Providing Students with the Knowledge about Green Technology in Environmental Preservation

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Abstract: Advances in technology today are very influential to the surrounding environment. In today's world, people are very dependent on technology. However, it cannot be denied that the survival of human life is also very dependent on the environment. Green Technology is the most expected technology to overcome the global warming that has been rampant on this beloved earth. Green Technology is environmentally friendly technology, so it does not have any negative impact on the environment. The use of Green Technology should be continuously improved and people should be socialized into it in order for the technology to be accepted and accounted for. In this research, some observations were conducted on the conditions in the field. Higher education makes a significant contribution to the improvement of the quality of human resources in a country. Thus, universities have an important responsibility for providing knowledge of green technology for their students. Especially in Indonesia, it is necessary to include Green Technology materials in the curriculum of each study program so that students can understand how to use and innovate technologies that sustainably preserve the environment. Thus, it is expected that there will be some cadres for development that can preserve the environment in a sustainable manner.

1 INTRODUCTION

Technological development that has triggered globalization is a factor between changes in the external environment that have a very significant impact on business and community behavior and culture. The growth in population density grows and rate of business requires greater energy, but the sources of energy on earth are limited. For this reason, it is necessary to use an effective, efficient method. A new paradigm is, thus, needed to enable competition in a new business environment. Today's industrial revolution 4.0 is characterized by a cyber-physical system. Industry starts to touch the virtual world in the form of human-machine-data connectivity; everything is everywhere. This is known as the Internet of Things (IoT). Industry 4.0 is the name of the latest automation and data exchange trends in factory technology. This term includes the cyber-physical system, the Internet for everything, cloud computing, and cognitive computing that produce "smart factories." In industry 4.0, this relates to the optimization of all resources in the business network to meet all market demands. Optimization is actually not new; the difference is in "how to play" in carrying out the optimization. Rapid changes in the business environment require organizational flexibility in handling various changes. However, these changes do not have to be done radically. They can be done in stages depending on the needs, with all situations and conditions taken into consideration. Thus, the utilization of information and communication technology (ICT) for businesses is expected to contribute significantly. Automation of the use of ICT has helped organizations enjoy extraordinary efficiency and cost effectiveness.

Along with the growth and development of ICT, it turned out to have had an impact on the environment and global warming. The need for ICT devices has had an impact on the environment. This is especially the case as ICT devices must consume electricity. Likewise, old devices that cannot be used any more will turn into waste. Environmental issues, including the issues related to ICT, deserve attention. Some efforts that have been made by humans have bring about the concept of Green Technology, otherwise called Clean Technology/Environmental Technology. This concept was born from human awareness of the needs for the use of natural resources on Earth in a sustainable manner as well as matters

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related to the reduction of the carrying capacity of the earth, for example, the attempt to reduce the effects of global warming by making efforts and taking actions that are more environmentally friendly. In the ICT sector, it is known as Green ICT.

The application of the Green ICT concept is widespread in various business processes. In essence, entrepreneurs or anyone associated with the ICT sector are expected to be able to realize efficiency to support the preservation of the surrounding environment. Furthermore, sustainability makes the ultimate goal that must be achieved by all organizations. The final objectives include a balance of economic performance, social welfare (well-being), and environmental rejuvenation and conservation. It is our responsibility as humans to always protect the planet from any damage and destruction. To achieve sustainability, it is necessary that every community receives education and knowledge about Green Technology. Higher education institutions as educational institutions at the top of the hierarchy of formal education have three missions, namely Education and Teaching, Research, and Community Service, better known as the Tri Dharma of Higher Education. It is not an easy task to realize the three missions. The fact that universities contribute in solving various problems faced by the community, especially in matters relating to technological innovation and community entrepreneurship development through education, research, and community service efforts, is very important. Universities are also formal education institutions that carry out the mandate to create knowledgeable academic communities and also serve as agents of social change.

The function and role of tertiary institutions in Indonesia are central to human resource development, so these institutions have a significant contribution to the improvement of the quality of human resources in Indonesia. Students are a generation of people who have a high level of intellectuality, and scientific culture is always an alternative in problem-solving. Thus, a college has an important responsibility for providing knowledge on Green Technology for its students to form development cadres who can sustainably conserve the environment. Providing students with Green Technology knowledge can be done in various ways, including by adding it to teaching materials, holding discussions about Green Technology, creating a club about Green Technology, and creating specific courses on Green Technology. Essentially, a university is needed to provide materials about sciences that are oriented towards maintenance of environmental quality, reduction of the impact of hazards from industrial processes (hazard reduction), reduction of the use of non-renewable natural resources (sustainable non-renewable resources consumption minimization), and maintenance of sustainability. Thus, the knowledge provided for, and experience gained by, students during their time in college will serve as their main capital for pursuing works and professions as the form of their dedication to the community, nation, and state.

2 SUSTAINABILITY

According to John Elkington, sustainability is a balance between people, planet, and profit, known as the Triple Bottom Line (TBL) concept. Sustainability lies in the meeting of three aspects: people-social; planet-environment; and economic profit.

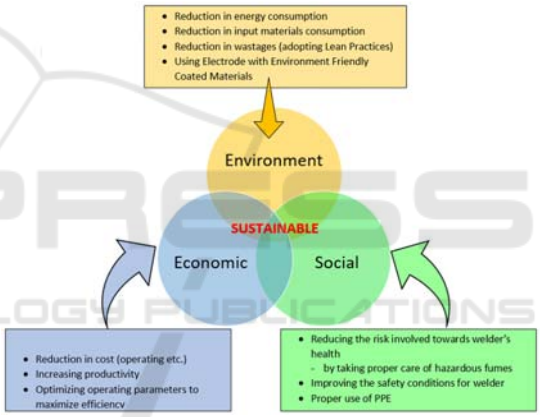

Figure 1: Elkington's Triple Bottom Line.

So, according to Elkington, a company must be responsible for the positive and negative impacts it has on economic, social, and environmental aspects. Furthermore, there are two types of sustainability according to Dunphy et al., namely ecological sustainability and human sustainability. Ecological sustainability includes the design of organizations that can contribute to sustainable economic development, protection of the environment, and renewal of the biosphere (i.e., the of the and the inhabited by living things). Human sustainability refers to the improvement of human capabilities and expertise for high and sustainable corporate performance and for social welfare (well-being) and community economic and ecological sustainability.

A sustainable organization is an organization that carries out activities by understanding the needs and interests of other parties (community groups,

educational and religious institutions, workers, and the general public) as well as increasing the cooperative network that unites them all.

From the explanations, it can be seen that the aspects that must be achieved in sustainability are economic, social, and environmental welfare and rejuvenation. Achieving sustainability means that the next generation will at least have the same opportunity to utilize existing resources as they are today. It would be better if you could have a greater chance than the current condition. This will be achieved if natural resources are still sufficiently available or ideally increasing. According to Gregory C. Unruh, sustainability must be the ultimate goal of a company. According to him, by recycling, companies can save the biosphere. Unruh proposed four steps that must be taken by a company to achieve sustainability, namely 1) using fewer raw materials, 2) redesigning products, 3) paying attention to economies of scale, and 4) maintaining buyer-supplier relationship.

3 GREEN TECHNOLOGY

Green technology is an encompassing term. It deals with using science and technology to protect the environment. A lot of techniques fall under this term, for example, the use of green chemistry, environmental monitoring, and more. All of these things have to deal with making sure that the environment remains protected. This technology is used to breathe life back into a damaged ecosystem. It is also referred to as environmental technology or clean technology. The main goals are to conserve nature and to remedy the negative impact that humans have on it. Since the 1990s, a lot of focus has been put on Green Technology. It offers a lot of benefits to not only the nature itself but also a clean and greener human lifestyle. Human beings need earth to stay alive. This technology ensures that the earth remains healthy for all life to continue existing. In the future Green Technology will be considered as the goal of human life because humans cannot continue to use technology that causes negative impacts on the environment and every form of life that depends on the environment. It is our responsibility as humans for always guarding the planet from any damage and destruction. With Green Technology, various ways to satisfy human needs without causing environmental damage or rapid reduction of natural resources on earth can be found and developed.

One example of alternative conventional technology applied according to the concept of Green Technology is the process of recycling waste. This effort can significantly reduce the negative effects on the environment by reducing the amount of waste and pollution resulted from activities carried out by humans. The application of the concept of Green Technology, in general, has several priority objectives in human life: 1) sustainability—continuous efforts to meet the needs of the society in the future without damaging or depleting natural resources; 2) recycling trash—efforts to end the cycle of disposable goods through the creation of products that can be fully recovered or reused; 3) reduction of waste sources—efforts to reduce waste and pollution sources through the change in production patterns and consumption patterns; 4) innovation—efforts to develop environmentally friendly alternative technologies to meet human needs without damaging the environment, 5) viability—efforts to create a center for economic activities in all fields of technology and products that benefits the environment and to create new business opportunities that truly protect the planet from damage; and 6) education—efforts to increase the understanding of the importance of applying Green Technology to support the creation of sustainable environmental carrying capacity.

The varied forms of world's Green Technology concept applications are based on the main principles of Greentech. The Greentech concept is applied to help humans with the use of the simplest technology to the most up-to-date technology to achieve comfortable, economical, and environmentally friendly lives. Basically, the Greentech concept applied to create products is to minimize raw materials, streamline processes, and maximize product output with minimal waste. So far, the ICT sector has contributed 2–3 percent of the world carbon emissions.

Despite having a contribution to carbon emissions, ICT actually also has the potential to reduce carbon emissions. ICT can reduce world carbon emissions by up to 20 percent. The efficiency of environmentally friendly ICT can help organizations anywhere enjoy extraordinary cost efficiency. Green ICT is a concept that is generally associated with efforts to reduce energy and other natural resources consumption, in addition to emissions and waste generated from activities in the field of information and communication technology. The application of the Green ICT concept is widespread in various business processes. In essence, entrepreneurs or anyone else associated with the ICT field are expected to be able to create efficiency to support the preservation of the surrounding

environment. For example, there is an increasingly developing campaign of sophistication of Internet services that support the use of electronic mails (e-mails) for communicating with business colleagues and data transmission for the reduction of paper use, which means fewer trees will be cut down. With reduced tree felling, we will once again enjoy low carbon emissions. Environment-friendly efficiency around the ICT field includes implementing teleconferencing that can reduce travel costs and has an impact on reducing carbon emissions, but is still able to increase business productivity. It can also do more. The efficiency of ICT that is environmentally friendly can actually help organizations everywhere enjoy extraordinary cost efficiency. So far, the ICT sector has contributed 2–3 percent of the world carbon emissions. But despite having a contribution to carbon emissions, ICT actually also has the potential to reduce carbon emissions. Using ICT can reduce the world carbon emissions by up to 20 percent.

4 GREEN TECHNOLOGY AT UIN SU

Higher education institutions become places for students to build character and personality to be more mature, unlike who they were in the first school years when they were still immature. At university, students are required to be more independent in creating and innovating. Universitas Islam Negeri Sumatera Utara (UIN SU) is a state university that has more than 20,000 students and has lecture buildings that are not concentrated in one place. Thus, it will require considerable energy resources.

Since the establishment of the Faculty of Science and Technology in 2015, there have been five study programs existing in the Faculty of Science and Technology, namely Information Systems Study Program, Biology Study Program, Mathematics Study Program, Physics Study Program, and Computer Science Study Program. In conducting activities and management of the five study programs, it turned out that more energy resources are required because to carry out the activities, a lot of laboratories are needed. For example, the Information Systems Study Program and Computer Science Study Program require computer laboratories, network laboratories, and so forth. Similarly, other study programs have several laboratories. For example, a computer lab will contain dozens of computational units. If one personal computer unit requires 150 Watt of electrical energy, 100 personal computer units will need 15,000 Watt of electricity. Based on this, the Faculty of Science and Technology will especially require considerable energy. In this case, it is necessary for the academic community in the Faculty of Science and Technology to have understanding and knowledge of Green Technology so that they will be able to use energy more efficiently to achieve a sustainable future.

In the use of ICT in the campus environment, the Green ICT concept is applied as follows: 1) use online information systems optimally and attempt paperless practices—various academic applications used by students can be accessed online from anywhere; 2) switch the monitor of the personal computer used to a standby mode after 5 minutes of inactivity (without active screensaver)—this prevents the waste of a lot of electrical power because the computer does not use much power; 3) recycle toners and paper—all toner and paper must be reused; 4) turn off the lights and ACs if the classroom does not have students; 5) shut down PCs after office hours—all computers and equipment must be turned off after work, 6) apply timer switches to non-networked technology and printers—there are some devices over a computer network that do not have to be always active, so timers can be applied to them to set the activity; 7) set the default green printing, including duplex and grayscale by default—this aims to reduce the number of prints so as to reduce the amount of paper usage and electricity consumption; 8) implement printer consolidation—printer use is not always the most important requirement in one part or division in a company, thus printers can be consolidated together to allow for printer hardware and electrical resources use savings; and 9) ensure re-use of equipment that is no longer required but is still serviceable; if re-use is not possible, recycle or ensure green disposal—there are some components of ICT equipment that cannot be used anymore, but if there are some components that are still suitable for use, they must be reused; this will reduce ICT waste.

The nine Green ICT policies, if done properly and correctly, will have a very significant impact on the organization. There will be enormous energy and cost savings. Thus, the use of resources when ICT equipment is used will be very effective and efficient. Students of the Physics Study Program and Biology Study Program can especially be provided with the knowledge of Green Technology on the following policies. 1) Recycling—Rather than throwing all of your trash into a landfill, recycle objects made of glass, metal, paper, and plastic. These materials are reusable and by recycling them, you can help prevent

further depletion of the Earth's resources. 2) Environmental Remediation—Another aspect of Green Technology involves removing contaminates from the soil, air and water. These processes range from chemical to biological processes. Industry is responsible for much of the contamination, and the government has enforced strict regulations to curb it. 3) Renewable Energy Sources—The world cannot rely on fossil fuels forever to power homes, automobiles, and factories. Green Technology includes the conversion of renewable resources, such as sun's light, wind, and water, to energy that we can use. Solar panels, wind turbines, and geothermal wells are examples of technological innovations that can be alternatives to coal and oil. 4) Alternative Fuels—Aside from harnessing nature's energy, scientists are also looking into other alternatives to fuel, which include hydrocarbons, fuel cells, and the highly debated concept of clean coal. The clean coal concept is driven by the goal to lessen the impact of carbon dioxide emissions on the environment from the burning of coal as an energy source. The desired effect is either zero carbon dioxide emission or reduction of the emissions to such a low amount that the impact becomes insignificant. Another alternative fuel goal is that someday, hopefully soon, automobiles will not need to run on gasoline. 5) Cradle to Cradle—This term refers to the recycling of manufactured products from renewable materials that can be reused again and again, rather than going from cradle to grave, used once and then disposed. 6) Sustainable Development and Building—Designers and building owners can take many steps to make a building "green". Some of these strategies include properly siting the building to take advantage of natural conditions including solar orientation, use of recycled or environmentally friendly building materials, and reduction of suburban sprawl. Obviously, any type of construction is inherently detrimental to the environment, but with careful planning it is possible to reduce any negative impact. 7) Green Nanotechnology—This quickly growing field of science operates on the scale of one billionth of a meter or a nanometer. Materials are manipulated in ways that will transform the manufacturing industry. Green nanotechnology involves principles of both chemistry and engineering and knowledge of Green Technology as explained in many other fields. Thus, a new breakthrough is needed to incorporate green technology materials into the curriculum of each study program so that students can understand how technology is used to preserve our environment.

5 CONCLUSIONS

Not everyone buys into the theory of global warming or believes that human actions have such a significant impact on the environment. Even scientists share differing opinions. However, there is enough evidence to prove that the earth's resources are limited, so precautions must be taken to preserve them for future generations. Universities have a significant contribution to the improvement of the quality of human resources in a country. Thus, they have an important responsibility for providing knowledge of Green Technology for their students in forming development cadres. Especially in Indonesia, a new breakthrough is needed to include Green Technology materials in the curriculum of each study program so that students can understand how to use and innovate technologies that sustainably preserve the environment.

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