

# Building Green Information Technology “Animated” At TESDA School In The Province Of Rizal, Philippines

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**Abstract**— Global warming is the phenomenon's that were caused by a portion of emissions of Carbon Dioxide (CO<sub>2</sub>) at the atmosphere. Information Technology is one of the area that was added at least 3% of the CO<sub>2</sub> emissions and the percent is keep surge happening regularly every day as Information Technology turn out to be one of the essential in human's daily life. In order to sustain the environment, Green Information Technology was being introduced. “Unfortunately, Green Information Technology at Philippines is still in slow movement and can be identified as at alarming condition. The status of Green Information Technology awareness among Philippines focusing on TVET Schools student was still unidentified. TVET Schools is one of the sources of Technical and Vocational Education and Training institution that was aimed to produce at least thousands of professionals. These future professionals should be educating with Green Information Technology knowledge to safeguard the sustainability of the environment for the future. As such, this conceptual paper aimed to discuss the need of build up the TVET Schools student with Green Information Technology knowledge through conventional education and guided with Green Information Technology Education curriculum.

**Index Terms**— Green Information Technology awareness, Green Information Technology Education Curriculum, TVET Schools, TechVoc Students.

## 1 INTRODUCTION

Recently, Philippines was awakened by the drastically changes of weather since early 2014. At Kelantan, the temperature of the state had reduced drastically from 33 Celsius into 20 Celsius. Experts ascertained that the drastic changes of weather had happened around the world. One of the causes for this phenomenon was come from human activities around the world and this phenomenon had relationship with climate change that was been discussed since 1960s. Climate change is the increased surface temperatures that makes the earth become warmer and that also can be called global warming. “From global warming or the rise of the average temperature, it is leading to some phenomenon such as thawing of glaciers and thawing of the polar ice, increase of the mean sea level as well as generally more of life-threatening weather events and nature disasters like droughts, floods, and tornadoes. Carbon dioxide (CO<sub>2</sub>) emissions belong to the most significant causes of global warming”. Nowadays, the emission of CO<sub>2</sub> at Philippines had been increased from day to day. Honorable Rodrigo Duterte had aimed that Philippines will reduce 40 % of the CO<sub>2</sub> emissions by 2025. In order to achieve this target, a Department of Energy, Green Technology and Department of Science and Technology had been developed and Green Technology had been introduced at Philippines.

## 2 DETAILED CONCEPTS

### 2.1 Impact to the Environment

Information technology (IT) plays a most important part in human activity in the world. It is tremendously important to all areas including business, education, entertainment, engineering, and medical.

The growth of Information Technology (IT), especially the Internet has opened-up new interests and expectations in the economy, particularly in community development in developing countries such as in our country. Information Technology can provide a faster way space to improve the quality of life compared to the industrial age in the previous era. Information Technology industry has a noteworthy role and impact to the economy globally, but on the other hand Information Technology is responsible for 2-4% of CO<sub>2</sub> emission around the world. This is about the same as emission by aviation activities. The main Information Technology device such as computer had contributed a lot of the environment whereby the computer components contain toxic materials [1]. Information Technology device was contributed indirectly to the environment around the world and the impact was still not being realized by the end user [2,3]. Thus, every Information Technology device had contributed to CO<sub>2</sub> emissions which were showed in Figure 1 [4]. It shows that computers and monitors had contributed 40% of the CO<sub>2</sub> emissions, where else 23% was contributed by servers and 15% was contributed by telephone line. Then, 9% comes from mobile telephone and Local Area Network device contribute to 7% of CO<sub>2</sub> emissions and 6% comes from printers. Furthermore, every Information Technology device had different CO<sub>2</sub> emissions and electricity usage based on its type as showed in Table 1 [5].

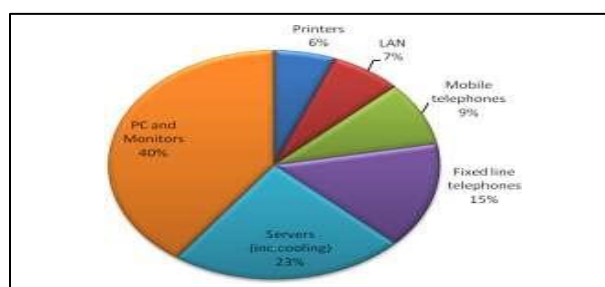


Fig. 1. Energy and emissions of IT Hardware. [6]

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TABLE 1

ESTIMATION OF ANNUAL ELECTRICITY USED BY IT DEVICE IN 1999.[7]

Best estimate of annual electricity used by U.S. office equipment in 1999, TWh/year:				
Equipment Type	Residential	Commercial	Industrial	Total
Portable Computer	0.14	0.13	0.02	0.29
Desktop Computer	2.67	10.21	1.46	14.34
Server	0	1.60	0.23	1.83
Minicomputer	0	8.86	2.95	11.81
Mainframe	0	5.62	0.63	6.25
Terminal	0	1.83	0.61	2.44
Display	3.13	9.82	1.40	14.35
Laser Printer	0.10	5.36	0.77	6.23
Inkjet/Dot Printer	1.10	1.56	0.22	2.88
Copier	1.10	5.71	0.82	7.63
Fax	0.44	2.26	0.32	3.02
Total	8.7	53	9.4	71

## 2.2 Green Information Technology

Green Information Technology is one of the initiatives that being introduced to reduce CO<sub>2</sub> emission by IT device. It also being known as Green Computing that contains any practices, actions or activities by using IT device that can reduces the CO<sub>2</sub> emission and minimize any harmful effect to the environment that was produced by human activities [8]. "Green Information Technology contains four major elements such as Manufacturing and production of computer resource, design of computer resource, usage of computer resource and disposal of computer resource that were showed in Figure 2 [9]. Green Information Technology can be looked as a savior of the CO<sub>2</sub> emissions produce by IT industry and become the ideal way to save the environment [10]".

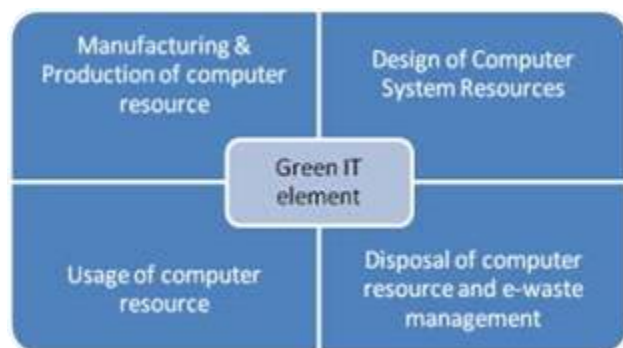


Fig. 2 The (4) four main origin in Green Information Technology [11].

Philippines had been introduced to Green Information Technology since 2009, but the pervasiveness of Green Information Technology among Philippines is very slow and can be assigned as an alarming condition. Green Information Technology had been introduced but the practice among Philippines still does not reflect to the practice aligned by Green Information Technology initiatives. The outcome of the Green Information Technology initiative can be questionable and might not reach at the ground level [12]. Green Information Technology awareness among Philippines is still low and need to be promoting continuously in order to achieve 40% reduction of CO<sub>2</sub> emission on 2025. A lot of strategies

and studies should be done to state the awareness of Philippines regarding Green Information Technology [13]. Awareness is the first stage that should be undertaken to ensure the implementation of Green Information Technology [14]. The high level of awareness is needed to make the environment greener in the developed nation [15]. This paper will propose to get the state of Green Information Technology awareness among TVET Schools students at Philippines.

## 2.3 Why TVET Schools Students Should be Involved in Green Information Technology Awareness Research

Most of the research that being piloted were focusing on the necessity of Green Information Technology [16, 17, 18, 19, 20, 21] adoption of Green Information Technology at the organization [22, 23], monitoring Green Information Technology situation [24], and Green Information Technology attitude [25]. Furthermore, some research had been done which were focusing on Green Information Technology awareness among university students at abroad [26], Green Information Technology awareness among staff [27, 28, 29], Green Information Technology awareness among college students at abroad [30]. Just a few of the research was conducted in order to identify the level of Green Information Technology awareness among Philippines's TVET students [31, 32, 33]. For this paper, the researchers want to highlight the importance of study the state of Green Information Technology awareness and enhance the awareness among TVET Schools students at Philippines. TVET Schools is one of the institutions that was under supervision of Technical Education and Skills Development Authority which also known as a provider for Technical and Vocational Education and Training (TVET) in the Philippines. TVET Schools was being identified as a technical and vocational institution that should provide the country with skilled industrial workforce. TVET Schools was aimed to produce about thousands of skilled industrial workforce persons. In fact, Philippines's President Rodrigo R. Duterte had gave commitment in order to reduce at least 40% CO<sub>2</sub> emissions during 2025. "Thus, graduates from TVET Schools were aimed to be the professional workers during 2025 that will fulfill the target of reduction CO<sub>2</sub> emissions and keep the effort to ensure the sustainability of the environment through Green Information Technology". On the other hand, TVET Schools students were identified as the end user of Information Technology whereby they were always spending their time using computer and Information Technology device in order to search for information and complete their task. They also use Information Technology device to do presentation, produce assignments, e-learning platforms and share notes through social media. Therefore, they should be instilled with Green Information Technology knowledge and awareness, so that they will be a responsible person toward environment in the future. Furthermore, as a student and end Information Technology user, they should know the impact of Information Technology device to the environment and aware about Green Information Technology practice. They must fully understand the Green Information Technology concept because they must implement it in their daily life and as a preparation for the future.

## 2.4 Knowledge as the Root for Green Information Technology Awareness

In order to raise the Green Information Technology awareness, the first step that should be taken care is knowledge. Knowledge is a crucial part that should be measured as the key priority to raise Green Information Technology awareness among TVET Schools students [34]. Knowledge also the key of the success of increasing Green Information Technology awareness and become the driver for Green Information Technology execution in daily life [35]. As a result, "knowledge is the first stage in the adoption process and cannot being deserted in order to implement Green Information Technology. The consumer cannot implement Green Information Technology in their daily life without the knowledge about Green Information Technology [36, 37] particularly students [38, 39]". Knowledge is also essential element in Green Information Technology framework to clear misunderstanding people particularly student regarding the function of real contribution of screen saver to the CO<sub>2</sub> emissions [40].

## 3 SECTIONS

As demonstrated in this document, the numbering for sections upper case Arabic numerals, then upper case Arabic numerals, separated by periods. Initial paragraphs after the section title are not indented. Only the initial, introductory paragraph has a drop cap.

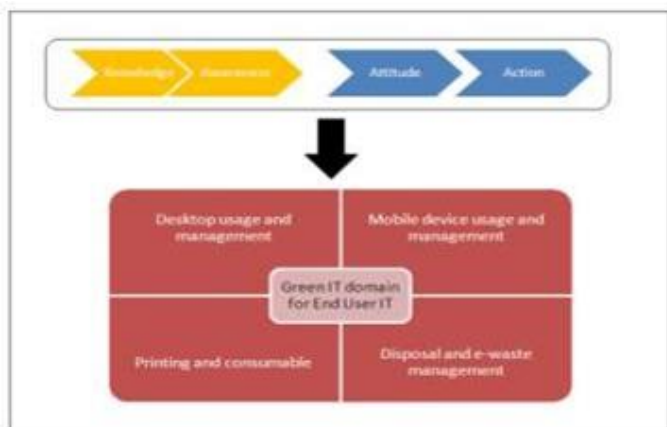


Fig. 3 Conceptual framework to raise Green Information Technology implementation.

Based on the conceptual framework as showed in Figure 3, knowledge becomes part of awareness. Then, based on the high level of Green Information Technology awareness will shape a responsibility attitude towards Green Information Technology and thus was translated into the action which is aligned with Green Information Technology practice. The proposed conceptual framework is focusing on the Green Information Technology implementation for end user IT especially TVET Schools students. The four domains contain Desktop usage and management, mobile device usage and management, printing and consumable, disposal and e-waste management which were highlighted by Philipson [41]. For the top part that contain knowledge as part of awareness, together with attitude and action were the continuous process that should be considered in order to make sure the successful of Green Information Technology implementation at TVET Schools. Attribute is another important part that should be developed after the awareness part. A lot of CO<sub>2</sub> emission can

be reduced and energy can be utilized efficiently if attribute that being developed were aligning with Green Information Technology vision [42] This situation was proved by Pearce [43] and Dookhitram [44] which claimed that most of the university's student unable to shut down their PC when not in use which were claimed as contrast with Green Information Technology attitude.

## 4 BUILD UP THE FUTURE PROFESSIONAL WITH GREEN INFORMATION TECHNOLOGY KNOWLEDGE THROUGH PROFESSIONAL EDUCATION

TVET Schools student can be acknowledged as the upcoming professional that will accomplish the missions of the Philippines's transformation. In order to strengthen the awareness among TVET "Schools student concerning the importance of Green Information Technology and sustain the environment; a formal education should be developed. Formal education in this situation was identified as teaching and learning process in a classroom or through virtual environment". The process of teaching and learning will be guided with the Green Information Technology curriculum that should be implemented at all TVET Schools in Philippines. Education institution that offers tertiary education should essential to develop knowledge, skills and attitudes among students as a preparation for a sustainable future [45]. An effective approach can be used to develop Green Information Technology curriculum as a continuous effort to sustain the environment for a long term [46]. Formal education with guided by efficient curriculum can lead the student to the right track towards responsible citizen [47, 48]. By implementing formal education through development of Green Information Technology curriculum, will engage the students to give full commitment to the teaching and learning process in Green Information Technology course. Thus, it will raise the level of Green Information Technology awareness midst the students. On 2011, about five education institutions around the world had running Green Information Technology course guided with Green Information Technology curriculum. One of the universities that offers Green Information Technology course is Montclair State University, USA [49]. Based on the study done by Robila [50], the university had covered the misunderstanding amongst the students regarding basic knowledge about power usage by screen saver. On the other hand, some of the education institutions were still developing the Green IT curriculum for their institution. Unfortunately, at present, limited institution that took a step on the track to educate people in Green IT specifically in two year or TechVoc programs. This institution are the limited universities that have lecturers certified as Green Information Technology Instructor. This institution was aimed to offer Green Information Technology program / course at their institution, but the development of the course is still under progress.

## 5 CONCLUSION

In conclusion, the awareness regarding Green Information Technology among Philippines should be improved as it was in alarming condition. If the awareness among Philippines is still low especially students at higher institution, how we want to expect for another six years? On 2025, Philippines was supposedly reducing at least 40% of CO<sub>2</sub> emissions. In fact, to achieve the target, a lot of efforts should be done. One of the approaches that can be implemented was educate people through formal education guided by Green Information



Technology curriculum. Knowledge regarding Green Information Technology should be fully understood and alive in their soul as they are the asset for the country and the future skilled talent pool for Green Information Technology. Furthermore, the state of the level of Green Information Technology awareness among TVET Schools student should be identified clearly. Thus, the process of teaching and learning Green Information Technology at TVET institution supposedly was taken care and get the main priority by Government of Philippines and TESDA. A future study will be conducted in order to state the level of Green Information Technology awareness among TVET Schools student at Philippines. Then, the conceptual framework that was proposed will be updated specifically and examined to identify its effectiveness. Future studies will be conducted to implement and investigate the proposed framework.

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