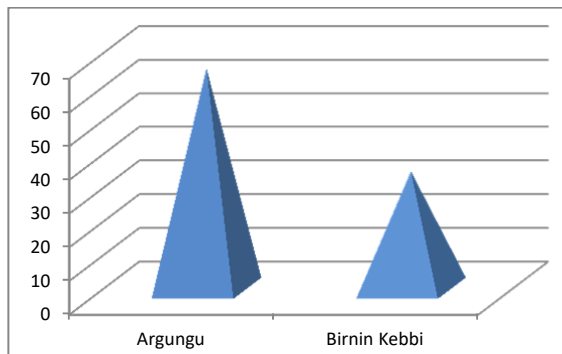

Fig. 1 Town of the Respondents

C. Gender of the Respondents

The gender analysis showed that about 76.9% of the respondents were male while about 23.1% were female. The results are presented in Fig. 2.
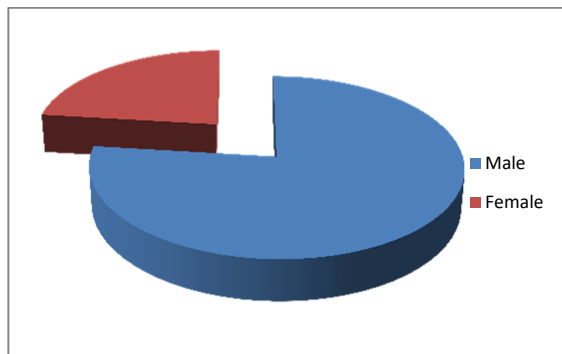

Fig. 2 Gender of the Respondents

D. Age of the Respondents

Regarding the age of the respondents, as Fig. 3 shows, the study found that about approximately 37% of the respondents were aged between 15 and 19 years followed by respondents within the age group of 20 to 24 years at about 29.6%. About 18.2% of the respondents were aged between 25 to 29 years, 11% between 30 to 34 years, and nearly 5% were above the age of 35 years.

E. Highest Level of Education

The study hunted to found the highest level of education of the respondents. Fig. 4 shows that more than half (52.8%) of the respondents had studied up to SSCE level, followed by Certificate/Diploma at 28.9%, bachelor's degree at 14.9% and 3.4% at the master's level.
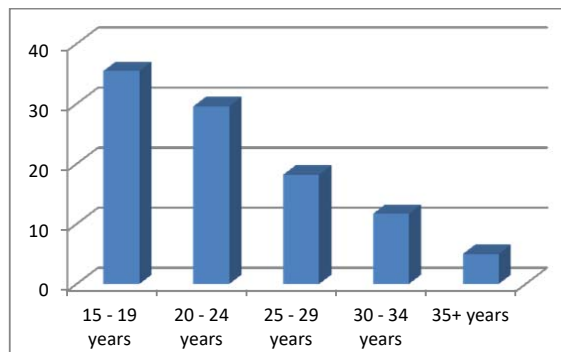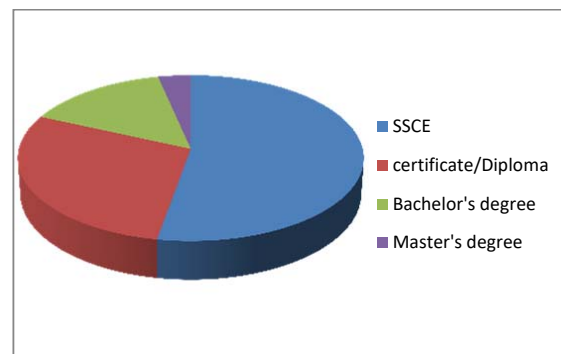

Fig. 3 Age of the Respondents

Fig. 4 Highest Level of Education

TABLE II
FREQUENCY AND PERCENTAGE DISTRIBUTION

S/No	x-Location (m)		Yes	No	I Don't Know	Total
1	Recycling computer hardware helps to keep the environment clean.	f	46	12.6	51	111
		%	41.5	14	45.9	100
2	Turning off the PC saves more energy than putting it sleep mode.	f	78	5	23	106
		%	73.6	4.7	21.7	100
3	PC recycling increases environmental pollution.	f	26	63	32	121
		%	21.5	52.1	26.4	100
4	PC recycling minimizes e-waste in Landfills.	f	19	42	57	118
		%	16.1	35.6	48.3	100
5	Laptops consume more power than desktops.	f	18	83	12	113
		%	15.9	73.5	10.6	100
6	A discarded computer leaks lead and mercury into environment.	f	21	15	73	109
		%	19.3	13.8	66.9	100
7	Increased computer use contributes to global warming.	f	23	13	81	117
		%	19.7	11.1	69.2	100
8	Using ENERGY-STAR Computer product increases electricity.	f	14	11	86	111
		%	12.6	9.9	77.5	100
9	Monitors release toxic chemicals if disposed in a landfill.	f	38	23	58	119
		%	31.9	19.4	48.7	100
10	Computers are made of poisonous materials.	f	27	8	74	109
		%	24.8	7.3	67.9	100

F. Green Computing Awareness

This section presents results for the Green Computing awareness among computer users in some part of Kebbi State.

Frequency (f) and Percentage (%) Distribution for Green Computing Awareness

About 45.9% of the respondents indicated *I don't know* that the recycling computer hardware helps to keep the environment clean; about 74.6% said *Yes* that Turning off the PC saves more energy than putting it sleep mode; about 52.1% said *No* that PC recycling increases environmental pollution, about 48.3% said *I don't know* that PC recycling minimizes e-waste in Landfills, about 73.5% said *No* that Laptops consume more power than desktops, about 66.9% said *I don't know* that A discarded computer leaks lead and mercury into environment, about 69.2% said *I don't know* that Increased computer use contributes to global warming, about 77.8% said *I don't know* that Using ENERGY-STAR computer product increases electricity, while about 48.7% said *I don't know* that Monitors release toxic chemicals if disposed in a landfill. In addition, about 67.9% of the respondents said *I don't know* that Computers are made of poisonous materials. Table II shows these results.
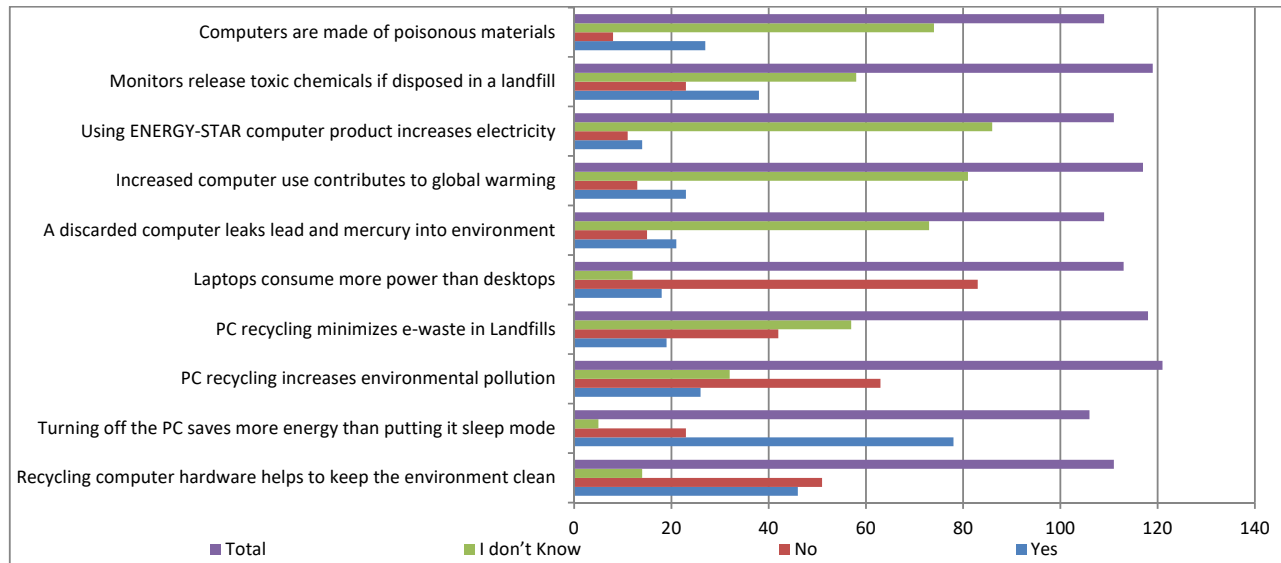

Fig. 5 Frequency Distribution on a Clustered Bar Chart

Descriptive Statistics for Green Computing Awareness

The study analyzed the mean and standard deviation of the items of green computing awareness. Table III shows the mean and standard deviation for "The green computing awareness", ($M = 113.4$, $SD = 5.04$).

One-way ANOVA on Green Computing Awareness

A one-way analysis of variation was carried out to establish if there was significant difference between the mean of Green computing awareness and Location (Town). As Table IV shows, the tests established no significant differences between the mean scores for Green computing awareness and both Argungu and Birnin Kebbi respondents $F(1,134) = 1.51$, $p = .24$

IV. DISCUSSION

The findings from this study show that the respondents have little awareness of green computing which invariably hinder their conscious use of computing devices. For instance greater percentage of the respondent chooses *I don't know* to some questions (e.g. questions 1, 4, 6, 7, 8, 9, 10).

Among the items which majority of respondents could not answer correctly is "PC recycling increases environmental pollution", "Laptop consume more power than desktops", and "Computer are made of poisonous materials". Some of the respondents that were able to answer some of the questions, by ticking the right answer do so through a quest work. This finding supported [7] and [8] which reported that university students failed to show understanding of some basic things about computer, like practice of screen savers, putting system in a sleep mode and switching off the system when not in use. The finding shows that computer users do not know that the system still consumes the same amount of energy be it in sleep mode or not. For instance, some of the questions which were incorrectly answered are questions which are presumed to be known by most of the computer users. The study revealed that there is no significant difference in the conscious use of computers among all the respondents of the study.

TABLE III

MEAN AND STANDARD DEVIATION FOR GREEN COMPUTING AWARENESS

S/No	x-Location (m)	Yes	No	I don't Know	Total
1	Recycling computer hardware helps to keep the environment clean.	46	51	14	111
2	Turning off the PC saves more energy than putting it sleep mode.	78	23	5	106
3	PC recycling increases environmental pollution.	26	63	32	121
4	PC recycling minimizes e-waste in Landfills.	19	42	57	118
5	Laptops consume more power than desktops.	18	83	12	113
6	A discarded computer leaks lead and mercury into environment.	21	15	73	109
7	Increased computer use contributes to global warming.	23	13	81	117
8	Using ENERGY-STAR computer product increases electricity.	14	11	86	111
9	Monitors release toxic chemicals if disposed in a landfill.	38	23	58	119
10	Computers are made of poisonous materials.	27	8	74	109
	Sum	310	332	492	1134
	Mean	31	33.2	49.2	113.4
	Variance	365.556	648.622	950.84	25.378
	Standard Deviation (STD)	19.11951	25.46806	30.836	5.0376

TABLE IV

ONE-WAY ANOVA FOR GREEN COMPUTING AWARENESS AND LOCATION

Source of Variation	SS	Df	MS	F	P-Value	F Crit
Between Groups.	1973.6	2	986.8	1.506548	0.239726	3.354131
Within Groups.	17685.2	27	655.07			
Total.	19658.8	29	73.03			

V. CONCLUSION

The findings of this study have revealed that greater percentage of the computer users in the setting of the study possess none or little awareness of green computing. Generally, they are not mindful users of computer and its accessories. The finding has unveiled and shed light to the state of awareness of green computing among the computer users in the sample of the study. Therefore, the study has contributed to literature on the phenomenon and suggests a further study on the awareness and acceptance of green computing among computer users in Kebbi state, since they constitute a large segment of ICT users. Based on these findings the following suggestions are made:

- An urgent attention is required by way of creating awareness on safe use and acceptance of environmentally friendly computing practice among the computer users in Kebbi state.
- The ICT stakeholders in the state should as a matter of urgency organize workshops and seminars to educate computer users on what green computing is all about.
- It is recommended to set up a committee that will handle the sales of eco-friendly computers and also control import of outdated computers into the state.

APPENDIX

THE SURVEY QUESTIONNAIRE

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