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Impact of FinTech on Sustainable Development

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Abstract: Since the global financial crisis of 2008, we have observed a very rapid increase in use of digital technologies in the finance and development of FinTech companies, and similarly the impact of climate risk on banking. The aim of the paper was to examine the impact of FinTech on achieving sustainable climate and social goals through innovative financial instruments. FinTech can boost the development of green finance, which addresses environmental protection or climate change and has become an opportunity for industrialised countries to achieve sustainable growth. Finally, this paper presents the positive and negative impact of FinTech on the sustainable growth perspective. To assess the impact of Fintech on sustainable finance, the authors carried out a critical analysis of the latest literature and reports of financial institutions.

Keywords: banks, new technologies, FinTech, sustainable growth.

1. Introduction

Since the global financial crisis of 2008, we have observed a new trend in the financial sector focused on the business model related to digitalisation and FinTech (Thakor, 2020). Similarly, an emerging topic in the literature is the impact of climate risk on banking (BIS, 2021). The FinTech revolution brought new factors that influenced the financial sector and had an impact on sustainable growth. Apart from the typically indicated features, such as decreasing costs, FinTech has attracted increasing attention for its potential in accelerating more sustainable economic growth. However, FinTech has had both a positive and negative impact on the sustainable growth perspective. Therefore, the aim of this paper was to investigate the impact of innovative financial technologies (FinTech) on sustainable development.

It has been argued that FinTech companies are able to tackle key environmental and climate issues. FinTech may boost the development of green finance, which addresses environmental protection and climate change, and has become an opportunity for industrialised countries to achieve sustainable growth, due to its ability to reduce information asymmetry for investors interested in green financial products (Yang, Su, & Yao, 2021). Merello, Barberá, and De la Poza (2022) also suggested that FinTech companies are more willing to be involved in green finance since it has a positive impact on their market and book value. There are numerous FinTech companies that have already begun offering green investment opportunities for their clients, or are even solely focused on such investing (the so-called "Green FinTech"). This includes different financial innovations, e.g. crowdfunding platforms (Crowdfundres), blockchain (Climatechain), robo-advisors (VisualVest or LIQUID), and mobile payment platforms (Alipay's Ant Forest campaign) (Dorfleitner & Braun, 2019; Muganyi, Linnan, & Sun, 2021). These green activities of FinTech companies include: promoting green finance through green credit or green investment, improving carbon emission trade, encouraging clients to participate in green finance projects, promoting environmentally friendly consumption. Although the research on the impact of FinTech companies on the environment is in its early stage, the recent results indicate that such companies may have a beneficial effect on issues such as carbon dioxide emissions (Tao, Su, Naqvi, & Rizvi, 2022) and the "resource curse" (Zhou, Zhu, & Luo, 2022). This is especially evident in the more developed regions, where establishing FinTech is easier because of the already existing infrastructure, market regulations or higher availability of capital (Muganyi et al., 2021; Zhou et al., 2022). However, there also exists a 'dark side' of financial innovations, for example due to high electricity demand and consumption of energy generated from carbon fuels cryptocurrencies contribute to higher emissions of carbon dioxide (Tao et al., 2022).

This paper used as a research methodology a critical analysis of the latest scientific papers and reports of international financial institutions (published in 2017--2022) on digital techniques and sustainable financing. Firstly, based on the available

literature (academic articles and reports of international financial institutions i.e. BIS, FSB, IFC), this paper defines the basic concepts related to FinTech and sustainable development. Secondly, the authors tried to find both a positive and negative impact of FinTech on the sustainable growth perspective. Despite the relevance of the topic, empirical works in this field remain quite scarce. The paper also addresses the issue of social gap digitalisation (United Nations, 2021), and contributes to the literature on the subject by identifying the strengths and weaknesses of the use of FinTech in sustainable development.

2. New technology in the financial sector and sustainable growth: basic definition

Technological progress has caused the appearance of new competitors for traditional banks. There are banks which use FinTech technology as an additional distribution channel, as well as new banks (neobanks) which do not have traditional branches. Neobanks are not burdened with older infrastructure and can use new technology at lower costs, faster and in a more modern format. Furthermore, one can distinguish between BigTech and FinTech companies. BigTechs are large companies that operate platforms enabling direct interaction among large numbers of users and have many lines of business. BigTech companies usually enter the financial services market thanks to brand recognition. Their core business is usually non-financial, nd lending is only part of it, often a small part (BIS, 2019, p. 63). Notably, technological giants such as Amazon, Apple and Google, which already operate in the lending market, have great potential for the development of financial services because they have access to a huge amount of customer data. For this reason, there is no single, universal definition of FinTech and it is defined by the services and products it co-creates (Harasim, 2021; Pawłowska & Staniszewska, 2021). However, the broad expansion of FinTech functionality has extended this definition. The Financial Stability Board (2019, p. 1) defines FinTech as "technologically-enabled financial innovation that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions, and the provision of financial services".

Thanks to the use of digital technologies, FinTech companies can provide banking services at lower costs than traditional banks and increase competition in the financial market (Goetz, 2018).

In the EU and in other parts of the world the process of digitising the public and private lives of citizens have been speeded up because of the pandemic. Parallel to the development of new technologies, the concept of sustainable development is developing worldwide. The concept of sustainable development was introduced by the United Nations Brundtland Commission in 1987. Sustainability was defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (UN, 1987). Since then, pressure on the

environment has greatly increased, mainly due to the climate change, transformation of wildlands into agriculture areas, industrial demand for water and energy, lack of global waste management and rising global household consumption. Actions undertaken to sustain resources and environmental quality for future generations are insufficient. The ongoing climate summits, declarations and protocols are proof of how policy makers act ineffectively in a global framework. Unfortunately, developing countries cannot afford expensive new technologies, although their resources has been exploited by rich countries for centuries. In fact, only through introducing innovations and lowering the demand driven by China, India and the West would give chance to "next generation to meet their own needs". However, lower demand ends up with hampering economic growth (Teachout, 2021).

The goals of sustainable growth are incorporated in the agendas of over 140 countries (UN, 2022). Besides imposing regulations and declarations there is also a need for financing. The financial market has provided a solution for financial of social and environmental projects that do not obtain capital in current corporate or sovereign budgets, namely Social Impact and Green Bonds. The investors and issuers of these instruments are mainly players connected to the market or business activity. In 2007, a group of UN experts published a report "Innovative Finance for Sustainable Development". The experts underlined the insufficient involvement of private sector and public-private partnerships. They pointed to the transactional costs in fundraising process as a barrier for many 'life-changing' projects. The reason for these costs is that information asymmetry causes limited access for entities who seek investment opportunities in the projects supporting sustainable growth. At the same time, the issuers are unable to reach an effectively wide range of investors willing to be part of green or social projects. FinTech enabled the emergence of crowdfunding for artistic and start-up purposes. The same mechanism can be driven for ecological or social initiatives, however on a bigger scale. Currently, only institutions that include sustainable growth goals in their mission can become intermediaries for such projects, as the scale of financing is limited to a deposit base or support from governmental agencies.

Understanding and appreciating the gravity of the current environmental and climate problem has led to the emergence of green finance. IFC (2017) defines green finance as financial instruments that provide environmental benefits. Green finance is intended to provide investment, financing and operating funds for environmentally-friendly projects. Environmental protection and the effective use of resources are considered as important as traditional criteria while evaluating the project (Zhou, Tang, & Zhang, 2020). Through green finance, idle social capital is distributed to various economic industries such as renewable energy and green building (Wang, Zhao, Jiang, & Zheng-Zheng, 2022). The importance of green finance is constantly increasing as it is seen as an important channel for industrialised nations to achieve sustainable growth (Muganyi et al., 2021).

A notable example of green financial instruments are green bonds. Over the last few years, the experience around the world has shown that they are a key instrument of green finance and can offer sufficient funding for green investment by balancing costs between current and future generations (Flaherty, Gevorkyan, Radpour, & Semmler, 2017). Since the inaugural issue of the Climate Awareness Bond by the European Investment Bank, green bonds (both corporate and public) have become more and more popular. Globally the green bond market grew by an average of 50% per year in the period 2015-2020 (Spinaci, 2022).

FinTech contributes to the development of green finance by reducing information asymmetry for investors who value natural assets (Yang et al., 2021). This may lead to unlocking access to new sources of finance and investment from a larger investor base for environmentally friendly projects (Dorfleitner & Braun, 2019). There are already existing several initiatives in Europe that analyse how FinTech can be used to enhance green finance (the Climatechain in France tries to determine the potential of blockchain technology in achieving the goals set by the Paris Agreement; CrowdFundRES initiative analyses the challenges faced by renewable energy projects and provides guidelines regarding regulatory frameworks).

Crowdfunding is a financing mechanism in which entrepreneurs, small businesses or projects gather the necessary funds from a large number of contributors through the crowdfunding platform (Belleflamme, Lambert, & Schwienbacher, 2014). The main advantage of crowdfunding platforms is the fact they have lower fixed and transaction costs than larger financial institutions. Similarly to robo-advisors, one can distinguish green crowdfunding platforms that offer green financing options or are exclusively dedicated to sustainable financing. There exist several crowdfunding platforms that specialise in sustainable crowdfunding – Oneplanetcrowd (the Netherlands), Abundance (the United Kingdom), and Ecrowd (Spain). Some of the green crowdfunding platforms are dedicated to narrower fields, for example, financing renewable energy projects, such as: Lumo (France), Enerfip (France), Bettervest (Germany), Econeers (Germany) or Trine (Sweden). Despite the increasing significance of crowdfunding for environmentally friendly projects, the scale remains small. Larger crowdfunding platforms, such as Kickstarter, lack precise categories for sustainable projects.

The category of FinTech that plays an increasingly important role in green finance are entities based on blockchain technology. Blockchain can be defined as a distributed ledger which records and stores transactions across a peer-to-peer network. Transactions are verified by each node of the network and are compiled in a block. Then they are added to the existing block of chains in a permanent way certified by cryptographic signatures. The main blockchain applications in green finance include peer-to-peer financing and investment platforms, peer-to-peer trading platforms and measurement, reporting and verification (MRV) of impact data (Dorfleitner & Braun, 2019). As regards the peer-to-peer financing and investment platforms, a notable example is Cryptoleaf which is a platform specialised in

financing green projects. Examples of green peer-to-peer trading platforms include: Climatecoin, Poseidon, WePower and SunContract. Another branch of blockchain--based companies are those providing services of MRV of impact data. Companies such as Green Assets Wallet and IXO facilitate the validation of the green impact of a given project.

3. FinTech, green finance and sustainable development: new trends

The Paris Agreement, adopted in 2015, stated that currently the greatest challenge faced by governments is their ability to achieve environmentally friendly and economically sustainable strategies, technologies and innovations. The relationship between technological progress and ecological environment has two sides. On the one hand, technological progress has been a source of environmental degradation, and on the other, it is suggested that technological advancement may become a solution to various environmental problems.

3.1. Sustainable bonds markets

The constant growth of green and social impact bonds market creates opportunities for FinTech solutions. Currently, bonds are mostly issued by local issuers (governmental agencies/governments, ethical banks/trusts, large-scale non-financial corporates, NGOs) for sectoral investors operating on the same market. The diversity of goals, values, maturities, ratings and sales methods create a certain barrier for unspecialised investors, hence providing a niche for FinTech to support sustainable growth in creating a standardised marketplace for Social Impact Bonds (SIB) and green bonds, where institutional investors have access to projects from around the world. To demonstrated how unintegrated these markets are, it is worth mentioning that specialists face problems with the accurate estimation of the market size. An attempt to unify the data can be a step forward towards building fundations for one funding platform for diversified bonds available for diverse investors. Growing GSS+(Green, Social, Sustainable and Other Labeled)[1] debt volume above USD 1tn in 2021 proves that despite the pandemic, the market remained active. What is more, COVID-19 pushed public and governmental attention to environmental issues, which clearly seen in the rapid upsurge of green bonds. This market reached USD 2.8tn cumulative volume. However, in terms of the number of bonds issued in a particular market, the highest position belongs to social bonds; these were smaller projects diversified geographically.

Sustainability and social bonds reached a similar level of outstanding volume – approximately USD 0.5 tn. However, sustainability goals gathered approximately double the funding per one issuer (Climate Bond Initiative, 2021, p. 8). The data

[1] GSS+ bonds relate to debt instruments dedicated to finance sustainable projects.

presented in Table 1 and Figures 1 and 2 are drawn from reports for the Climate Bond Initiative.

It should be noted that green bonds are mainly issued in EUR due to the green targets set by the European Commission that members shall meet by 2050 (more than half of the green bonds that originated in 2021 came from Europe). The average size of an individual green bond reached USD 250m. Half of the 2021 green bond volumes originated in Europe, which contributed USD 265bn (50%) to the total. The most aggressive growth in the region came from financial corporate (136%) and sovereign (103%) issuer types. Six European countries added sovereign volumes in 2021. In 2015, sustainable bonds were issued mainly on the EU market which is visible in the currency used. With time, when instruments became more popular globally, a major role will be played by USD and EUR.

Table 1. Size of sustainable bonds markets

	Green	Sustainablity*	Social*	SLB	Transition
Total size of the market	USD 1.6tn	USD 520.5bn	USD 538.8bn	USD 135.0bn	USD 9.6bn
Number of issuers	2045	425	861	225	15
Number of instruments	9886	2323	3471	317	32
Number of countries	80	51	44	37	12
Number of currencies	47	38	33	16	7

(*) Numbers are approximate as are derived from two incoherent databases 1. Social and Sustainability Bond Database 2. Green Bond Database. Source: Climate Bond Initiative, Sustainable Debt, Global State of the Market 2021, p. 2. Available on https://www.climatebonds.net/resources/reports/sustainable-debt-global-state-market-2021

Note: GSS+ group of bonds shall be understood as: green, social, sustainability, sustainability – linked (SLB) and transition bonds market. It captures three databases: 1. Green Bond Database 2. Social and Sustainability Database 3. SLB and Transition Bond Database

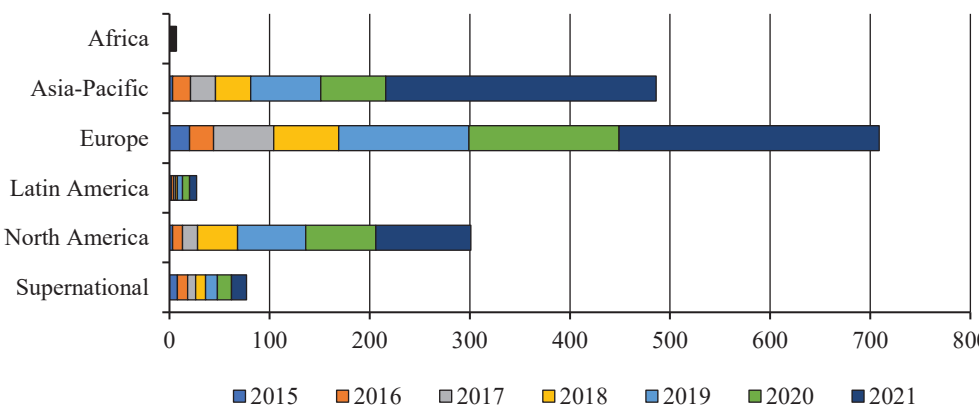

Fig. 1. Cumulative Issuance of Green Bonds by Region in billions of USD

Source: own elaboration based on (Climate Bond Initiative…, 2021, p. 8).

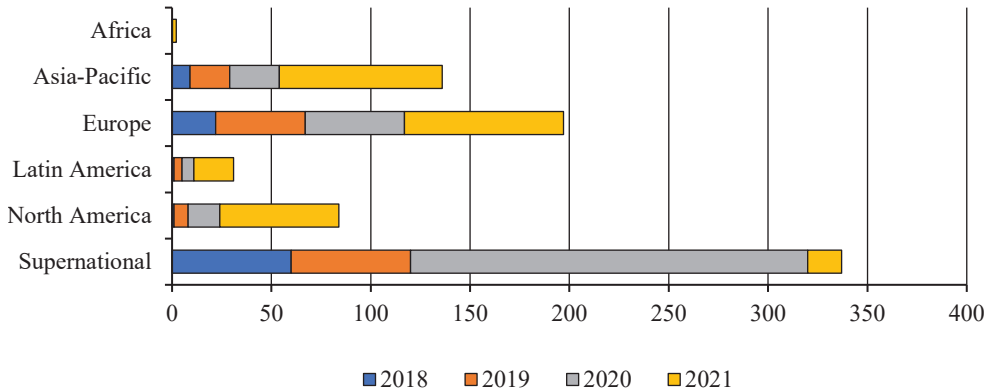

Fig. 2. Cumulative Issue of Sustainable Bonds by Region in billions of USD

Source: own elaboration based on (Climate Bond Initiative…, 2021, p. 11).

It should be noted that green bonds are issued mainly in EUR, mostly due to the green targets set by the European Commission that shoud be met by 2050. From the GSS+ bond group the most predominant is the green bond sector which rose by 75% in comparison to 2020. The average size of an individual green bond reached USD 250m. More than half of the green bonds issued in 2021 came from Europe (USD 0.76tn). Half of the 2021 green bond volumes originated in Europe, which contributed USD 265bn (50%) to the total. The most aggressive growth in the region came from financial corporate (136%) and sovereign (103%) issuer types. In 2015 sustainable bonds were issued mainly on the EU market which is reflected in the currency used. Over time, when the instruments became more popular globally major role was played by USD and EUR.

FinTech also supports such green bond initiatives as Green Asset Wallet (GAW) and CICERO. GAW was introduced by Stockholm Green Digital Finance and supported by Norway's Center for International Climate Research (CICERO), and monitors green bond proceeds and effectiveness in many countries. The aim of CICERO is to equip green investors with the technology to better deliver the goals of the Paris Climate Agreement. The project offers the marketplace – a digital platform – for validation and impact reporting of green investment (Repinsky, 2017). In the case of GAW, half of the EU bonds come from the Nordic countries, issued for the banking, energy and real-estate sectors (GAW, 2022).

The use of FinTech in the area GSS+ bonds concentrates on the delivery of a digital, global marketplace that connects geographically diversified private and public investors with the bond issuers. Such a market will support supra-national projects that require global green financing.

3.2. FinTech and sustainable development: other new application

Since its emergence, FinTech has been widely applied in different sectors. It is argued that FinTech has already improved the efficiency of banking and the entire financial system (Lee, Li, Yu, & Zhao, 2021). FinTech companies have also attracted increasing attention in the recent years for their potential in accelerating more sustainable economic growth. It has been suggested in the literature that such entities may play a key role in tackling environmental and climate problems and countries' transition into a more green financial system. FinTech entities may have the ability to help counteract climate change via, for example, promoting clean energy trade, improving carbon emission trade or enhancing climate finance flows (Tao et al., 2022). However, the concept of the relation between green finance and FinTech is not widely recognised and the research in this field remains in the early stages, and the empirical evidence remains scarce. For example, Puschmann, Hoffmann, and Khmarskyi, (2020) examined the existing literature to determine the degree of papers addressing the issue of the relation between FinTech development and the goal of reaching a low-carbon economy. They searched for two words – "FinTech" and "climate" and found no publications dealing with this subject. Only in the 2020s, has there been a noticeable rise in the number of studies dealing with this issue and providing empirical evidence.

There are different approaches by FinTech companies to promoting sustainable development. For instance, China's Ant Group (owner of the world's largest mobile/digital payment platform Alipay) launched the Ant Forest initiative in order to encourage its customers to actively participate in green finance projects and lower their carbon footprint (Muganyi et al., 2021; Yang et al., 2021). The main feature of the application is converting simulated energy generated while engaging in activities that help reduce carbon emissions into real trees planted in China.

Another example of a FinTech solution for sustainable growth is Kiva, which supports the delivery of capital from individuals, donors, trusties, corporations and social enterprises to unbanked or undercapitalized individuals globally. The flagship market for Kiva capital transfers is the online platform where anyone can financially support borrowers presented in the Kiva portfolio devided by sectors. Money transfer is supported by PayPal, which transfers funds at no cost between the two sides of the contract. However, peer to peer online lending enables connecting investors who want to take part in something more than just liquidity delivery (Kiva, 2022).

Figure 3 presents values of loans raised by Kiva and the value of the FinTech index on the Nasdaq stock exchange (KFTX). KFTX embraces US financial technology companies such as PayPal. The development of sustainable growth financing instruments is greatly dependent on technology, which is very visible in the case of Kiva.

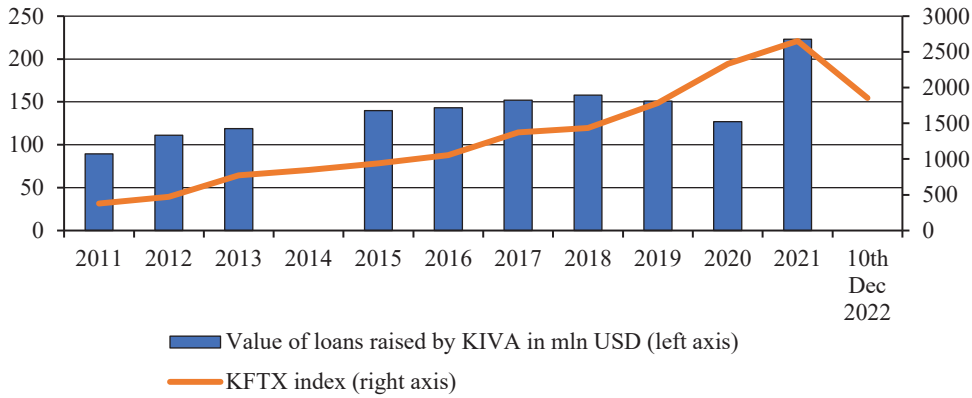

Fig. 3. KFTX index and value of loans originated by Kiva in millions of USD

Source: own elaboration based on Kiva financial statement 2011-2021 (https://www.kiva.org/about/finances) and Nasdaq data (Kiva financial report for 2014 and 2022 are unavailable at the moment of writing this paper).

Without FinTech solutions, this connection between borrowers and lenders would be impossible. The positive role of FinTech in such a case is undisputable. However, linking sustainable growth with financial technologies is not that obvious which is addressed in the next section of this paper.

Some FinTech companies are actively incorporating 'green' measures in order to, for example, reduce carbon emissions and facilitate the more efficient use of resources (Muganyi et al., 2021). FinTech such as crowdfunding platforms, robo--advisors and entities based on blockchain technology increasingly offer green finance opportunities for the general public (Dorfleitner & Braun, 2019).

Robo-advisors are FinTechs that provide automated investment advice and portfolio management applying computer algorithms to find optimal investment strategies (Kaya, 2017). Due to their lower operating costs they enable individuals with scarcer financial means to obtain investment advice. One can distinguish green robo-advisors, i.e. such entities that either are solely dedicated to green investment or offer the option to invest sustainably (Dorfleitner & Braun, 2019). There are already several green robo-advisors operating in Europe. VisualVest and LIQUID from Germany, include in their offer sustainable investment portfolios besides the standard strategies. Nutmeg and Wealthify from the United Kingdom, on the other hand, offer socially responsible investing options. Vividam (in Germany) is solely dedicated to ethical and ecological investment strategies, however, this is associated with higher fund or product costs compared with more conventional strategies. This is due to a more costly process of measuring and evaluating sustainability criteria (Dorfleitner & Braun, 2019). High-quality data are required and furthermore, a low number of entities meet such criteria. The robo-advisors sector has recorded

a significant increase in its value in recent years and with its expansion, more companies are able to offer sustainable strategies.

FinTech companies operate as moderators and indirectly affect the relation between green finance and high-quality economic development (Yang et al., 2021). Moro-Visconti et al. (2020) argued that FinTech companies promote both sustainable development and green finance. Zhou et al. (2022) corroborated this statement with empirical evidence from China. According to their results, FinTech companies have a significant positive impact on sustainable growth, mainly through promoting green credit, green investment and other 'green' mechanisms. This leads to improving the balance of green credit and green investment in the economy. However, this impact depends, to a great extent, on economic development and is substantially stronger in more developed regions. Similar evidence was found by Muganyi et al. (2021). This is mainly due to the fact that it is easier to establish FinTech in well-developed economies because, for example, the necessary infrastructure, venture capital and market regulations are already available (Yang et al., 2021).

Activities in the field of green finance can lead to tangible positive environmental outcomes. For instance, Muganyi et al. (2021) demonstrated that incorporating 'green' measures results in the reduction of industrial gas emissions. Similarly, Tao et al. (2022) indicated that the higher the level of financial innovation in a country, the lower the carbon emissions, which favours further FinTech development. Yang et al. (2021) showed that green finance driven by the FinTech sector positively influences sustainable economic development in three dimensions – ecological environment, economic efficiency and economic structure. Furthermore, Luo et al. (2022) suggested that FinTech innovation supports green transformation and the sustainable development of the real economy. Tian & Liu (2019) argued that technological progress driven by the FinTech sector may help break the 'resource curse' and thereby increase both the effectiveness and sustainability of an economy. Other studies that indicate positive impact of green finance on sustainable development include: Flaherty et al. (2017), Zhou & Cui (2019) and Wang et al. (2022).

Another question is whether FinTech companies can benefit from their involvement in green finance. Merello et al. (2022) studied how this affects such companies market value. Although they found that CSR practices are positively correlated to company's market value, such a relation in the case of green practices was negative. This issue also requires further investigation.

An important field of research is the use of artificial intelligence in the energy sector (cf. Makala & Bakovic, 2020; S&P Global Report, 2022). AI systems can be very useful in the automation of routine and structured tasks, leaving humans to grapple with the power challenges of tomorrow. AI can be used both to optimise the construction, siting and the operations of a wind farm, but more importantly, it can be used to optimise across different systems, both in terms of consumption and

production (e.g. French utility Engie is using AI software from Google to optimise its wind power operations. The pilot programme is an extension of Google's in-house project to capture higher revenues by scheduling hourly wind-power commitments).

4. Advantages and disadvantages of FinTech in financing sustainable development

It should be stressed that technological advancements may become a solution to various environmental problems but also it can be the source of environmental degradation and societal dissection. Blockchain technology remains one of the more controversial financial innovations while considering its impact on the environment. On the one hand, it can be applied in green finance, as mentioned above. On the other hand, due to the complex mechanisms, blockchain involves enormous energy demand and consumption, resulting in higher carbon emissions (Fuessler et al., 2018; Tao et al., 2022). Societal groups with no access to innovation (for example due to poor internet range or operator services) cannot benefit from innovation-based growth compared to groups with developed infrastructure. This means FinTech may bring an additional factor of growth rate stratification.

FinTech has both advantages and disadvantages when compared to more traditional financial entities such as banks. The possible benefits stem from FinTech's characteristics – technological expertise and lower operating costs. Thanks to them FinTech companies can offer competitive products on favourable terms in comparison to traditional financial institutions. Consequently, FinTech's product offer is, generally, addressed to a broader customer base. For instance, less wealthy and less sophisticated investors due to the emergence of robo-advice and crowdfunding are now able to take advantage of products that they could not afford before (Kaya, 2017). Higher accessibility and increased financial inclusion is possible because of lower fees and charges, user-friendly web or mobile applications and almost no geographical limitations. Furthermore, FinTech has enabled people from less developed regions of the world to access the financial system from which they were previously excluded. On the other hand, financial innovations such as peer-to-peer platforms and crowdfunding have facilitated the financing of projects that would not be possible for traditional banking credits, due to their more strict criteria (Dorfleitner & Braun, 2019). Funding barriers are lower thanks to decentralised collection of funding without the involvement of traditional intermediaries and the possibility of obtaining funds from a large global investor base. Potential beneficiaries include start-ups, small and medium enterprises, innovative companies and green projects. According to FSB (2017), such decentralisation may help mitigate the negative effects of financial shocks. Finally, FinTech contributes to better capital allocation thanks to its advanced data processing technologies and therefore to improving overall efficiency in the financial system.

Yet, FinTech is not flawless and there exist some potential disadvantages or even risk related to it. FinTech solutions, such as robo-advisors, are based on standardised questionnaires and therefore provide only limited information on customer's preferences and cannot offer more individualised products (Dorfleitner & Braun, 2018). Owing to limited due diligence and verifiability of information there is a greater possibility of fraud compared to traditional investments (Lam & Law, 2016). Blockchain, in turn, due to its complexity remains difficult for its widespread adoption, and also requires a certain level of skill and experience from its users. Moreover, transaction speed in this technology is rather low and involves enormous amounts of energy (Dorfleitner & Braun, 2018). Furthermore, innovative financial technologies require either adapting the existing or implementing a new legal and regulatory framework, which should not lead to non-regulation or overregulation (Neves and Prata, 2018). This is especially challenging since innovative technologies are changing quickly. A situation in which there is not enough governance and process control may pose a significant risk to the financial system if these entities become bigger. It is worth to mention Ezubao, one of the largest peer-to-peer lending platforms, before it turned to being a lending scheme.

Due to the above, digitalisation provides numerous advantages, but may also bring new risk and give rise to new threats. The risk associated with the operations of FinTech and BigTech may be classified on a micro and macroeconomic level. Microeconomic risk involves, directly or indirectly, possible losses brought on by a loss of funds from financial institutions, and at the same time due to operational risk, e.g. a result of a cyberattack, risk inherent in sharing infrastructure such as cloud services, or due to infractions or failures on account of new solutions that have not yet been tested. Macroeconomic risk chiefly pertains to systemic risk being of high significance for the macroprudential policy and affects the relations between the financial sector and the real economy (FSB 2017). Systemic risk involves the effects of contagion, pro-cyclicality and increasing volatility. Another risk source may emerge along with so-called systemically important institutions. As was already mentioned, an important aspect here is enhancing cyber security.

The development of the FinTech sector in the European Union has attracted the interest of regulators in its influence on financial stability (FSB, 2018). The Financial Stability Committee examines how the FinTech activities fit into the regulatory framework and whether they are in line with the arrangements resulting from the member authorities' approach to FinTech, and what challenge the FinTech sector poses for regulators and supervisors. It seems that monitoring the activities of FinTech companies creates major challenges as some entities are subject to financial reporting regulations but have limited or no obligations at all, e.g. due to their small size or because they are registered under licences that impose less reporting requirements than full banking licences. As a result, information on licensed FinTech companies may not be directly available in traditional banking statistics, e.g. in Europe where a regulatory reporting framework exists (Zetzsche, Buckley, Arner,

& Barberis, 2017). An important area of using FinTech technologies are regulatory sandboxes, accelerators and innovation nodes. There are also other activities that can be an important source of information about new FinTech companies and their business models. Regulators focus, however, on how FinTech affects the domestic financial landscape; cross-border issues are generally not discussed. In some cases, regional cooperation is an important factor, especially in relation to counteracting money laundering and terrorist financing or illegal transactions of an international nature. It is important to increase cyber security, but efforts to do so are not necessarily public, mainly for national security reasons, although cyber risk does not only concern FinTech but also activity based on digital solutions (cf. FSB, 2017, pp. 23-32).

FinTech is covered by the existing regulations on macrofinancial and microfinance risk. In the context of macrofinancial risk, FinTech companies should be subject to more intensive supervision, have greater loss-absorbing capacity, as well as recovery and resolution plans, which is expected to reduce the likelihood of bankruptcy or collapse and its impact on the financial system. In the context of microfinance risks associated with FinTech activities, such as credit risk, leverage, liquidity and maturity mismatch, FinTech companies may fall under the shadow of the banking policy framework.

Bandi and Pandimiglio (2022) drew attention to another issue – the negative practice of greenwashing. Greenwashing is the process of providing misleading information about the extent to which a company or a project is environmentally friendly and socially committed. This may refer to, for example, a situation when an entity deceptively announces sustainable projects to be financed by green bonds but does not implement them effectively. Their results show that such practice is not rare, especially among manufacturing companies and in the financial sector. This negative phenomenon is more pronounced among multinational entities due to their greater distance from local communities. Nevertheless, Bandi and Pandimiglio (2022) also demonstrated that investors are aware of such practices and are inclined to accept lower returns in exchange for confidence that they contribute to the funding of projects with greater influence on the sustainable development.

It should be noted that half of the world's population is still not connected to the Internet. Income, gender, education and other inequality factors are also under risk of digitalisation exclusion (United Nations, 2022). Paradoxically, digitalisation increased the inequalities during the pandemic between developed and underdeveloped economies. According to the International Children's Emergency Fund (UNICEF), at least one-third of the world's school children – 463 million children – were unable to access remote learning when COVID-19 shut down their schools, with large differences between and within countries (UNICEF, 2020). Another troublesome issue is the overload of information in the digital environment, as well as misinformation which can be harmful to people's physical and mental health. Google, Twitter and Facebook addressed the problem by signing a voluntary Code of Conduct.

The importance of other applications is also rising, aimed at rapid growth mostly based on misinformation. Therefore, FinTech tools may be used to filter information and perform analysis in a positive, sustainable way, but also for negative purposes.

5. Conclusion

This paper analyses the impact of new technology in the financial system on sustainable growth. A new trend has emerged focused on business model changes, particularly linked with digitalisation and FinTech companies. Similarly, the authors also observed the impact of using FinTech companies in support of sustainable growth. FinTech can boost the development of green finance, which addresses environmental protection and climate change, and has become an opportunity for industrialised countries to achieve sustainable growth.

However, every coin has two sides. This study fond both positive and negative impact of FinTech on sustainable growth perspective. On the one hand, technological progress has been a source of environmental degradation, while on the other, it is thought that technological advancement may become a solution to various environmental problems. This paper suggests that the positive aspects of using FinTech in sustainable development prevail. Investors have also strongly embraced several non-financial benefits in their decision-making, such as the very rapid growth of green and social bonds and the ESG-style investment (environmental, social responsibility, corporate governance) funds suggests. Furthermore, a very important issue involves the sustainable finance taxonomies which can play a role in scaling-up sustainable finance. The estimation of the promised impact of the projects financed by green bonds, as well as the ex-post tracking of their achievement, is greatly facilitated by the mandatory uniform annual impact and the use of proceeds reports. The standardisation of units and disclosure of computation methodologies should be encouraged for reporting impact metrics (Ehlers, Gao, & Packer, 2021). The next step in research will be to calculate the econometric model. However, estimating the quantitative impact of FinTech on sustainable growth, due to the complexity of the problem, will require the development of a more detailed methodology and using a sample of comparability of data, which at this stage seems very difficult.

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Wpływ FinTech na zrównoważony rozwój

Streszczenie: Od czasu globalnego kryzysu finansowego z 2008 roku następuje bardzo szybki wzrost wykorzystania technologii cyfrowych na rynku finansowym (FinTech). Równolegle obserwujemy wpływ ryzyka klimatycznego na bankowość. Celem artykułu jest ustalenie, jaki jest wpływ FinTech na osiąganie zrównoważonych celów klimatycznych i społecznych, m.in. poprzez innowacyjne instrumenty finansowe. FinTech może pobudzić rozwój zielonych finansów, które dotyczą ochrony środowiska lub zmian klimatycznych i stały się szansą dla krajów uprzemysłowionych na osiągnięcie zrównoważonego wzrostu. Ponadto w niniejszym artykule podjęto próbę przedstawienia zarówno pozytywnego, jak i negatywnego wpływu FinTech na perspektywę zrównoważonego rozwoju. W celu oceny wpływu FinTech na zrównoważony rozwój przeprowadzono krytyczną analizę literatury przedmiotu oraz raportów instytucji finansowych.

Słowa kluczowe: banki, technologie cyfrowe, FinTech, zrównoważony rozwój.