

# Sustainable Development Goals Implementation and Technology Adoption: A Research Agenda in Vietnam

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**Abstract** The call of the United Nations' Sustainable Development Goals (SDGs) promotes action by governments and business organizations towards sustainable development. Indeed, the role of business is intertwined with various sectors of the economy, society, and environment because its activities span production, manufacturing, marketing, advertising, transportation, consumption, and recycling. Technology has significantly changed and expanded business operations globally. In particular, innovation has been affirmed as crucial to achieving the SDGs. This paper presents a literature review and the experiences of many countries and organizations. It discusses and examines the impacts of innovation and technology on sustainable development. To contribute to research in this field, the paper aims to identify positive results from innovation in achieving the SDGs in Vietnam. Implications for authorities and businesses are also mentioned.

**Key words:** Technology, SDGs, Sustainable development, Vietnam.

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## I. INTRODUCTION

The perspective on the trade-off between economic development and environmental protection has evolved with the concept of sustainable development (SD). The foundational idea of SD has been discussed for a long time. The generally accepted definition of SD is: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Brundtland report, 1987). This definition has been expanded across various sectors because of its significant impact on nature and society. By adopting the 2030 Agenda for SD, the United Nations (UN) called on countries to contribute to transforming the world towards sustainability, following 17 SDGs and their 169 targets (United Nations, 2023). This strategy supports governments and businesses in harmoniously and effectively fulfilling their roles in improving SD.

Innovation was affirmed as an essential driver factor of SD, especially in the context of industrialization and technological booming (Cordova & Celone, 2019). United Nations Industrial Development Organization (UNIDO) stated that promising industry 4.0 in sustainability development could affect all nations (UNIDO, 2018) because the fourth industrial revolution promotes manufacturing and production thanks to rapid prototyping technologies and intelligent technology application. Besides, industry 4.0 found the new way to develop, then it could balance environmental protection, social development and economic achievement. In order to achieve this advantage, thus, countries should transform into sustainable innovation in their 4.0 industry. Regarding developing countries, UNIDO suggested that transitioning from outdated technology to state-of-the-art solutions is a suitable approach. Indeed, the strong interest from governments, organizations, and researchers in SD promotes the adoption of sustainable practices and innovation. However, significant challenges remain, particularly for developing countries. Environmental quality continues to be a major hurdle for SD in some ASEAN developing countries due to the lack of clean energy technology applications (Sinha, et al., 2020). Additionally, a gap exists in SD efforts in Asian nations, as their innovation research has been more focused on productivity rather than environmental protection.

Concerning insight of business activity, companies are now pursuing sustainability either due to competitive pressure or governmental mandates, leading to positive outcomes. Innovations, hence, is the key to improving productivity through material and energy savings. In addition to solving immediate problems, innovation enhances production processes before issues arise. Nevertheless, sustainable consumption and production in Vietnam have received limited attention. Several Vietnamese companies, particularly large or multinational ones, have implemented sustainability practices and integrated sustainability information into their annual reports (Vu & Graham, 2023). To steer impose stricter environmental regulations on producers and educate citizens on sustainable consumption. Other obstacles include a lack of budget and technology. Regarding consumption towards sustainability, Vietnam needs to to SDG 13, the weather forecast system, technical infrastructure, observation systems, and forecasting technology have been significantly improved. However,

internal activities still face challenges such as insufficient participation from the private sector, inadequate legal frameworks, and budget constraints (Vu & Graham, 2023).

To bridge this research and application gap, this paper will discuss the interplay between sustainable development (SD) and innovation adoption, as well as the current circumstances in Vietnam, structured into four sections. Following the introduction, the overall research on the interplay between technology and SD is discussed. The third part addresses the research agenda for Vietnam, and the final section presents the promising application and expansion of green technology to achieve the SDGs.

## II. OVERVIEW OF INTERPLAY BETWEEN TECHNOLOGY AND SUSTAINABLE DEVELOPMENT

### 1.1. Technology in context of national sustainable goals

The concept of sustainable development (SD) began in the early 1900s with the idea of forest protection to control climate change. Gradually, it expanded to encompass many dimensions and goals. The 1987 Brundtland Commission meeting created the most widely accepted definition of SD. Since then, SD has gained significant attention, involvement, and commitment from numerous countries (Brundtland, 1987). In 1992, more than 178 countries attended the Earth Summit in Rio de Janeiro and developed a comprehensive plan for environmental protection and human well-being. In 2002, the Johannesburg Declaration on SD and the Plan of Implementation were established.

In 2021, members formed the UN High-level Political Forum on SD and proposed a set of SDGs at the United Nations Conference on Sustainable Development (Rio+20). In 2013, the General Assembly established a 30-member Open Working Group to develop a proposal on the SDGs. The year 2015 was a landmark year for SD, with 17 SDGs being revised (as shown in Figure 1) and attracting more than 170 nations. These SDGs, with their 169 targets, led to the creation of 3161 events, 1320 publications, and 6015 initiatives. Additionally, a system for SDG assessment was established, playing a crucial role in guiding countries and stakeholders to implement the global goals.



**Figure 1.** Sustainable development goals (UNDN, 2019)

The 17 Sustainable Development Goals (SDGs) are integrated to create triple-bottom outcomes across social, economic, and environmental sectors, and are considered a comprehensive solution for all nations. Countries can address issues such as poverty, healthcare access, gender inequality, climate change, and education because participants committed to prioritizing these goals to eradicate poverty, hunger, AIDS, and gender discrimination against women and girls in their national development plans. Additionally, the UN stated that to fully achieve the SDGs, creativity, know-how, technology, and financial resources are essential foundational elements. Currently, the SDGs encompass five fundamental pillars known as the 5Ps: People, Prosperity, Peace, Partnership, and Planet. Among these, people are considered the core focus, emphasizing human activities for sustainable development.

The goal 1 – No poverty aims to end poverty on over area. The goal 2 – Zero hunger achieves zero hunger, food security and sustainable agriculture. The goal 3 – Good health and well-being covers the achievement

of healthy lives and human well-being. Goal 4 – Quality education creates equal opportunity for education. Goal 5 – Gender equality aims to achieve gender equality. With Goal 6 – Clean water and sanitation, all human can access clean drinking water. Goal 7 – Affordable and clean energy ensures energy sufficiency and sustainable energy resource switch from unclear one. Goal 8 – Decent work and economic growth promote sustainable economic development and working environment through upgraded technology and innovation and higher productivity. Goal 9 – Industry, innovation, and infrastructure builds resilient infrastructure, sustainable industrialization and innovation. Goal 10 – Reduced inequality aims to reduce inequality of gender, religion, ethnicity, and economic status. Goal 11 – Sustainable cities and communication were set to create sustainable and resilient cities for all citizens. Goal 12 – Responsible consumption and production ensure sustainable production and consumption by efficient nature resource usage, chemical management, product life cycle management and others related. Goal 13 – Climate action calls for together combating climate change and global warming. Goal 14 – Life below water enhances marine life protection by stopping overfishing, reducing ocean acidification impacts, etc. Goal 15 – Life on land means protecting, restoring and promoting terrestrial ecosystem, forest conservation and combating desertification. Goal 16 – Peace, justice, and strong institutions has targets of removing trafficking, violence, and corruption. Goal 17 – Partnership for goals calls for cooperation and financial support between countries toward global sustainable goals.

Concerning the role of innovation in SD, (Silvestre & Țircă, 2019) highlight the essential role of technology in achieving the SDGs. Practical evidence shows that innovation acts as a decisive step in the SD process both broadly and deeply. For example, SDG 3 refers to lifelong education, and high technologies have been widely and strongly supported in this area. In Nigeria, (Bello, 2019) found that innovation promotes both scientific and practical knowledge acquisition. (Adams, et al., 2018) illustrated the relationship between blockchain technology and the achievement of the SDGs by nations. Regarding SDG 7 on energy consumption, solar energy is a key contributor to sustainable energy targets, as demonstrated by the adoption of solar cells in manufacturing in Japan and Europe. The interplay between innovation and SD has been clearly shown in many previous studies (Omri, 2020) (Zhang & Vigne, 2021). To meet the goal of SDG 11 – Sustainable Cities and Communities, technology plays an essential role. Building smart cities with smart homes, automated administration systems, and other high-tech infrastructure relies heavily on information and communication technologies (ICT). ICT is considered crucial for pursuing SDGs by spreading knowledge, enhancing productivity, and being a key innovation for smart cities (Wu, et al., 2018). Additionally, regarding SDG 13 – Climate Action, information technology enables access to big data on significant issues, resulting in better control of climate change, biodiversity, and more accurate forecasts through big data analytics (Wu, et al., 2018). Similarly, (Ganda, 2019) highlighted the essential assistance of innovation in achieving cleaner production and reducing emissions. High technology can undoubtedly improve productivity as well as support cleaner production.

## **1.2. Innovation in business context to achieve sustainability**

Private sector is considered the crucial seed for SDGs implementation by various involved activities, including, cleaner production, eco-product, sustainable supply chain management, social development program (Ike et al., 2019; Salvia et al., 2019; UNDESA, 2019; Topple et al., 2017). Indeed, business role is related to various sections of economy, society and environment because its activities include and spread from production, manufacturing, marketing and advertising and transportation, consumption and recycling.

The matrix between SDGs and innovation in the report of UN (UNDN, 2019) indicated which special SDGs are directly supported by innovation. Positive impacts of innovation on SD are not new and cover on various SDGs but not all 17 goals. According to statistics of UN, technology has affected nine SDGs with various dimensions in 17 SDGs. Energy efficiency may support SDG 3; SDG 7, SDG 9 and SDG 13 while green energy supply makes impacts on SDG 7, SDG 9, SDG 11 and SDG 13. Material efficiency supports to achieve SDG 3, SDG 9, SDG 11, SDG 12 and SDG 15. Water technologies contribute to achievement of SDG 3, SDG 6, SDG 11 and SDG 14 (Table 1). Furthermore disastrously, some SDGs have been not matched to technology application, including SDG 1, SDG 2, SDG 4, SDG 5, SDG 8, SDG 10, SDG 16, SDG 17. This signifies innovation has not been adopted in many sectors of SD and not taken its advantages.

**Table 1.** Matrix of SDGs and technological field

| SDGs/Groups         | SDG 3 | SDG 6 | SDG 7 | SDG 9 | SDG 11 | SDG 12 | SDG13 | SDG14 | SDG15 |
|---------------------|-------|-------|-------|-------|--------|--------|-------|-------|-------|
| Energy efficiency   | ✓     |       | ✓     | ✓     |        |        | ✓     |       |       |
| Green energy supply |       |       | ✓     | ✓     | ✓      |        | ✓     |       |       |
| Material efficiency | ✓     |       |       | ✓     | ✓      | ✓      |       |       | ✓     |
| Water technologies  | ✓     | ✓     |       |       | ✓      |        |       | ✓     |       |

Source: (UNDN, 2019)

### III. RESEARCH AGENDA OF TECHNOLOGY IMPACTS ON SUSTAINABLE DEVELOPMENT IN VIETNAM

#### 3.1. SDGs achievement in Vietnam

Vietnam has committed 17 SDGs at all levels, organizations, communities and the people. Among 150/169 global targets, Vietnam selected 115 specific targets that are suitable to Vietnam's economic and social development conditions. Although Vietnam is regarded as a lower middle-income country and most affected by climate change, Vietnam achieved outstanding results of SDGs. Vietnam is ranked 88 out of 149 countries; while in 2020, Vietnam was ranked at 49 among 166 countries and was the second nation after Thailand among ASEAN countries (UNDN, 2019).

According to 2018 report of Vietnam's voluntary national review on the implementation of the sustainable development goals, it is shown that Vietnam achieved better results from year to year. This is presented clearly in the table 2 – achievement of Vietnam SDGs in 2017 compared with 2015 according to in 2018. Among clear data of SDGs result in the table 2, Vietnam also achieved improvement in justice, education and environmental protection. However, the goal 10 to 17 have been not shown clear achievements as other goals. Moreover, these outcomes focus on reaching life standard at the average level rather than high standard.

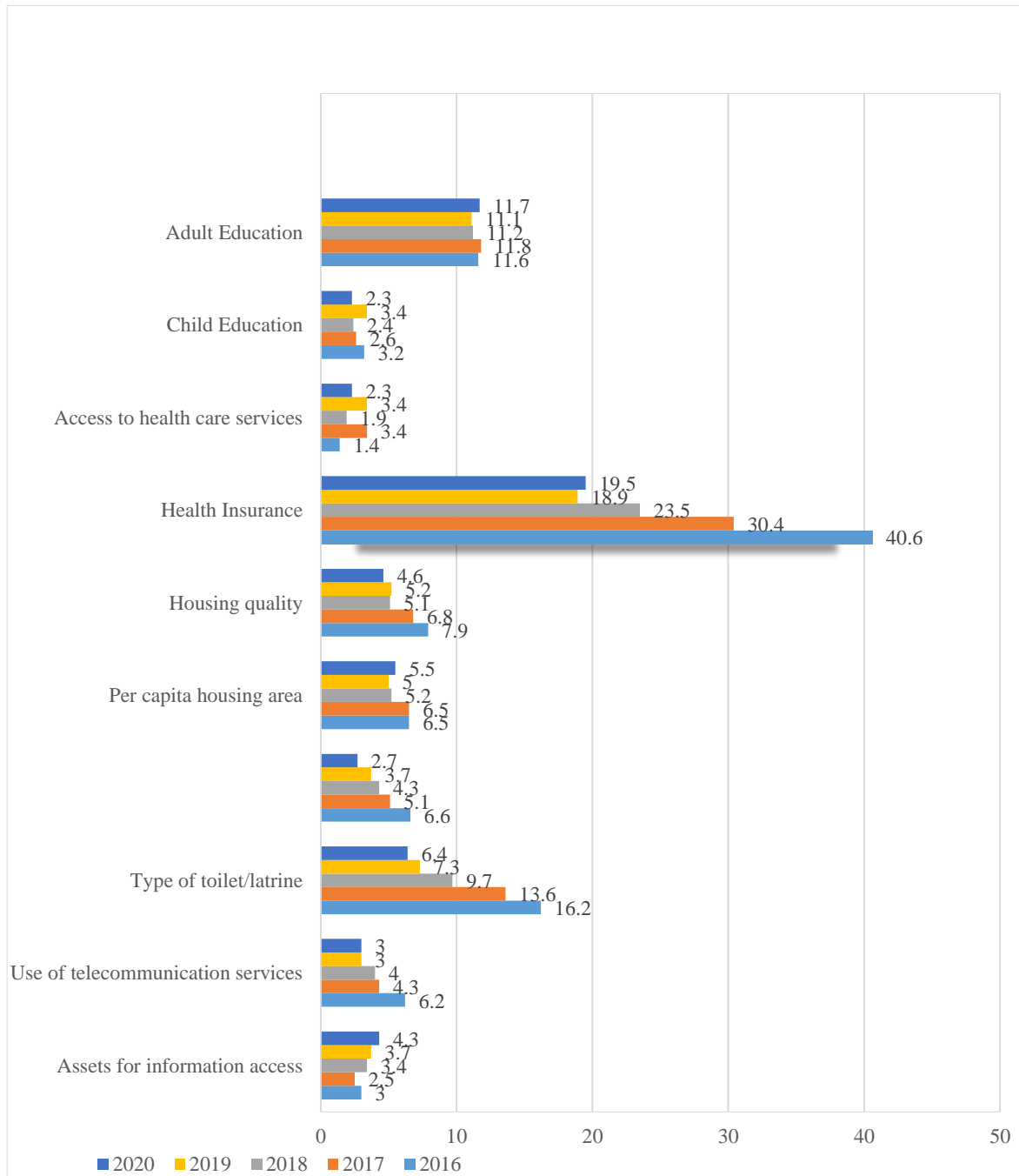
**Table 2.** SDGs implementation results of Vietnam

| SDGs          | Vietnam implementation results   |
|---------------|--|
| <b>SDG 1</b>  | Poverty rate: 9.9% in 2015 to 7% in 2017<br>Social insurance rate: more than 13.9 million  |
| <b>SDG 2</b>  | In 2017, food shortages of household number were down by 31.7%.<br>Number of households facing food shortages reduced by 31.7 per-cent compared to 2016. Under-five malnutrition (low weight for age) was reduced from 14.1 per-cent in 2015 to 13.1 per-cent in 2017. |
| <b>SDG 3</b>  | Under-5 mortality rate per 1000 live: decrease from 22.1 in 2015 to 21.6 in 2017<br>Health care insurance: 86.4%<br>Traffic accidents: declined by 7%  |
| <b>SDG 4</b>  | Primary completion rate: 99.7%   |
| <b>SDG 5</b>  | Women leader in the national assembly: over 30%<br>Ranking 87 of 156 countries in 2021, compared to 65 of 144 countries in 2016.   |
| <b>SDG 6</b>  | Safe water access: 93.4%   |
| <b>SDG 7</b>  | Electricity access: more than 99%  |
| <b>SDG 8</b>  | Internet cover: 54.2%  |
| <b>SDG 9</b>  | GDP: 6.8%  |
| <b>SDG 10</b> | Forest cover: 41.5%  |
| <b>SDG 11</b> | More dwellings for poor households<br>Better facilities of transportation<br>Upgraded urban facilities of road, electric grid, primary school system, healthcare system of clinics   |
| <b>SDG 12</b> | Green energy label of products<br>Applying sustainable public procurement  |
| <b>SDG 13</b> | More modern forecast system<br>Better forecast scenarios for wider regions   |
| <b>SDG 14</b> | More suitable regulations and laws to protect diversity of sea and land  |
| <b>SDG 15</b> | Forest conservation and deforestation<br>Reserve rare, endangered and precious species   |
| <b>SDG 16</b> | More accessible justice to citizens<br>Added more laws to enhance human rights   |
| <b>SDG 17</b> | Signed the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP)<br>Enhanced financial mobilization from other sources, including the private sector through Public-Private Partnerships (PPPs)  |

**Source:** (United Nations, 2018)

In particular, the poverty indicator has shown positive changes in recent years. The proportion of multidimensional poverty households in 2019 was reduced by more than half compared to 2016. Although there remains a gap between rural and urban areas, it has been narrowing. During 2016-2019, the proportion of

households deprived of basic social requirements decreased across various indicators, demonstrating that Vietnamese households gained better access to basic social services. For instance, health insurance, which had the highest deprivation level, saw a significant drop from 40.6 percent in 2016 to 19.5 percent in 2020 (Fig. 2). Health-seeking behavior and children's education are indicators that remain at the lowest deprivation levels. The deprivation levels of indicators such as assets, access to ICT, health-seeking behavior, children's education, and adult education have shown slight improvements over the years. These indicators contributed to multidimensional poverty in 2019, with adult education at 18.6%, improved sanitation at 17.7%, dwelling quality at 12.5%, and health insurance at 11.1% (United Nations, 2023). As a result, improvements in sanitation, health insurance, adult education, and dwelling quality have contributed to a better multidimensional poverty level in Vietnam.



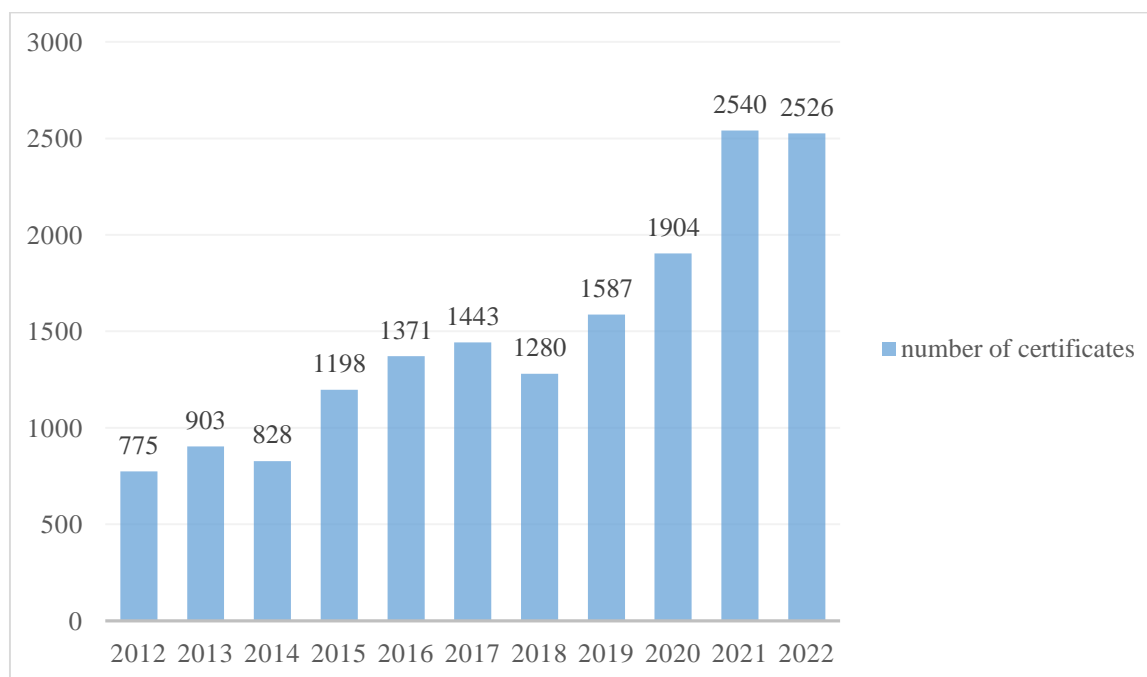
**Figure 2.** The proportion of household deprived in basic social requirement. Source: (United Nations, 2023)

### 3.2. Green technology and innovation adoption in Vietnam

According to the World Intellectual Property Organization (WIPO), in the Global Innovation Index (GII) rankings, Vietnam was 47th out of 127 nations in 2017, a jump of 12 places compared to its 2016 position. This achievement resulted from the government's efforts to encourage creativity in business and the application of

modern technology. However, to succeed in achieving the SDGs, Vietnam is advised to focus on quality-based growth through improved productivity, experience sharing, and technology transfer from developed countries (WIPO, 2024).

Indeed, in many industries, Vietnam has achieved significant advancements, which are necessary conditions for innovation adoption for sustainable development in a developing country. According to Vietnam's report, the country has completed numerous solar energy systems in various cities and provinces. By 2020, there were 9 GW of operational solar energy systems across Vietnam. The country plans to build a 20 GW solar energy system by 2030, accounting for 14% of the total national energy system (Dang, et al., 2021). Additionally, Vietnam has established various research programs for renewable energy, such as dye-sensitized solar cells (DSSC).



**Figure 3.** Number of Vietnamese companies getting ISO14001 certificate. Source: (ISO, 2024)

According to Resolution 13-NQ/TW on Building Synchronous Infrastructure Systems to turn Viet Nam into a modern industrial country by 2020 (VIETNAM MOIT , 2021), Vietnam has set up a smart city project based on four key factors: smart security, smart management, smart community, and smart homes. To date, many programs have been completed, such as the installation of traffic cameras on most main roads and highways, and the implementation of an online governmental administration management system for all services. Smart homes have been built in many major cities in Vietnam, with more than 280 hectares of smart homes in Ho Chi Minh City and Hanoi in 2019. Danang is planned to be part of the smart city network of the 32nd ASEAN Summit.

Sustainable development (SD) results can be evaluated by various dimensions, such as sustainable energy application, green products, and cleaner production. ISO 14001 is also a measure to assess environmental management and sustainable innovation adoption. This certification represents the application of an environmental management system in corporations. To achieve this certification, an organization must establish a defined environmental policy, appoint stakeholders for EMS coordination, ensure communication within the organization, identify the organization's environmental impacts, comply with environmental requirements, define environmental objectives, targets, and programs, plan to monitor and measure progress, conduct EMS performance audits, and commit to continuous improvement.

In Vietnam, there were only 775 companies in 2012 that achieved ISO 14001 certification, but this number tripled to 2,526 in 2022 (Figure 3). The dramatic increase in the number of Vietnamese companies obtaining ISO 14001 certification since 2012 highlights the growing concern for sustainable development in Vietnam.

### **3.3. Drawback of SD in Vietnam**

Despite the achievements in SDGs, Vietnam still lags behind other countries in technological application and sustainable development. Pay gaps between men and women are still prominent, and the productivity of various sectors is limited by the use of outdated production technologies. Vietnam has shifted to an integrated

water resource management approach to improve water quality, but water pollution remains a significant challenge.

Although Vietnam may reach the goal of affordable energy sources for all citizens by 2030. However, despite initiating policies toward sustainable and efficient energy use, Vietnam still falls behind many countries in efficient energy use and the exploitation of non-hydropower renewable energy. The ratio of renewable energy in the final energy consumption structure is currently very low at 0.4%, and nearly 2% of mountainous households cannot access electricity. Furthermore, infrastructure is lagging behind the country's rapid socio-economic development and remains fragmented and of low quality. Spending on science and technology research is still limited, accounting for less than 1% of the national budget.

Another drawback to sustainable development in Vietnam is the transportation sector, which emits high levels of greenhouse gases. However, the latter strategy has been implemented nationwide, attracting the participation of more than 9,000 enterprises in mining, steel manufacturing, food and beverage, chemicals, construction, and other processing industries (Vu & Graham, 2023). Vietnam has started to use "green" and energy-saving labels for electric and electronic products and is applying sustainable public procurement practices in accordance with relevant green economy standards. The Vietnam Sustainability Index (VNSI) was introduced by the Ho Chi Minh City Stock Exchange in July 2017 to evaluate the sustainability performance of 20 companies listed on the stock market.

Sustainable consumption and production have received little attention. Several Vietnamese companies, particularly large or multinational ones, have implemented sustainability practices and integrated sustainability information into annual reports. To orient consumption towards sustainability, Vietnam needs to impose stricter environmental regulations on producers and educate citizens on sustainable consumption. Other obstacles include a lack of budget and technology. Regarding SDG 13, improvements have been made in the weather forecast system, technical infrastructure, observation systems, and forecasting technology. However, there are still challenges such as insufficient participation from the private sector, inadequate legal frameworks, and budget constraints (United Nations, 2018)

All in all, despite of SDGs achievement, Vietnam is still lagged behind other countries in technological application as well as SD. Payment gaps between men and women are still prominent, while the productivity of various sectors and fields is limited and held back by use of out-of-date production technologies. Viet Nam has shifted into integrated water resource management approach to improve water quality but water pollution remains a big challenge for Viet Nam (United Nations, 2018). Furthermore, infrastructure is lagging behind the country's rapid rate of socio-economic development and remains fragmented and low quality. However, spending on science and technology research is still limited, accounting for less than 1 per-cent of national budget (Dang, et al., 2021).

### **3.4. Towards SD suggestions**

As a developing country, Vietnam still faces technological inequality and a significant gap with developed nations. Nevertheless, any country can take advantage of ICT to achieve SDGs (Nagasawa, et al., 2017). Vietnam has considered some next steps toward the 2030 Agenda in the 2018 SD report. To bridge the gap and achieve SDGs as planned by 2030, there are several suggestions for Vietnam, as following:

(1) **Education and Training:** The first step should be to educate and train society to heighten awareness of sustainability. Currently, SDG achievements come primarily from government efforts, but the involvement and coordination of the entire political system, governmental authorities, enterprises, researchers, and communities are more significant and effective.

(2) **Adopting 4.0 Technology:** Adopt 4.0 technology applications to build statistical indicators on SD. Information and data collection for monitoring and evaluating SDGs should be done through ICT. Another suggestion is the utility of blockchain technology, which could achieve both ecological and social results in business to meet national SDGs ( Ibrahim & Muftawu, 2021). SDG 8 is likely restricted by inadequate urbanization (Sinha, et al., 2020); therefore, this should be considered before implementing this national policy.

(3) **Continuous Cooperation and Learning:** Continuously cooperate and learn from the experiences of SD application from pioneer and developed nations. Vietnamese corporations and governmental authorities lack sufficient experience in SD; thus, learning and improving knowledge is a proper solution in this case.

(4) **Proper Combination of SDGs:** Last but not least, a proper combination of SDGs in SD strategies may be a suitable approach. Due to the shortage of financial, technological, and human resources, Vietnam could improve SD results by leveraging SDG combinations. Indeed, it has been illustrated that SDGs support and interplay with each other. For example, promoting SDG 7 (Affordable and Clean Energy) may help achieve SDG 13 (Climate Action) (Sinha, et al., 2020), so these goals should be pursued simultaneously. The focus on SDG 9 (Industry, Innovation, and Infrastructure) should be combined with the environmental awareness fostered by SDG 4 (Quality Education). Proper education can enhance public environmental awareness (Sinha, et al., 2020). Moreover, like other Asian countries, Vietnam should prioritize SDG 8 (Decent Work and Economic Growth),

SDG 9, SDG 7, SDG 4, and SDG 13 in its SDG strategy. These goals are interconnected, and developing them concurrently could maximize their advantages.

#### IV. CONCLUSION AND DISCUSSION

High technology significantly promotes sustainable development (SD). As an emerging nation, Vietnam should leverage technology to advance SD effectively and swiftly. Vietnam has actively engaged in the world's sustainable development strategy through commitments and agreements (Dang, et al., 2021). However, in the case of Vietnam, productivity remains low, and outdated technologies are still major obstacles to production and SD (UNIDO, 2018). Indeed, Vietnam's infrastructure has lagged behind that of other countries at the same economic development level.

Understanding the interconnectedness and compliance between SDGs is crucial for Vietnam to leverage technology for SD. For example, aligning SDG 7 (Affordable and Clean Energy) and SDG 4 (Quality Education) may facilitate the attainment of SDG 13 (Climate Action). Policymakers also need to invest more in R&D activities to approach renewable energy, enhance environmental awareness, and improve energy efficiency (Sinha, et al., 2020). Therefore, a strategy focusing on sustainable technological infrastructure, green production and consumption education, and allocating more GDP budget for these activities is expected to improve the SD situation in Vietnam.

This study discussed the promotion of innovation for SDGs but did not delve into the factors that drive this relationship. This would be an attractive topic for future research.

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