Chapter 117. Green Technology Transfer

Global Sustainability in the presence of Green Technology Transfer

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Abstract

The literature gives credence to the role of energy consumption, and air transport to induce economic growth, without much attention to the role of green technology transfer. However, as economic growth upsurges, utilization of energy increases, thereby releasing toxic chemicals, which causes environmental degradation. There are also evidences that green technology, in place of unreplenished resources, have a potential to enhance sustainable development. As a result, recent research suggests that policy makers stabilize and/or subsidize investment in green technology for a sustained economic and social development. This also extends to promoting a green environment. Conversely, not much research has been carried out on the role of green technology transfer for a sustainable energy system, and unless clean, alternative sources of energy are available, reducing global warming will be challenging.

Keywords: Green Technology Transfer; Global Sustainability; Technological Advancement; Renewable and Non-renewable Energy; Emissions

1. Introduction

There are numerous facets to science, most of which were related to technological innovation and research improvement. However, investigation of how the facets will be effectively utilized boils down to the issue of global sustainability. Generally, sustainability means the lifespans of resources, regularly natural resources such as studies of oilfield, mines, ecosystem, energy; and artificial resources such as solar PV or green plants. However, when it comes to global sustainability, it is centered around the universe measuring how natural resources are being exploited globally. Global sustainability fledges support that allows stability, harmony, and strength to help present and future generations through the interaction between humans and natures, society and biosphere, and world and earth. From this, it could be viewed as an ideal objective to improve global ecological quality. It is no doubt that people on the earth have stepped up to improve global development through the utilization of Information and Communication Technology (ICT), but there is backward progress for the natural environment through the

enhancement of this technology, which consequently, has resulted in the weakening of the environment, ecosystem, and biodiversity.

It is never argumentative to believe that life's quality on earth is continually fostering to a very good extent using ICT, but it also has adverse consequences on the quality of the natural environment. The principal impact is but is not limited to, atmospheric emission of pollutants, thereby resulting in the greenhouse effect. Evidence of these effects have been significantly provided in the literature (Adedoyin et al. 2020a, d, c, b, 2021), and could also arise from the difficulty to sustain the excessive use of non-renewable resources as described in a research article published by Hayward et al. (2000). Non-renewable resources – fossil fuels such as petroleum, coal, natural gas, and rare minerals – are just as they are; when exhausted, they are hardly replaced with immediate effect. Hence, concerning these unreplenished resources, it becomes difficult to maintain sustainable development, and exploiting them did not imply that modern generations would not enjoy the right to meet standard needs (Hayward et al., 2000). So, what is the essence of stressing on an unstainable resource whose depletion harm the nature of the environment when, in actual sense, does not hinder the growth and the need for the future generation.

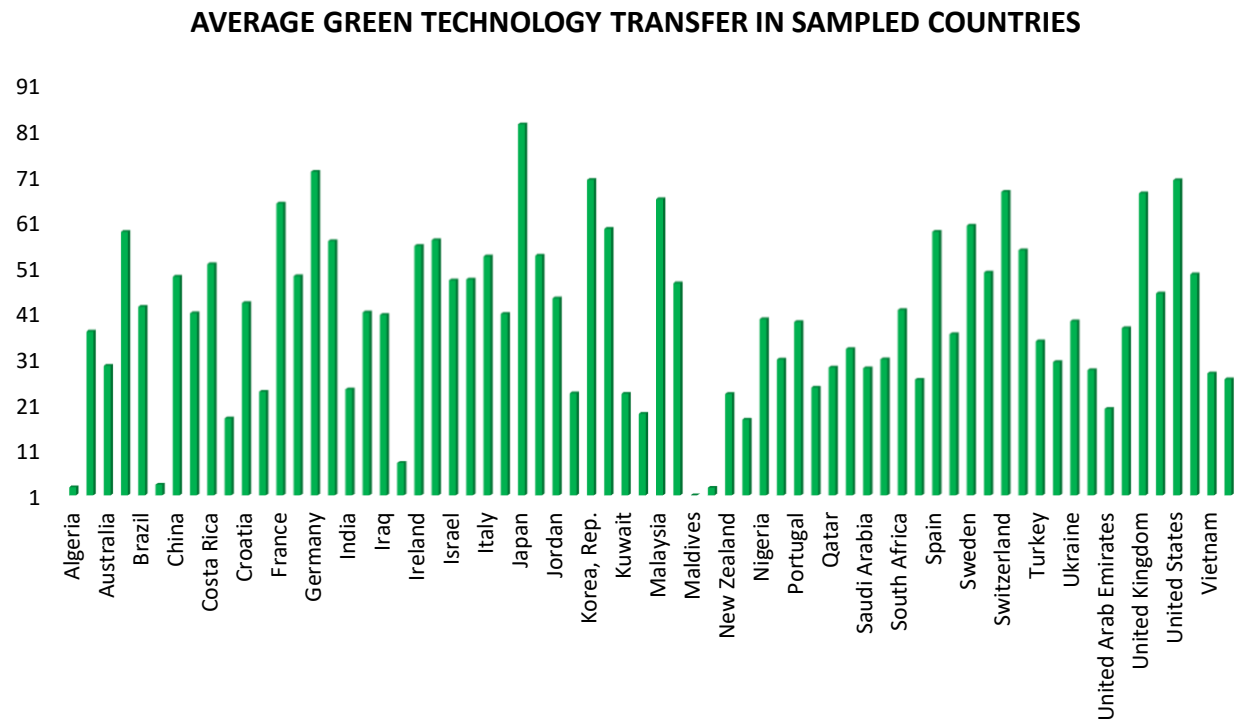
Instead of continuous utilization of such resources, an alternative would rather be encouraged to improve the quality of the environment while at the same time enhancing global technology in a wider sense. Such alternative is renewable natural resources. It is evident that renewable natural resources, unlike non-renewable ones, cannot be run out or exhausted even if used incessantly. They are sun, wind, solar, hydro, tidal energy, and others. According to International Environmental Agency (IEA), renewable energy resources produce less carbon emission, and they are a more sustainable energy system. Although, that energy is renewable does not mean it is sustainable. Sustainability is a multifaceted word and has diverse definitions and meanings of which few, such as environmental sustainability, economic sustainability, and social sustainability, would be smashed out to mention its diversity as related to sustaining renewable energy globally. While environmental sustainability implies that the utilization of renewable energy does not cause havoc in the environment nor harm the complete ecosystem, economic sustainability implies the production of renewable energy foster global economic growth while safeguarding the environment at the same time. Regarding social sustainability, there is enough production of food and energy for the globe through proper management of sustainable energy.

But the improvement in the global production capacities to promote economic growth have, in one way or the other, resulting in environmental problems such as global warming, and greenhouse gas emissions. Hence, to obtain a sustainable purpose for developing economic growth, green technology transfer has been put in place (Wang et al., 2021), because the principal

value of green technology, according to Abbas and Sagsan (2019), is to sustain the economic request of the society without comprising the quality of natural resources. Thus, the quest for green technology transfer replaces energy sustainable and economical energy production, thereby matter in global sustainability for renewable energy demands to diminish environmental emission (Jiunn et al, 2021). The alleviation of the ancient economic development model and improvement in the standard of living can be through green innovation which assumes an essential role in accomplishing the global sustainable development goals (UNCTAD, 2018). Initially, the essence of green technology focus on emission control and natural manageability (Braun and Wield, 1994), but integration of sustainable development that considers the environment, economy, and society, has been incorporated in its core values (UNCTAD, 2018).

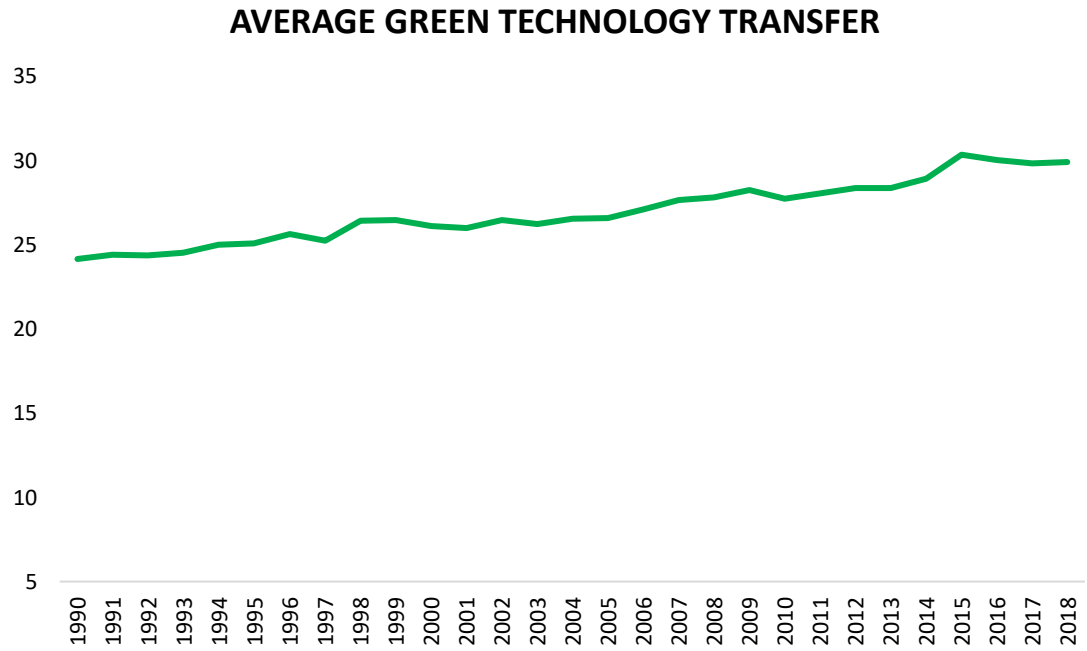
As a result of this development, energy policy around the globe have channeled efforts towards allocating resources to improve green technology transfer, although the trend in the development is not equal as the developing countries are still underway to meet the global expectation as indicated in the column chart in figure 1, it could be observed from the chart that Japan has the highest green import and export green tech follow by countries such as United Kingdom, United States, Korea Republic, Malaysia, and so on. While some countries such as Algeria, Maldives are very far from accessing green technology. Moreover, another trend is plotted in figure 2 to depict the development of green technology as the world moves on. Fortunately, as observed from figure 2, the green tech revealed upward movement meaning the world is moving at a very fast pace to eradicate unstainable energy systems. Thus, the Green Technology Transfer platform aims to assist the countries of South-Eastern Europe to meet international climate pledges by encouraging the transfer of low-carbon technologies from Japanese leaders in the field.

Figure 1: Column chart of medium and high technology across sampled countries in the world



Source of data: World Bank Development Indicator

Figure 2: Trend of medium and high technology across a period of years



Source of data: World Bank Development Indicator

2. Green Technology Transfer and Global Sustainability

The global quest for economic development is linked to the development and consumption of energy. And mostly, the supply of energy is from non-renewable energy such as

fossil fuels, which is causing havoc in the environment through its relationship with environmental emission (White and Walsh, 2008)). Undoubtedly, the production of these energy sources, e.g., coal rent, cannot only be depleted but also not sustainable at its peak (Bartlett, 2005). Therefore, it is in the interest of every country in the world to work on increasing the efficient use of energy to moderate its growth while its toxic environment is being diminished at the same time (Umar et al., 2020; Su et al., 2020). That is, the economic and socio activity that are not harmful to the environment needs to be focus on using advanced technology. The alternative way to this unreplenished energy is the incorporation of green energy or green technology (Mohd, Wira and Hooman, 2017). In a broader sense, technology can be utilized to innovate environmentally sustainable systems and control pollution in the environment, therefore sustainable energy must replace the unsustainable ones through innovation of new technologies which is referred to as technology transfer.

Green technology (GT), otherwise known as environmental technology or clean technology (Munn, 1992), can be broadly viewed as a field of new innovative approaches that make friendly the natural environment in day-to-day activity. It is made and utilized in a form that preserves natural assets and the climate. It is implied as an alternative source of innovation that lessens non-renewable energy sources and shows less harm to the human, production, and plant wellbeing, and lessens damages to the world (Podesta, 2007). The utilization of green innovation should diminish the measure of waste and contamination that are its utilization. According to Guo et al. (2020), the actual characterization of GT is precisely complicated, because of its vulnerability and inherent needs to meet the standard of the concerned policy makers and stakeholders. This complexity and inability to agree upon a precise and definite definition prone to difficulty in classifying GT (WIPO, 2019). Its definition is following the balancing different viewpoints on the instrumental nature of value.

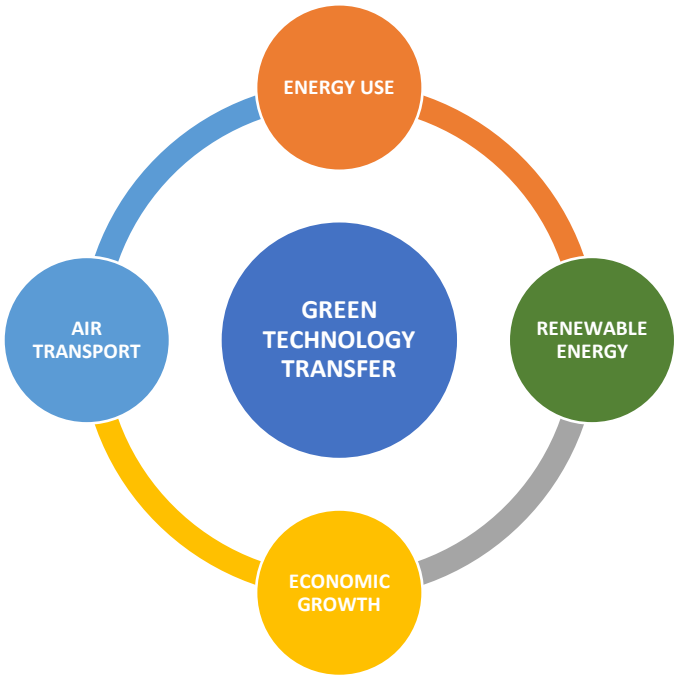
Therefore, technology served its purpose if natural resources are maximumly utilized without put into consideration, its undesirable impact on the natural world (Guo et al, 2020). However, Yu et al. (2019) posited that nature should have more ecological and intrinsic value with the concept idea of sustainability evolution of the environment. Thusly, the motivation behind GT is strengthening the harmony between humans and nature. Hence, any technology that achieves the need of society without depleting the future needs while also considering both humans and nature is, thus, generally, refers to as green technology (Borch et al, 2004). GT indicates the mechanical framework that can diminish contamination, develop products, and secure the environment, in this manner advancing the development of ecological civilization and the friendly harmony between man and nature.

Furthermore, in the process of solving global issues, for example, environmental change, ecological contamination, and wasteful use and exhaustion of resources, technology that improves economic activity and are environmentally less toxic while also preserving natural resources need to be employed by nations. This will be achieved through sustainable development which is associated with less ecological damage driven by international and local policies to employ GT, thereby accounting for future generations (Minjian et al., 2020). In fact, according to the report titled "Our Common Future" by The World Commission on the Environment and Development (WCED), sustainable development is termed "as the cycle of promoting the present and future development through the harmonious development between misuse of natural resources, and technological advancement and social change." Given this unique situation, "sustainability" is considered as a way ahead that permits humankind to meet current natural and human wellbeing, monetary, and cultural necessities without compromising the advancement and accomplishment of people in the future (WCED, 1987).

3. The broken link in Environmental Sustainability

One of the important purposes of the global sustainability agenda is to have a healthy community through the availability of clean air, a non-hazardous environment, and natural resources. As figure 3 shows, several aspects or determinants of environmental sustainability has been largely explored in the literature but with an omission of green technology transfer. Since global sustainability is all about strategic innovation that integrates economic and social development without harming the nature of the environment, achieving this goal will be subject to efficient energy use in all aspects of human endeavor such as air transport, economic growth, etc. Hence, reviewing the extant literature about the roles of energy use and air transport in the economy and environmental emission is essential in this study. There is a continuous increase in carbon dioxide (CO_2) emission from the consumption of non-renewable resources such as fossil fuels, and coal rents. These non-renewable energies are not sustainable, and it is difficult to have total control over them as they release toxic substances to the environment and affect climate conditions. A way to mitigate the emission is incorporating the efficient use of sustainable energy such as renewable energy which is a derivative of natural resources such as biomass, tidal, geothermal energy, wind, sunlight, ocean, rain, and green power, which is the electricity produced from natural resources without causing harm to the environmental quality (Dvarenjan and Herbert, 2017).

Figure 3: The broken link in Environmental Sustainability



Renewable energy, such as biomass, results in less environmental emission, and even no emission in the case of solar photovoltaic and/or wind power. A study conducted by Kelly (2003), and Moreno and Lopez (2008) revealed a significant and positive relationship between renewable energy supply and CO_2 emission. This means that the large integration of renewable energy into a sustainable system could result in a significant reduction in CO_2 emissions. Other studies have also investigated the connection between energy use, economic growth and environmental degradation which is mostly proxied by CO_2 emission, ecological footprint, and greenhouse gas emission. To start with, the study of Remuzgo and Sarabia (2015) showed that global CO_2 emission diminished by approximately 22% because of increased economic development. Contrary to this is the research of Azam et al. (2016) which is conducted in three countries – the USA, Japan, and India. The outcome showed a positive relationship between CO_2 and economic development. According to Sarkodie and Owusu (2017) to Energy use and economic growth also led to more consumption of carbon emission. Some studies also go to the extent of confirming a causality effect of economic growth and environmental emission. Sarkodie and Owusu (2016), using Sri Lanka as a target country, report a two-directional causality from energy use to industrialization and one-directional causality from carbon emission to energy use. This means that energy use is important for the growth of industrialization and the more carbon emissions released into the atmosphere, the more energy that would be consumed. On the contrary, evidence of long-run relationship and one-directional causality was firmly established from energy use to carbon emission (Mohiuddin et al., 2016; Gul et al., 2015).

Another strand of literature is the issue of energy use for sustainable economic growth, and several methodologies have been employed to come to contrasting results. Shiu and Lam (2004) in China, and Ho and Siu (2017) in Hong Kong, use growth hypothesis to conclude that energy consumption is essential to foster the economy of a nation; Ozturk and Acaravci (2010) had used transition economies as a case study to showed a neutrality hypothesis between energy use and economic growth, and Ozturk and Acaravci (2011) target MENA countries and conclude that energy use and economic are cointegrated in few countries such as Egypt, Israel, Oman, and Saudi Arabia. The Same outcome surfaced for all OPEC members in the study of Squalli (2007), but cointegration between energy use and economic growth occurs only in nine African countries in the study of Wolde-Rufael (2006) and all members of OECD countries (Kula, 2014).

Furthermore, air transport, through its impact on economic growth, is another important factor that could enhance global sustainability. In fact, according to International Civil Aviation Organization (ICAO), air transport is regarded as an indispensable key driver of economic, social, and cultural development. Certain studies in the past have worked on the relationship between air transport and economic growth using different methods. For example, Marazzo et al. (2010) study of air transport-economic growth nexus in Brazil revealed as the number of air transport increase, then the growth in the economy of Brazil upsurge. For OECD member countries, Küçükönal and Sedefoğlu (2017) revealed a different a positive impact of air transport GDP per capita growth. Also, Hu et al. (2015) and Baker et al. (2015) has also related a bidirectional causal inference between air transport and economic growth – that is, as air transport is important from economic development, economic development also boosts the air transport system. Even though a significant role in economic growth and industrialization is played by air transport, yet it is undisputable fact that the amount of bunker fuel release into the atmosphere always harm climate change and leads to loss of biodiversity (Mootien, 2012). Thus, finding from these reviews demand sustainable movement required the growth of the economy from energy use, but the energy needs to be properly conserved to lessen the greenhouse gas emission that environment unfriendly to humans.

4. Summary

Innovation is required to obtain the goal of sustainability (Walz et., 2017), and the achievement is stimulated by GT through the identification of environmentally friendly sources of growth through creating industries, jobs, and then technologies (Ghisetti and Quatraro, 2017). Sustainable development permits nations to continuously use technology for the betterment of the economy, society, and environment. Accordingly, the aim of sustainable green technologies is focused on reducing environmental hazards through the innovation of the high-quality product.

The sustainable society also benefited from this through the promotion of natural resources and the development of economic growth. With the steady emergence of environmental problems, the significance of sustainable green technology will always be recognized globally (Hyung and Baral, 2019). In this context, global sustainability required that green energies should be available and properly implemented in all countries around the globe. This is because the developing countries have little or no capacity to access new green technology, and therefore struggling to create a balance between environment and economy (Chen, 2018).

Consequently, for this purpose, green technology transfer is very important for defending the environment from losing its quality (Shan et al., 2021) while also conserving sustainable energy for present and future use. And to promote green technology transfer, diverse strategies are being employed by different countries, especially developed countries. For instance, according to Guo et al. (2020) and Wang et al. (2021), China has suggested Green Technology Bank (GTB) to help promote GT innovation. The GTB, as Guo et al. (2020), averred is to implement the UN 2030 agenda and Paris agreement; and to promote technology transfer, through innovation of science and technology, at a local and global scale. Additionally, Guo et al. (2020) posited that an established green investment bank in the United Kingdom (UK) render financial assistance to different industries for the promotion of green technology in the country. The United Nations Framework Convention on Climate (UNFC) has also launched a programme that is a channel on climate technology with the involvement of eighty-five countries (Guo et al., 2020, Shan et al., 2021).

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