

## The Role of green digital finance in achieving sustainable development-presenting The experience of ASEAN+3 -

دور التمويل الرقمي الأخضر في تحقيق التنمية المستدامة-عرض تجربة منطقة ASEAN +3

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### Abstract:

The objective of the study is to present the most important techniques and mechanisms adopted by companies, economic, financial and banking institutions to operationalize the role of green digital finance as a strategy for promoting green finance through the interaction of the role of digitization within financing patterns. Several variables have emerged, such as the role of innovation and green financial technologies in promoting green finance. The ASEAN+3 region is a pilot experiment, in the context of achieving the sustainable development goals established within international initiatives and the United Nations Environment Goals under 2030.

**Keywords:** green digital finance, green finance, sustainable development, green financial technology;

**JEL Classification Codes :** R51, G21, Q01, O31

### ملخص:

تهدف الدراسة إلى عرض أهم التقنيات و الآليات المعتمدة من طرف الشركات و المؤسسات الاقتصادية و المالية و المصرفية، لتفعيل دور التمويل الرقمي الأخضر كاستراتيجية لتعزيز التمويل الأخضر من خلال تفاعل دور الرقمنة ضمن انماط التمويل. إذ برزت عدة متغيرات على غرار التكنولوجيات المالية الخضراء Green Fintech في تدعيم التمويل الأخضر و التي ترتبط بشكل وثيق بدور الابتكار في تدعيمها. تعتبر تجربة منطقة ASEAN+3 من أهم التجارب الرائدة في التمويل الرقمي الأخضر لما حظيت به من اهتمام في هذه المنطقة , و ذلك في اطار تحقيق أهداف التنمية المستدامة المقررة ضمن المبادرات الدولية و أهداف الأمم المتحدة للبيئة في اطار 2030؛

الكلمات المفتاحية: ، التمويل الأخضر ، التمويل الرقمي الأخضر ، التنمية المستدامة، التكنولوجيا المالية الخضراء؛

تصنيفات JEL : R51, G21, Q01, O31

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### **INTRODUCTION:**

The issue of climate change and the challenges and risks facing the societies that have emerged from it, extending over the coming decades, has been one of the most important focus of the economies of nations today. Through this, the financial sector plays a key role in this challenge, especially as it calls for it to be addressed within global initiatives and for the achievement of sustainable development goals in accordance with the Paris Agreement. In this context, green finance is an effective tool to promote the transition of economies to sustainability and to promote the adoption of clean technologies and sustainable environmental practices.

Green finance has interacted with several technological variables, particularly in the context of the fourth industrial revolution, by highlighting the concept of "green digital finance" among the priorities of financing systems that allow the use of digital technologies and financial innovation to support projects and initiatives through the role of green financial technologies, aimed at promoting environmental and social sustainability. Among these factors, green digital finance stands out as an effective means of achieving sustainable development goals according to several considerations;

The study seeks to highlight the importance of green digital finance in the context of achieving sustainable development goals according presenting the ASEAN's experiences. The main focus of the study will be to address the following question:

- **How does green digital finance contribute to the achievement of the ASEAN sustainable development goals as an experiment?**
  - Following are the following **sub-questions**:
    - What's the concept of green digital finance? What's the relationship between green digital finance and green finance? ;
    - What efforts are made to support green digital finance practices in the ASAEN region?;
  - **The hypotheses** could be formulated:
    - Green digital finance is an extension of traditional green finance through the use of digital technologies to enhance efficiency and transparency ;
    - Financial technologies will be used for green digital finance in the ASAEN region;
- Objectives of the study:** The main objectives of the study are:
- Presentation of the concept of green finance, financial technology, "financial technology" and green digital finance;
  - To highlight the importance of using green financial technology to improve the green finance of the clean projects;

**Importance and methodology of the study:** The importance of the study is reflected in its introduction of an important topic: the relationship between green digital finance and sustainable development in order to provide green technology-based financing. Through the adoption of the analytical descriptive approach within the study sections

**Structure of the study:** In order to address the merits of the study, the division of the study is as follows:

- **Section I:** Green finance and digitization: basics;
- **Section II:** The role of green digital finance in promoting sustainable development;
- **Section III:** Green digital finance in support of the ASEAN sustainable development goals;

<b>Abbreviation: ASEAN +3</b>	ASEAN +3 countries. This group includes the ten member countries of the Association of Southeast Asian Nations (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam), in addition to China, Japan, and South Korea.
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**1- Green finance and digitization: the basics;**

Given the challenges of climate change, green finance has been considered as one of the most important points for achieving sustainable development. In this context, governments and international organizations have tried to strengthen it within the framework of the decisions of the Paris Agreement of 2015. Green finance has been affected by several special factors of the Fourth Industrial Revolution.;

**1-1 The concept of green finance:** several definitions of green finance have been provided, the highlights of which can be presented as follows:

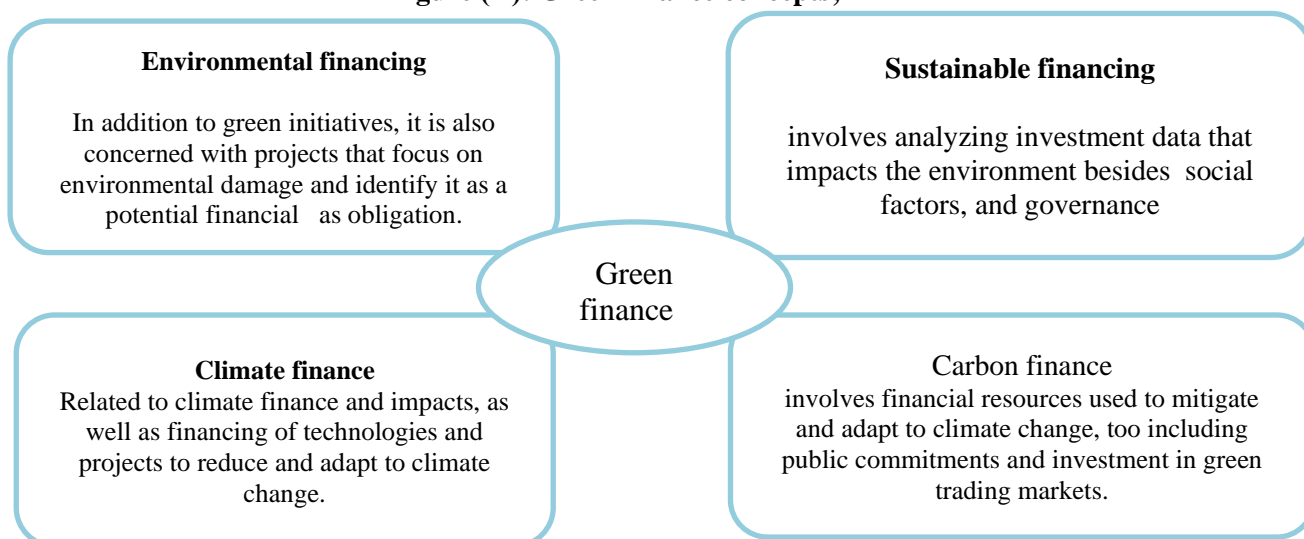
- Green finance includes channelling investments to projects and initiatives that promote sustainable development, as well as the adoption of environmental products and policies that contribute to a sustainable economy. It also includes climate finance (Lindenberg, 2014, p. 1)

An essential component of this is to boost the management of environmental and social risks, capitalise on opportunities for a satisfactory rate of return and environmental advantages, and ensure greater accountability. (UN)

Also, The Swiss Federal Ministry of the Environment (**FOEN**) defines” **sustainable green finance**”: as providing financial products and services that consider environmental, social, and governance factors in risk management and decision-making, promoting responsible investments with a positive impact on the environment, society, and governance :(UNEP, 2016, p. 13)

**1.1.1 Differences in green finance concepts;** The concepts of green finance are interlinked by including several elements of an integrated tariff problem. These concepts can be presented in the following form:

**Figure (1) : Green finance concepts;**



**Source:** Prepared by the researchers on the basis of:

- UNFCCC, iied, 2019« The case for a functional definition for climate finance », Submission to the Standing Committee on Finance by the International Institute for Environment and Development,

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- Charlene Wastsin and others, , Feb2021 «The Global Climate Finance Architecture», climate Funds Update, p32

Among previous concepts, green finance promotes the reduction of the carbon footprint by supporting projects focused on resource efficiency, waste reduction and, in addition, the protection of ecosystems. By integrating environmental and social factors into investment analysis, this provides investors with sustainable opportunities. It stimulates innovation in renewable energy, financial technologies and green infrastructure ;

**1-2 Digital finance:** refers to The innovative use of various products, applications and business models in the financial services sector, which develops traditional banking methods; (Commission).

- **Digital finance** also includes financial services that use smartphones, computers and reliable payment systems to promote financial inclusion and poverty reduction, moreover to promote financial stability and sustainable growth. (Hidajat Sofyan, Dwi, 2022, p. 56).
- The McKinsey Report 2016 has highlighted digital finance as product integration with fintech and customer interactions, for the purpose of promoting affordable services;

### **1.2.1 Digital Finance Objectives :**(Ozili, Peterson K, 2021, p. 2)

- Boosting financial inclusion.
- Expanding formal financial services to non-financial sectors.
- Providing affordable, safe banking services in developing countries.
- Achieving macroeconomic stability.

**1-3 Green digital finance:** It's using advanced technologies like big data, mass chains and Internet things to promote sustainable financing and encourage the efficiency of the financial system. By investing in carbon neutral assets and clean energy projects. )www.bbva.com (2024

- Within an associated framework, **sustainable digital finance** includes the provision of finance and institutional support through market mechanisms that promote technological ecosystems. It uses digital payment platforms, group financing and peer-to-peer lending, using big data, as well as artificial intelligence, automated learning, digital symbols and mass chain technologies. This promotes sustainable, balanced and inclusive growth and facilitates the achievement of development goals; (Ryan K.Merrill , Simon JD Schillebeeckx, 2022, p. 9)

In general, the term "**green digital finance**" refers to the trend of investments, institutions, applications and innovations aimed at using digital technology to enable investment in projects and initiatives that have a positive impact on the environment and society. The concept also includes a range of financial innovations and digital technologies that facilitate financial processes and green investment, thereby promoting sustainable project financing;

### **1-3-1 The importance of green digital finance:** Its importance is several points :

- **Supporting environmental sustainability initiatives:** such as renewable energy projects, ensuring natural resource sustainability, and reducing carbon emissions, is crucial for safeguarding the environment and mitigating adverse effects;
- **Promoting Green financial technologies (Green Fintech):** including green digital finance, improve resource efficiency, capital allocation, transaction transparency, and foster

low-carbon economies. This approach also creates new market demands and opportunities for innovation ; )Lili Wang, Yuwei Yan(76 صفحة ،

- Digital finance aids in the development of innovative green banking products and investment strategies utilizing digitization and technology;

**1-4: Technology techniques of green digital finance:** There are many techniques and financial technology - FinnTech - that are used to stimulate green digital finance and to improve its efficiency through the development of green financial technology, including:

**Table (1): Technology techniques of green digital finance;**

Technical	Description
- Blockchain and Green Block chain	Distributed databases enhance transparency, reduce costs, and are ideal for green finance applications. DLT advances decentralized cash transactions and smart contracts, while Green Block Chain promotes environmental sustainability.
Open banking APIs , Robotic Process Automation, Cloud computing	<ul style="list-style-type: none"> <li>- Cloud computing enables remote access to IT services, allowing users to access large data volumes and utilizing scalable, cost-efficient, fast, and reliable processing platforms.</li> <li>- Robotic automation is the use of a program to automate repetitive tasks, particularly those in the back office.</li> <li>- Open banking APIs could revolutionize financial services by allowing third-party access to client data, promoting competition and innovation, and enhancing consumer control over financial resources.</li> </ul>
IoT ( Internet of Things) and Big Data	Big data and IoT collect intricate information for real-time business insights, enabling smart computers to perform complex tasks and perform tasks not part of their routine operations.
Machine learning and artificial intelligence	Utilize advanced computer science techniques and algorithms to analyze vast data sets, forecast market trends, automate decision-making processes, and offer suggestions for enhancing decision-making abilities.

**Source:** Prepared by the researchers on the basis of:

- Sarmah, simanta Shekhar2018,, « Understanding Block Chain Technology », Computer Science and Engineering, p50.
- Sustainable Digital Finance Alliance2018,,” Digital Technologies for Mobilizing Sustainable Finance, Applications of Digital Technologies”, report, , p 13-14

**1-5 The role the implementation of digital technology and innovations in green finance:**

Digital technology drives innovation in green finance and improves efficiency and accuracy in data collection and analysis. It enables real-time monitoring of environmental impacts and sustainability performance, allowing financial institutions and investors to assess risks and returns associated with green projects. FinTech generates new business models and tools, while improving the security of transactions under the smart contract and Block chain. Industrial intelligence and automated learning are in line with the needs of individual users, thus facilitating the distribution of sustainable financial products.; (Lili Wang, Yuwei Yan, 2023, p. 76)

**1-6 Green financial technologies to enhance the role of green digital finance;**

Banking institutions and financial markets use various specialized techniques within sustainable digital transformation with the need for good risk management, particularly in the context of the fourth industrial revolution. These techniques are adapted to more effective environmental systems and benefit from technical knowledge in the market and the new economy to achieve sustainability. The most important of these techniques are:

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**Table (2): The green digital finance technologies;**

Technology	Description
<p><b>Sustainable digital payment</b></p>  	<p>Block chain based payment systems provide a sustainable alternative to cash payments, enabling secure, fast and affordable transactions without a central intermediary. That reduce carbon emissions, regulate procurement, mitigate illicit economies and activities, and enhance user identification requirements, transparency and accountability, making digital payments a safer option. One of the most important platforms is Alibay, Paytm, WeChat pay, Paygreen, Doconomy,</p>
<p>Green crowdfunding platforms</p>	<p>It refers to platforms through which financial resources are pooled by institutions and persons. This money is leading Peer To Peer as Loans, One of the most important green energy collective financing platforms is Energy4impact, Greenwaste, Windcentralle, Lindosphere Ecomill (Italy) Abundance (UK) Bettervestm Ricenow for investment in environmentally friendly projects, but this type of financing still needs a regulatory aspect.</p>
<p>Ant Forest technology</p>	<p>It began in 2016, and it is China's most significant digital innovation aimed at reducing carbon emissions, promoting reforestation, and alleviating poverty. The Alibay programme finances tree and agro-environmental projects, which attract more than 550 million users. Users earn "green spots" by engaging in low-carbon activities, such as online billing. These procedures have been converted into "green energy" for cultivating virtual trees.</p>
<p>Green Robo-Advisors</p> 	<p>Financial consulting programmes provide for the reduction of the cost of conservative management services using algorithms to determine optimal strategies. These programmes are particularly suitable for small investors, identifying investors on the basis of investment orientation, size, product preferences and risk preferences. Robotic advisers such as LIQID and VusualVest focus on sustainable investments, while German Chancellor Vivedam focuses on sustainable investments. Investors are also assessed on the basis of environmental and social standards and good interim environmental and security management.</p>
<p>ESG Digital ESG-Data and -Analytics Solutions</p>	<p>The company offers automated solutions for collecting green data, analyzing financing, and classifying green assets, offering ESG ATM ratings, carbon accounting, ESG classification for SMEs, automatic credit registration, and climate risk control. One of the most important of these platforms is Impaakt, Satelligence</p>
<p>Green Digital Risk Analysis and Insur-tech</p>	<p>Green insurance programs use AI, IoT, and satellite images to model and forecast climate and nature risks, enabling real-time risk assessment, pricing, and response. Predictive analyses and insurance technology solutions also facilitate risk mitigation and prevention, while smart contracts simplify insurance subscriptions and payments. Greenomy, Clarity AI, Central Bank of Spain One of the most important platforms ;</p>
<p>Green Reg-Tech</p>	<p>Technical service institutions utilize technology to address issues such as money laundering, fraud prevention, proactive reporting, information and communications technology security, and credit rating. Financial regulatory bodies also utilize digital technology to oversee markets and monitor banks, intermediaries, and other financial institutions, commonly known as SupTech.Three prominent institutions utilizing this technology are the Grenomee Foundation, Claretti, witch utilize this tech;</p>
<p>Green Digital Asset</p>	<p>Green asset encoding involves digital representation of real and intangible assets, including carbon credit and biodiversity. Solutions like green safety code display platforms offer ownership of fragmented green assets through automation and smart settlement.</p>
<p>Green bonds and green digital bonds</p>	<p>Blockchain-based green bonds address data transparency and efficiency concerns for both green bond exporters and investors, enhancing transparency and simplifying data collection for green investment.</p>
<p>Green digital currencies</p>	<p>Green encrypted currencies, using Blockchain technology, offer eco-friendly alternatives to traditional currencies, reducing carbon footprints, energy consumption, and promoting sustainable investment, making them attractive for environmentally-conscious individuals. Of these types of coins: Chia ,Cardano Lumen ,Stellar Lumins, Algondra, Nano ;</p>

Green digital deposit and lending solutions

Digital loans offer financial resources for green investments and enterprises, including digital solutions for mortgages utilizing digital technologies.

**Source:** Prepared by the researchers on the basis of:

- Kisters, S. (Ed.). (2023, 04 06). The Green Impact of Digital Payments - Promoting Sustainability and a Greener Future. Retrieved from originstamp: <https://originstamp.com/blog/the-green-impact-of-digital-payments/#the-benefits-of-digital-payments-for-the-environment>
- Data-pop alliance, Sustainable Digital finance Alliance, 2022, "DIGITAL Technology Shaping Green and sustainable Lifestyles: Exploring ALIPAY FOREST", p6-7
- Gregor Dorfleitner, Diana Braun, 2019, "Fintech, Digitalization and Blockchain Possible Applications for Green finance", p211.
- Farhad Taghizadeh-Hesary, Suk Hyun, 2022, "Green digital finance and Sustainable", Economics, Law, and Institutions in Asia Pacific, p10, Singapore
- Green Digital Finance Alliance, Swiss green Fintech Network, 2023, "Green Fintech Classification", p 6-11,
- Iberdrola, 2024, "Green cryptocurrencies", <https://www.iberdrola.com/sustainability/green-cryptocurrencies>

## **2- The role of green digital finance in promoting sustainable development;**

The Brundtland Commission's 1987 report on environmental issues led to the concept of sustainable development, focusing on balanced economic, social, and environmental development. The Paris 2015 and Rio 20+ Summits emphasized the importance of sustainable development, committing states to include sustainable plans and programs to achieve sustainable goals. These commitments are part of the permanent updating of the Sustainable Development Agenda to 2030.

**2-1 The concept of sustainable development;** There have been multiple definitions of sustainable development, including:

- The United Nations Commission on Environment and Sustainable Development focuses on development that meets current needs without compromising the ability of future generations to meet their own needs; )UN ,un.org(2024 ,
- It can also be defined as: "a set of principles and protocols aimed at advancing society towards a more favourable state through the utilisation of eco-friendly technology, in order to harmonise the utilisation of natural resources with the preservation of human well-being." With the aim of achieving this equilibrium both domestically and globally; ( عيسى يونسى، عائشة عماري، عائشة ميطر, ) 2021, p. 63)

**2-2 Sustainable development goals:** sustainable development pursues a several of objectives, the most important of which are: (مصطفى سلام عبد الرضا، حيدر محمد كريم، 2021، صفحة 131)

- Improving national income and maximizing production at lower costs ;
- Reconciling population growth with economic growth by controlling growth pace far from available resources;
- Linking modern technology to societal goals for resource conservation, pollution reduction, and climate stabilization;
- Promoting job creation to promote macroeconomic and sectoral development policies;
- Encouraging sustainable consumption and production patterns, and promoting sustainable sectors;

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### **2-3 The role of green digital finance mechanisms in achieving sustainable development goals;**

Green digital finance is a key component of the digital revolution, driving change towards a sustainable economy. It channels investment, provides innovative financial solutions, and improves risk management, financing green projects and meeting sustainable development goals. This approach is compatible with various fields. Green digital finance could play the following role in achieving sustainable development goals:

- Technology is critical to digital transformation, through the promotion of sustainable financing, digital integration into financial systems and the provision of secure digital infrastructure, which ultimately leads to the sustainability of payments and digital currencies; (UNDP, 2019)
- Green digital finance promotes sustainable development by modernizing industrial frameworks, often accompanied by organizational enhancements and ongoing refinement of the program; (Yubo Xiao, Muxi Lin, 2024, p. 5)
- Green Digital Finance: Promoting Financial Inclusion and Environmental Balance;
- Provides financial services to vulnerable groups, contributing to economic and social equity;
- Enhances management of renewable energy resources, forests, and water, preserving environmental balance;
- Contributes to the development of sustainable financial products and services, like green banks;
- Enhances marketing function, promoting investments in environmental projects and financial sustainability;

### **2-4 Mechanisms to support the shift towards green digital finance to achieve sustainable development goals;**

Several countries are endeavouring to implement technological solutions in order to alleviate the overall tensions resulting from environmental and economic challenges. These nations are experiencing growing pressures from industrial and urban advancements, which are compelling them to create advanced and innovative programmes, methods, and inventions. Additionally, they are initiating efforts and forming collaborations to tackle these intricate global challenges. The foremost of these initiatives are:

- **The Global Financial Inclusion Initiative:** aims to improve digitalization, particularly in cybersecurity, digital finance, financial services, and electronic payments;
- **The Green Finance Initiative of the City of London:** outlines the role of green financial technologies in collaboration with the Green Finance Committee and the China Finance and Banking Society to promote technology-based innovation applications to achieve green finance outcomes;
- **The Sustainable Digital Finance Alliance :** The Sustainable Digital Finance Alliance, a Swiss public-private partnership, aims to promote digital finance for sustainable development by stimulating market innovation and policy actions, addressing barriers to sustainable finance expansion, and fostering sustainable investments in the real economy;



- **Financial Centres for Sustainability FC4S:** a network of 16 financial centres, aims to accelerate green and sustainable finance expansion by sharing expertise in green digital finance, testing green asset portfolios, and improving efficiency and transparency;
- **The Green Digital Finance Corporation:** founded by ANT Financial and the UN Environment Programme, aims to promote digital technology dissemination to fund the Paris Convention on Climate Change and environmental conservation. The Global Finance Fund will enhance its green digital finance presence through policy participation, financial technology center networks, and piloting;
- **The Swiss Innovation Laboratory:** in Technical Science at the University of Zurich is a multidisciplinary research centre focusing on banking, finance, informatics, law, regulation and economics to address issues of the digitization of the financial system through advanced methods, the dissemination of innovative ideas and the strengthening of links with policymakers and industry experts; ( Swiss FinTech Innovation, Lab , 2022, pp. 1-2)
- **The UK Greening, Finance and Investment Centre (CGFI)** is a national initiative aimed at facilitating the swift adoption and utilization of climate and environmental data by international financial institutions; (fintechnorth.uk)

**3. Digital green finance to support ASEAN+3 sustainable development goals;**

ASEAN+3 is one of the most important models for the use of financial and digital technologies in green economy areas. The region is increasingly moving towards a broad adoption of strategies aimed at supporting green finance in the hope of reducing the negative effects of global warming and enhancing sustainable resources. It is considered to be one of the States that adhere to international resolutions. In addition, the ASEAN region has some of the most interdependent digital markets in the world. The location is attractive financial privacy creates an attractive investment environment, and total investment in the Association is expected to grow at a composite annual growth rate of 12 % between 2023 and 2030. Also 4.5 % in China, 5.7% in Japan and 3.3 % in South Korea, This will double total capital from US\$ 962 billion in 2023 to over US\$ 2.1 trillion by 2030. Digital infrastructure is a prerequisite for sustainable digital finance:

**Table (3): Frontier Technologies Readiness Index**

Country Name	Rank 2022	ICT Rank	Skills Rank	R and D Rank	Industry Rank	Finance Rank
Singapore	3	7	8	17	4	17
Korea	6	15	26	3	9	7
China (Hong Kong)/ china	9/35	9/117	23/92	29/1	2/8	1/4
Japan	19	10	51	7	13	3
Malaysia	32	30	64	28	7	16
Thailand	49	40	90	46	41	10
Philippines	54	94	79	52	3	80
Vietnam	62	69	117	41	23	11
Brunei	69	54	38	95	97	93
Indonesia	85	102	107	50	47	97
Cambodia	112	122	123	121	95	14
Mynamar	133	132	143	107	101	118
Lao people's	134	130	134	152	56	133

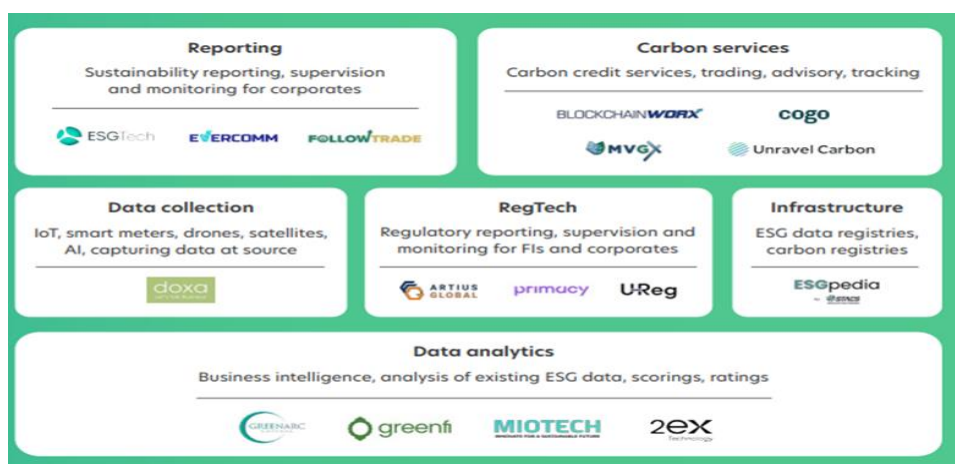
**Source:** Prepared by the researchers on the basis of: UN, 2023, " Technology and Innovation report2023: Opening green windows Technological opportunities for a low-carbon world", p 154-165

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The previous figure represents the level of readiness of digital infrastructure (information and communication technology), skills, research and development, industrial capacity, and financing. The image illustrates the key indicators of the infrastructure needed to develop the green digital finance industry. The indicators, especially for Singapore, China, and particularly the Hong Kong region, as well as Japan, rank very high among the indicators, while there are countries in the region that occupy lower positions. Sustainability is considered a matter of great importance for investors in the ASEAN+3 region. Where green financial technology (green FinTech) companies offer innovative solutions to help businesses and governments tackle the challenges and opportunities related to the shift towards sustainability;

Green FinTech companies, which use innovative technologies to enable financial processes and products, have grown significantly. They provide environmental benefits and contribute to a zero-carbon economy. They can help organizations meet the need for high-quality sustainability reports that are certified by regulatory bodies and are reliable and transparent in aspects such as carbon data. Among the leading companies in the South Asia region :

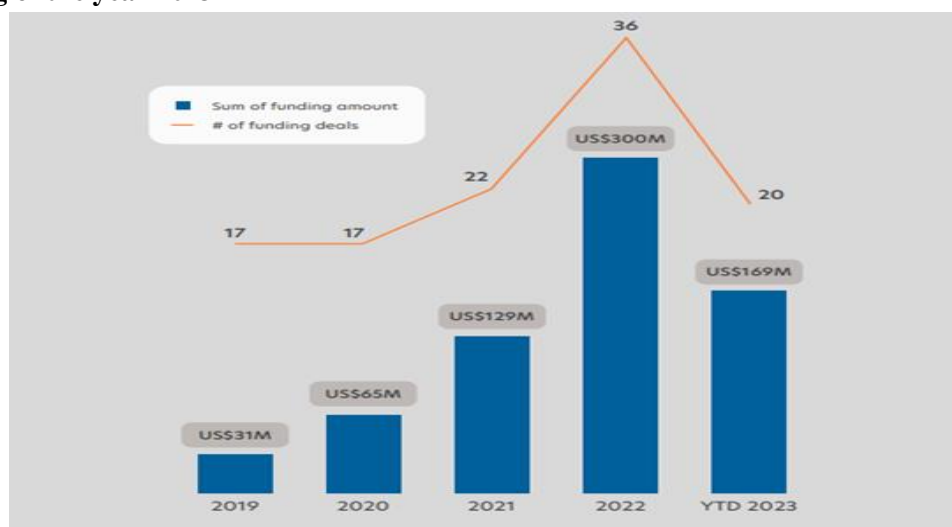
**Figure (1): leading companies in green fintech service providers in the ASEAN+3**



**Source:** UBA, PwC, SFA, 2023, "Fintech in ASEAN 2023: seeding the green transition", p16;

The above figure represents the leading companies in green FinTech in ASEAN+3 region. It is active in many activities related to green innovations in sustainable investments. For example, sustainability reporting, supervision and monitoring companies, such as ESGpedia, provide these green companies to comply with private environmental and security management regulations by providing advice and accounting on carbon emissions in line with global protocols. In addition, the ESGpedia platform is designed to provide a digital assessment of sustainable transactions and explore sustainable digital tools. Data collection from the most important DOXA is an emerging financial technology company based in Singapore. The company brings together buyers, suppliers and financiers on its corporate platform, Doxa Connex, to help digitize the procurement process in the overall payment process. By taking advantage of the cloud of computing and small services... Carbon credit, consulting and consulting services, such as Carbon Unravel, are a company that uses AI and data science to simplify carbon accounting and carbon removal. Its strength lies in its focus on emissions, which helps improve tracking and transparency across the entire value chain, and improve data quality;

Figure (2) : ASEAN+3 Green fintech and green technology financing trends , 2019 - since the beginning of the year 2023 Million \$



Source: UBA ,pwc,SFA,2023, "Fintech in ASEAN 2023:seeding the green transition", p13;

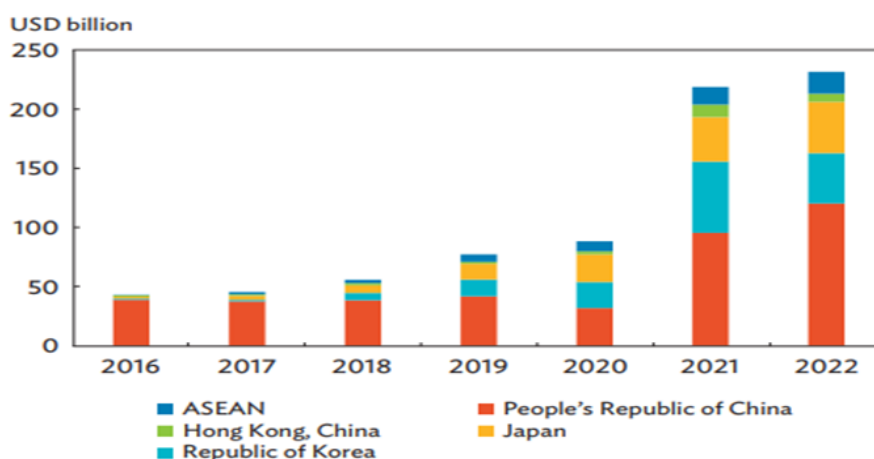
The curve shows the developments in the volume of investments for green fintech companies in ASEAN+3. The funding reached 169 million dollars in the first quarter of 2023, while it was 300 million dollars in 2022, marking an increase of 36% compared to 2021. While it reached 65 billion dollars and 31 billion dollars in 2020 and 2019, respectively. This indicates a growing interest in sustainability projects, particularly in finding the necessary funding sources for these initiatives. Also, refer to the regulations related to climate, government support, and environmental community awareness. Especially the nature of the climatic region. In light of this, the efforts of technology companies have focused on adapting their products within this framework. This indicates the adaptation and green financing initiatives to support efforts for the transition to sustainable energy. The funding volume for both Singapore and Indonesia accounted for 86% of the total funding, representing 80% of the total deals. As for Indonesia, it accounted for 27% of financial support and 16% of total transactions in 2023. Vietnam and Malaysia witnessed moderate growth in their share of the number of deals, with Vietnam achieving 6% and Malaysia increasing by 4%.

In China, more than 50 billion dollars are invested annually in clean energy innovations. Several technological partnerships have also been formed in the fields of sustainable energy and green digital finance. Just as technology giants in China, such as Tencent, Baidu, and Alibaba, are driving sustainable development through digital technology and green innovation. More than 60 organizations are using financial technology to support green finance initiatives nationwide. (دخول الصفحة 2024 ، 2024 ، daxueconsulting.com)

The investment in South Korea's green technology sector in 2023 reached the equivalent of 459 billion dollars. With 96 green companies in the finance and technology sector, in addition to 1,100 public agencies in the field of sustainable consulting. (statista.com (2024 ؛

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Figure (3): ASEAN + 3 sustainable bond issuance in 2022 by economy



Source: [https://asianbondsonline.adb.org/documents/abm/abm\\_mar\\_2023\\_recent\\_developments\\_asean3\\_sustainable\\_bond\\_markets.pdf](https://asianbondsonline.adb.org/documents/abm/abm_mar_2023_recent_developments_asean3_sustainable_bond_markets.pdf)

The figure shows the total issuances of sustainable bonds, which represent the most significant sustainable investments. The total issuance of sustainable bonds by the Association of Southeast Asian Nations + 3 reached 231.5 billion USD in 2022, an increase of 3% from 2021, when the issuance volume was 220 billion dollars. It is noteworthy that the issuance volume remained below 100 billion USD during the years 2020, 2019, and 2016. The share of ASEAN +3 in global sustainable bond issuance rose to 27.2% in 2022, with China leading the total issuance volume, accounting for over 51% of the region's total issuance, which reached \$120 million, up 5% from 2021. As for the ASEAN region, it is largely driven by an increase in issuances from governments in the major ASEAN economies. The share of ASEAN in regional sustainable bond issuance rose to 8.0% in 2022 from 6.8% in 2021. Japan's issuance reached \$60 billion in 2022, down 3% from 2021, with its issuance percentage at 25.9%. As for South Korea, its issuance rate reached 21.5% with a total issuance of 50 billion dollars, down 50% from 2021. Sustainable bonds are considered one of the most important funding sources for sustainable projects. They are issued extensively through financial markets and crowdfunding platforms, and thus rely heavily on technological innovations in the sector; (asianbondsonline.adb.org, 2024) The volume of green bond issuance in the region, especially in the ASEAN area, has exceeded 41 billion dollars. The Malaysian company Renikola is considered the first to issue climate bonds amounting to 390 billion Malaysian Ringgit in the form of (investment, sustainable, and responsible bonds) ; (www.thestar.com.my, 2024)

On February 7, 2024, the Hong Kong government issued nearly 5.9 billion dollar in digital green bonds. Multi-currency bonds denominated in US dollars, euros, Hong Kong dollars, and renminbi, making it the world's first multi-currency digital bond issuance. This allows for disclosures of green bonds through the digital asset platform, enabling access to the main green bond documents and thus providing access to information; (sustainablefutures.linklaters.com, 2024) .In 2022, the first digital green bonds were issued by a Japanese company ("JPX"), the first green bonds to be digitally tracked ("GDTB"), secured by tokens and stored on the blockchain, in order to enhance the security and transparency of issuing sustainable smart bonds ; (www.fsa.go.jp, 2024)

It is traded through digital platforms to facilitate operations, among the most important of which are:

- **Asian Green Bond Platform (AGBP);**
- **Renewable Energy Bonds Platform in Asia (REBA);**
- **Green Bond Trading Platform in the Middle East and North Africa MENA GBBP;**
- **The Green Bond Platform in India IGBP;**
- **The Green Bond Platform in Singapore SGBP;**

There are many crowdfunding platforms that focus on supporting green and sustainable projects. These platforms provide opportunities for individuals and companies to invest in environmentally friendly initiatives. Among them:

- **Funding Societies;**
- **KitaBisa ;**
- **Alix Global;**
- **Ata Plus ;**
- **Crowdonomic ;**
- **Eureeca;**

The sustainable robo-advisory market in the ASEAN +3 region is projected to reach a total value of \$22.54 billion by 2027, indicating a significant increase in financial resources from the automated consultancy market. The market is also predicted to experience a compound annual growth rate of 9.12 percent from 2024 to 2027, with an estimated 1.65 million users by 2027 ; (www.statista.com, 2024). Here are some prominent sustainable robo-advisors for socially responsible investing and environmental, social, and governance (ESG) investing: (theimpactinvestor.com, 2024)

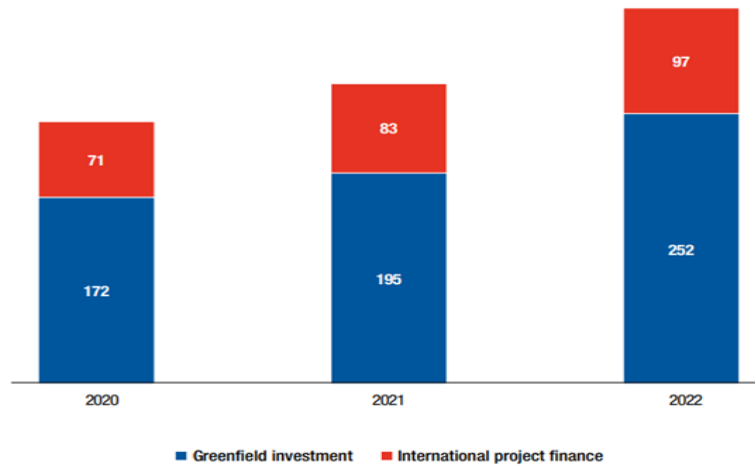
- **EarthFolio:** A sustainable platform that focuses on environmental, social, and governance factors in green projects;
- **Personal Capital:** It works to support sustainable capital through prudent financial planning;
- **Wealthfront:** Provides sustainable consulting for projects, while optimizing investment strategies;
- **Marcus Invest;**

Encouragement has been given to the element of innovation in the green financial technologies sector, contributing to the digitization of sustainable investment financing by promoting the sustainability of environmentally friendly projects. This has contributed to making the ASEAN+3 region attractive for investment;

These green digital financing mechanisms have clearly allowed to encourage sustainable investment, this is shown by:

## The role of green digital finance in achieving sustainable development-presenting the experience of ASEAN +3 as a Pioneering experience

**Figure (5): International investment in the sectors of the Sustainable Development in ASEAN, 2020-2022**  
unit: one billion dollars

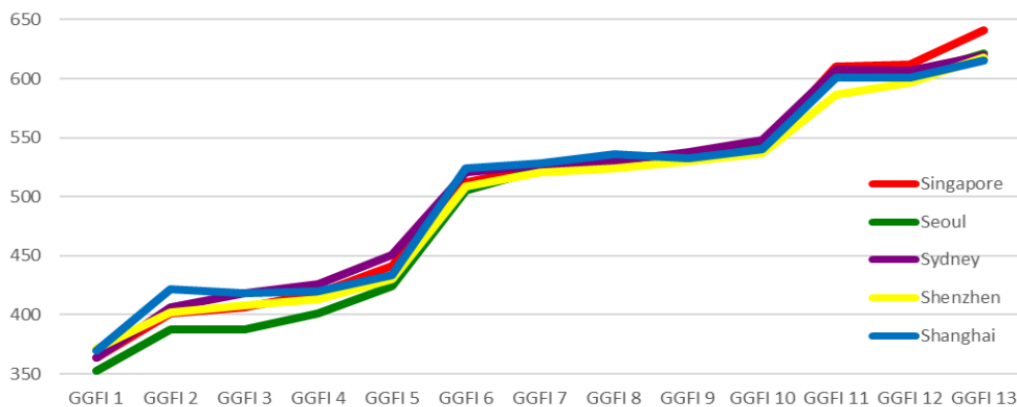


**Source:** UN, ASEAN ,dec 2023, ”a special ASEAN investment Report 2023”, p28.

The previous figure shows the overall magnitude of investment in sustainable projects within the ASEAN region. Over the past two years, there has been a significant rise in international investment in the sectors related to sustainable development goals in the Association of Southeast Asian Nations (ASEAN). This increase is evident through the development of new investment projects and international project financing deals, which have collectively amounted to approximately \$97 billion. In 2022, there was a 26 percent increase in the number of these projects, totalling 349. A substantial portion of the announced investment was allocated to new sustainable sectors. These industries have established a conducive environment for attracting investors;

The interest in the green digital finance sector and sustainable financing has expanded access to funding for investors in the region. This has contributed to the development of infrastructure for environmentally friendly and green projects, in addition to supporting the transition to a green economy, which is considered the modern trend. In analyzing this development, the green economy index is considered one of the most important indicators.

**Figure(5) : the top five rankings of GGFI in Asia-Pacific centers**



**Source:** Yen, Long finance, 2024, ” The Global Green finance Index”,p 40-46;

The previous figure represents the top five rankings of Asia-Pacific centers over time according to the Green Economy Index. Where the development of the index appears concerning countries, especially in the ASEAN region. The Global Green Finance Index(GGFI) is an evaluation index that relies on a set of core factors, including quantitative metrics, as well as a worldwide survey of assessments provided by experts in green finance. It aims to assess the quality and extent of green finance services offered in financial hubs. The centers that excel in the Public Investment Fund are typically institutions that are dedicated to promoting environmental advancements both within the economy and through direct financial support. The allocation of resources towards energy efficiency, sustainable infrastructure financing, environmental, social, and governance analytics, and the withdrawal of investments from fossil fuels has been categorized as dedicated and determined. Singapore's position in the top 10 of the leading group with rating more than 600. Malaysia ranks 63rd with a score of 579, Thailand 72nd with a score of 552, the Philippines 69th with a score of 550, and Indonesia 65th with a score of 560 in the GGFI 13 index. Furthermore, five countries from the Asia-Pacific region are included in the top 20 ranking, As for Beijing, it ranked 31st, and Tokyo 41st, with a rating 612 and 602. What highlights the role of sustainable financing in developing the fundamentals of this indicator is tracking its evolution, which also shows that the shift from sustainable financing to sustainable digital financing, within the context of global digital adaptation and revolution, plays a role in contributing to the funding of renewable and clean projects, which in turn is crucial for achieving the dimensions of sustainable development;

**Conclusion;**

The study explores the role of green digital finance in achieving sustainability. It emphasizes the positive interaction of digital transformation within green finance, directing financial resources towards sustainable projects and green infrastructure. The focus is on the ASEAN +3 region, a key global digital market, as it plays a significant role in utilizing green financial technologies, thereby enhancing green development and sustainability.

**Results of the study:** According to the study:

- Green digital finance depends on several techniques, including artificial intelligence, digital financial technology platforms, mobile phone platforms, the Internet of things...<sup>4</sup>
- There is a link between green digital finance and sustainable development, through its contribution to channelling finance into projects with an environmental dimension, which reduce the carbon footprint and finance green infrastructure and thus enable the achievement of sustainable development goals;
- The diversity of green financial technologies contributes to attracting as many investors as possible in sustainable projects. Given his ability to reach different financial centres;
- Global organizations focus on promoting green digital finance, through the development of pilot clean technology programmes, techniques and innovations, the development of initiatives and partnerships that respond to environmental problems and preserve sustainable development goals;
- Financial technology not only helps to drive inclusive and sustainable development in the global economy, but can also be used to help preserve nature and support a wider green transition;
- ASEAN +3 is one of the most important pilot experiences in translating green digital finance into sustainable development;

## **The role of green digital finance in achieving sustainable development-presenting the experience of ASEAN +3 as a Pioneering experience**

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### **Recommendations:**

- Given that technological techniques have several particular problems with electronic and cyber security, fraud through phantom platforms, accompanied by green numerical antelopes, appropriate controls and policies have been put in place to reduce them;
- The problem of the digital divide and the indicators of readiness and infrastructure remains one of the consequences of limiting the role of green digital finance in achieving objectives, so this need to be reviewed;
- The need to consider provisions for green digital finance through government and regulatory programmes designed to promote market access, competition and technological innovation;

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