

THE ENVIRONMENTAL IMPACT OF THE DIGITAL FINANCIAL INCLUSION: THE CASE OF THE REPUBLIC OF SERBIA

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ABSTRACT

Climate change is one of the most important issues in today's world. To address this matter, countries and companies are trying to become more sustainable. Countries have set the targets for greenhouse gas emissions reduction, which cannot be reached without the joint effort of the retail, small, medium, and corporate sector. Moreover, emissions and pollution reductions can be achieved through the economic and social development. Digitalization proved to be a fast-track for the economic growth and green development. That fast track becomes even faster if the country's financial system has a certain level of development. This study is based on two secondary datasets and focuses on the Republic of Serbia, in the period of 2005-2018. The aim of this research is to determine the state of financial inclusion in the Republic of Serbia, and to test the relation between financial inclusion and carbon emissions. Based on correlation analysis, the results suggest that higher number of bank branches will result in higher CO₂ emissions. Conversely, the introduction of more Automated Teller Machine (ATM) will yield lower carbon emissions. Results show that digitalization of financial transactions is enhanced, and environmental indicators are slightly decreasing. Therefore, findings suggest that digital financial inclusion in the Republic of Serbia can lead to carbon emissions reduction. Such results are important for policy makers since further digitalization can help in completing the goals of the Sustainable Development Agenda 2030.

Keywords: *Digital finance, Carbon emissions, E-banking*

JEL classification: *Q56, G2*

1. INTRODUCTION

The 2030 Agenda for Sustainable Development represents a blueprint for peace and prosperity of the people and our planet (UNSGSA, 2018). Such a welfare can be achieved by reaching targets which are set for the each of the seventeen sustainable development goals. World would be a more sustainable place if there is no poverty and hunger, if people have a good health and if quality

education is within their reach, if there are gender equalities present, if water and energy are clean, if there is an economic growth, innovation and reduced inequality, if cities are sustainable and if there is a reasonable production and consumption, if climate action is in place, if life on land and below water is preserved, if institutions are strong and if partnerships are established through which goals would be reached.

Financial inclusion is a new proposition of the strategic goals of sustainable development, and it represents an effective way to overcome environmental constraints (Wang and Guo, 2022). But how? Digital financial inclusion represents digitalization of the financial services, making them more cost-effective and more accessible to everyone. The advancement in the financial services industry and more precisely digitalization of the banking system can pave the path to more sustainable reality. Sustainable development goal of no poverty can be reached with the help of the digital financial inclusion. Digital financial services (DFS) enable families to save money, allow them to receive wages, pensions, or government donations. DFS can also help in reducing hunger, since it enables farmers to obtain credit more easily, to use digital micro-insurance or to save their earnings. Furthermore, digital finance can promote good health through micro health insurance. Digital loan products for education can help parents educate their children. In addition, teachers' salaries are more easily and safely transferable by means of digital technologies. Also, gender equality can be sustained since digital financial services offer woman more control over their finances and makes their creditworthiness more manageable. Furthermore, digital finance can help mini grid operators and therefore, enable utilization of clean energy which is much more affordable. Moreover, digitalization of payments of the micro, small and medium enterprises (MSME) can create their credit history and enable credit scoring. If MSME can more easily obtain financing, they can grow and develop more easily and in turn they can create more jobs. Increased economic growth and more income per household will lead to decrease in income inequality. Cities by means of public transportation, can be more sustainable if digital payments for transportation tickets are increased. Digital payments in this instance can decrease time needed for commute, as well as its cost. Digital payment platforms push everyone toward more environmentally friendly products with lower carbon footprint. In addition, savings, credits, and insurance prepare low-income individuals for climate change consequences (UNSGSA, 2018).

However, the impact of digitalization on society can be twofold. On one hand it will enable progress, but on the other hand, increased use of electronic devices will increase energy usage and consequently it will enhance emissions. Economic growth can be enhanced with digital financial inclusion, but such growth comes at the expense of increased emissions and pollution. Still, technological progress with innovative technologies and industrial upgrading can substantially lower harmful emissions. For example, if SME's can more easily have access to credit, that can enable more green innovations which can help decrease the emissions.

Digital payments are faster, more secure and transparent. Therefore, they lower the cost of sending or receiving any kind of payments, making every transaction less time consuming (UNSGSA, 2018). Moreover, fintech improves access to finance. Fintech has introduced new ways of financing for small firms and start-ups and enabled smaller funding amounts. Traditional banks invest in fintech heavily. Banks are especially interested in the lending and crowdfunding platforms, and they are exploring the possibilities of the blockchain technologies through different investment products (Bollaert et al., 2021). Therefore, it is important to know the level of the

digital financial inclusion in certain country, to be able to know how easily Sustainable Development Goals can be reached.

In this research, our aim is to assess how well the Republic of Serbia is prepared for achieving SDG. Therefore, we focus on the financial inclusion in the Republic of Serbia and its relation to the carbon emissions and pollution. According to the World Bank report, the highest risk to be financially excluded in the Republic of Serbia have youth (less than 24 years old) and individuals with low level of education (Nenadovic & Golicin, 2015). Do such findings have environmental implications? To address this question, we look at the indicators which are representative of financial inclusion and the environment. The structure of this paper is as it follows: in the second section, we present contemporary research on what constitutes digital finance, how digital financial inclusion is achieved and how it is linked to the environmental considerations. In the third section, we describe the present state of the digital financial inclusion in the Republic of Serbia and investigate whether there is a connection with the environmental quality indicators. Fourth section gives concluding remarks on the findings of the paper.

2. THEORETICAL BACKGROUND ON DIGITAL FINANCIAL INCLUSION AND ITS ENVIRONMENTAL EFFECT

2.1. Digital finance

Financial institutions, both, banks and non-banks are trying to improve existing channels and enable access to financial services to those that did not have access before. Digital financial services, for example include mobile phones and therefore enable cashless transactions. “Digital financial inclusion” can be defined as digital access to formal financial services to those who were excluded before. Such services should be appropriate for customers as well as institutions. Cost should be attainable for clients, but institutions should not experience a loss as well (Lauer and Lyman, 2015).

Digital financial inclusion model consists of three key components: digital transaction platform, retail agents and devices. Digital transaction platform is a medium through which a customer can make and receive payments, and to store value electronically. Transaction details are transmitted to banks and non-banks through digital communication channels. Retail agents through digital devices transmit transaction details. Digital device can be a mobile phone or credit card that connects to the POS terminal (Lauer and Lyman, 2015).

Financial inclusion can be assessed by examining whether an individual is banked, formally included, informally included, or totally excluded from the financial services sector. Individuals who currently use services of deposit money bank, in addition to using some banking product like Automated Teller Machine (ATM) cards can be defined as banked ones. Adults who belong to formal dimension of financial inclusion use other products of financial institutions like insurance or pension schemes. Informal inclusion means that adults do not have access to bank or other formal financial products, rather they use money lenders or saving clubs. Financially excluded do not use or do not have access to any formal or informal channels, yet they might have access to loans or gifts from friends or family, for example (Monye, 2022).

As it is already stressed, fintech improves access to finance. If we look at the fintech lending, we can see algorithms which are used to assess credit scores. In this way, process of loan assessment

is less time consuming and consumers and small businesses can get faster access to credit. In addition, those algorithms could improve loan performance since they are based on alternative data, and not just credit report (Bollaert et al., 2021). In the case of the ones that are not “banked”, alternative data might be the only available data, and if there is a chance for quality assessment that could enable lending and lead to economic growth.

Li et al. (2020) findings suggest that digital finance inclusion can promote household consumption. This effect is more pronounced with the poorer and less educated individuals. Their results show that digital finance influence household consumption through digital payments, online credit, purchase of financial products or insurance, or simply by online shopping.

2.2. Impact of digital finance on reaching sustainability goals

Digital financial inclusion cannot be present or enhanced without digital technology development since key components of the model are digital platforms and devices. Digital devices need electricity, which increased consumption can lead to increased carbon emissions and pollution. But what are the empirical facts regarding the influence that digital financial inclusion has on the climate indicators? Is there any spatial implication of such a relationship?

Digital technology development can reduce carbon emissions in local cities, but also it has spillover effect on surrounding cities. However, there are spatial boundaries to the reduction reach (Liu et al., 2022). Digital technology development can have a positive impact on the digital financial inclusion. The more the society is digitalized, the more people will have access to technology and that can enable higher financial inclusion. Zhang and Liu (2022) go one step further and examine the interaction of digital finance and green technology innovation and assess its impact on the carbon emissions efficiency. They find significant effect on carbon emission efficiency on the local level, but not on the neighboring cities. However, Pu and Fei (In Press) find evidence that digital finance increases residential carbon emissions. Raise is a result of the increased electricity consumption and use of transport for employment purposes.

Digital finance has a positive effect on the green technology innovation, since it removes the financing constraints. This effect is larger with the small enterprises, in the regions that are more polluted and where government governance is strong (Feng et al., 2022). Yu et al. (2020) find that digital finance has a positive impact on green control techniques in family farms which safeguard the quality of agricultural products. Digital finance improves credit availability, promotes information acquisition, and leads to increase in social trust. Gu (2022) finds that sharing economy has beneficial effect on carbon emissions reduction. Development of the personal credit information services and digital finance enables emissions reduction. Furthermore, technological innovation has a negative moderating effect on the relationship between economic development and carbon emissions. Sharing economy has a positive spatial spillover effect on the neighboring cities.

Shahbaz et al. (2022) examines whether financial inclusion influences pollutant and carbon emissions. They find that financial inclusion decreases pollutants, and those results are universal, regardless of the geographical area. However, their findings suggest that financial inclusion have asymmetric effect on carbon emissions, and that results are dependent of the geographical location. Wang and Guo (2022) also find evidence that digital inclusive finance help decrease carbon

emissions. There is a positive spatial spillover in urban areas, and the results are more pronounced in the cities where traditional finance is developed and there is a high degree of industrialization. However, findings are region dependent. Wang et al. (2022) find positive correlation between digital financial inclusion and carbon emissions. Increase in carbon emissions are due to increased digitalization of financial services and it is high in urban areas. Therefore, rural areas should be more digitalized, and that could improve inclusion but not at the expense of the carbon emissions. Furthermore, digital financial inclusion can improve industrial structure and reduce carbon emissions.

3. RESULTS

3.1. Data and methodology

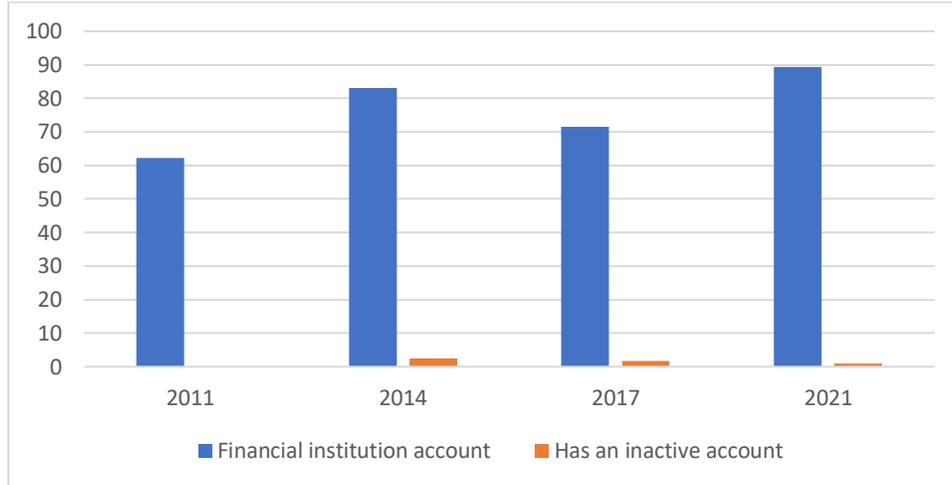
In this study secondary data from two databases, World Bank Indicator Database (Global Findex Database) and the Open data portal of the Government of the Republic of Serbia are used. Based on the World Bank data the state of the digital financial inclusion of a certain country can be assessed. Available data series varies depending on the country in question. In the case of the Republic of Serbia, the longest period is spanning from 2011 till 2021, where periodicity of the data is triennial (2011, 2014, 2017, 2021). Data regarding the number of bank branches, ATM's, CO₂ emissions and PM2.5 and PM10 pollution have different time periods. Depending on the series in question, data range from year 2000 till the year 2021, and series are presented yearly. Sample implemented in this study is derived from the available data, and it covers period from 2005-2018.

The aim of this paper is to assess the relationship between digital financial inclusion and carbon emissions and pollution in the Republic of Serbia. This association is analysed using correlation analysis, namely Spearman rho correlation. Data is ranked and correlation coefficient is computed. In this way, effect of outliers can be eliminated. Correlation analysis is used to determine whether systematic change in one variable is followed with a change in another variable (Cooper and Schindler, 2006). Therefore, it can be determined whether there is a connection between digital financial inclusion and CO₂ emissions.

3.2. Digital financial inclusion in the Republic of Serbia

Firstly, the state of the digital financial inclusion in the Republic of Serbia, based on the World Bank Indicators dataset is going to be assessed. In Figure 1, the percentage of respondents (older than 15 years) that have an active or inactive account with a bank or another type of financial institution is displayed.

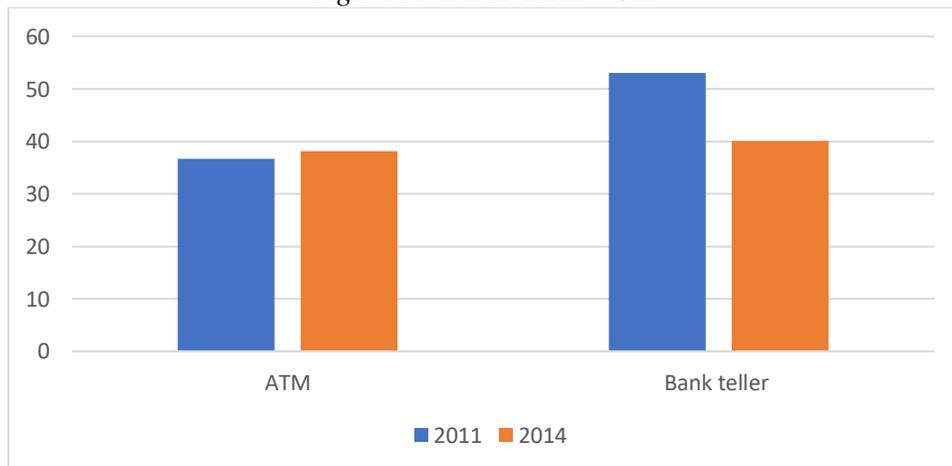
Figure 1. Account information in the Republic of Serbia



(Source: Global Findex Database)

The percentage of the respondents that have an account with financial institution is very high and is increasing in this ten-year period (Figure 1). The percentage of the inactive accounts is negligible, and it is decreasing. Data which can give us an insight into the reasons why a person do not own an account is available only for the year 2021. The most common reason why someone does not own a bank account is because someone in the family has one (51.57%). Moreover, there is a possibility for an increase in the digital financial inclusion in the Republic of Serbia. Respondents who indicated that a reason why they do not own a bank account is that financial institutions are too far (22.45%) or the individuals that find financial services too expensive (24.86%), are the ones that are financially excluded now but digitalization could enable them to be banked. In Figure 2, respondents' preferred mode of the withdrawal is presented. Data are available only for the years 2011 and 2014.

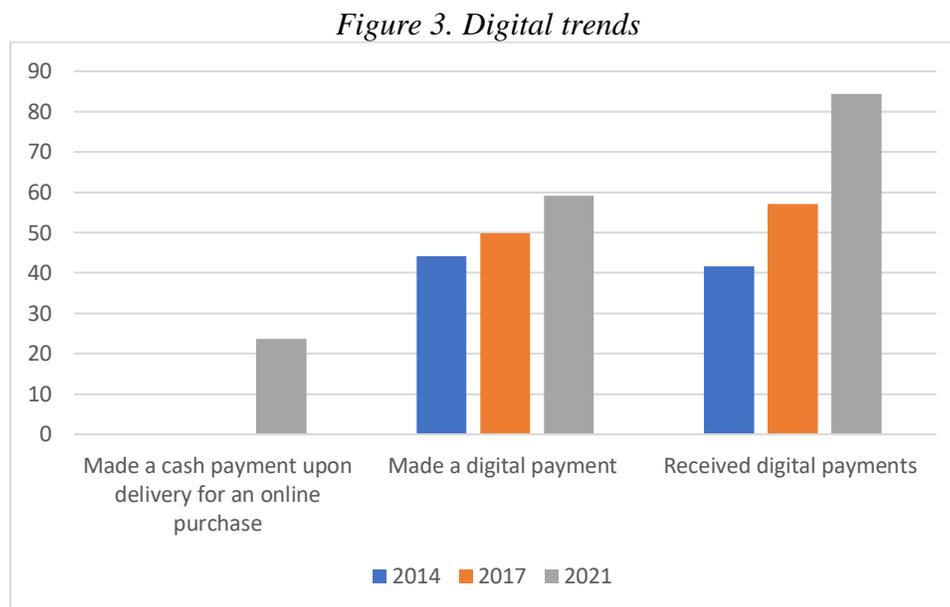
Figure 2. Withdrawal mode



(Source: Global Findex Database)

Figure 2 show that, in this period, the number of ATMs increased slightly. In the same period, there is a substantial decrease in the demand for the bank tellers' services. Therefore, it can be concluded that people are getting more accustomed with the digital transactions.

Figure 3 presents available data for the digital financial trends in the Republic of Serbia.



(Source: Global Findex Database)

The only available data point for cash payments upon delivery for an online purchase is the data for the year 2021. It is yet to be seen what the trend in the use of this channel for consumption purposes in combination with cash will be. There is a steady increase in made or received digital payments, and there is a very broad definition of what constitutes a digital payment. By digital payment it is assumed that respondent uses mobile money, a debit or credit card, or a mobile phone to make a payment from an account. In addition, usage of the internet to pay bills or to buy something online or in a store is also considered as digital payment.

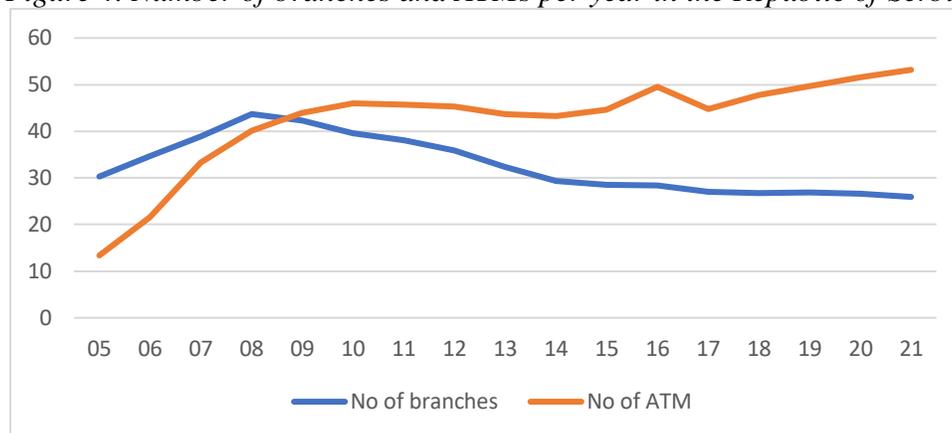
Data that depicts the state of the financial inclusion in the Republic of Serbia show that majority of the respondents have an account with a financial institution, such as the bank. There is a decrease in the use of bank tellers' services and increase in the usage of ATM's. When we look at the digital payments made by mobile money or phone, credit, or debit cards, or through internet we can see sharp increase in the past ten-year period. Hence, digital financial inclusion is increasing, but there is a room for its improvement.

3.3. Environmental impact of the digital financial inclusion

Purpose of this study is to determine whether there is a connection between digital financial inclusion and carbon emissions and pollution in the Republic of Serbia. Therefore, variables that we will use in this analysis are number of bank branches per 100.000 inhabitants, number of the ATMs per 100.000 inhabitants, CO₂ emissions per GDP and pollution with combined measure of PM_{2.5} and PM₁₀. Data are presented visually in the Figures 4 and 5. We use the number of bank branches and ATMs as indicators of the digital financial inclusion. CO₂ emissions are indicator of

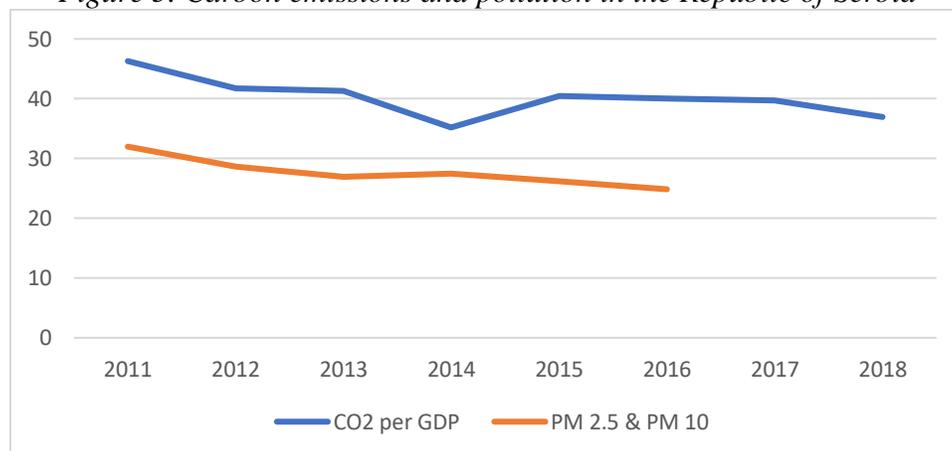
green-house gas emissions. Combined measure of PM2.5 and PM10 is an indicator of the pollution. Change in the number of bank's branches and ATMs per 100.000 inhabitants is displayed in Figure 4.

Figure 4. Number of branches and ATMs per year in the Republic of Serbia



(Source: Global Findex Database)

Figure 5. Carbon emissions and pollution in the Republic of Serbia



(Source: Open Data)

Figure 4 show that the number of ATMs is increasing and that there is a decrease in the number of branches. Also, the change in the CO₂ emissions and pollution measured with PM2.5 and PM10 particles is displayed in Figure 5. Therefore, it can be assumed that when the number of branches started decreasing and the number of ATM's started to increase, there is a slight decrease in the carbon emissions and pollution.

To determine the existence of connection between digital financial inclusion and carbon emissions and pollution, we check the correlation between the relevant variables. Available data series are short, which represent limitation of this study. The available time series for the pollution is only 6 years, and therefore this variable is excluded from the correlation analysis. For the rest of the indicators, longer time series are available (2005-2018). In Table 1, results of the Spearman correlation along with their significance levels are presented.

Table 1. Correlation matrix

	No of branches	No of ATM's	CO ₂
No of branches	1		
No of ATM's	-0.305	1	
CO ₂	0.657***	-0.609**	1

Source: Authors own calculations, Global Findex Database, Open Data. Notes: *p < 0.1; ** p < 0.05; *** p < 0.01

Table 1 present findings that there is no statistically significant relationship between the bank's decision how many branches and ATM's they are going to employ. Conversely, it is observed that there is a very strong statistically significant relationship between digital financial inclusion indicators and carbon emissions. The increase in the number of bank's branches will significantly increase CO₂ emissions. Branches need electricity to operate. Electricity from the renewable sources in the Republic of Serbia are increasing, but their share in the total consumption was only 26% in the year 2020. Therefore, increased electricity consumption would lead to increased electricity production from the traditional sources. Hence, carbon emission will increase. On the other hand, the decrease in the number of the branches, that happened in the previous period led to the decrease in the carbon emission. Furthermore, employees use either public or their own transportation for commute. Transportation increases the emissions. Again, decrease in the number of the branches yield less harmful emissions. When we look at the correlation between number of ATM's and the CO₂ emissions, we can see that there is strong negative correlation. In the period in question there was an increase in the number of the ATM's. That is related to the decrease in the carbon emissions, since less electricity is consumed, and less transportation is used for employment purposes. Hence, we can conclude that there is a relation between digital financial inclusion and decrease in CO₂ emissions.

4. DISCUSSION AND CONCLUSION

Digital technology development can increase digital financial inclusion. Researchers offer mixed results regarding the interaction between digital financial inclusion and environmental indicators. Digital finance improves carbon emission efficiency, but the results are region and city specific. In the urban areas, it can lead to increased electricity and transportation consumption and emissions. On the other hand, digital financial inclusion can improve industrial structure and reduce emissions. The results might be more beneficial in the rural areas.

The aim of this study is to determine whether an environmental impact of digital financial inclusion in the Republic of Serbia. The sample is comprised of the yearly data from 2005-2018. Correlation analysis is implemented to be able to determine if there is a relationship between these two concepts.

In this paper, we analyze the state of the digital financial inclusion in the Republic of Serbia, and its connection to the environmental indicators. Based on the available data, it is observed that there is an increase of the digital financial inclusion in the Republic of Serbia. Individuals who are more than 15 years old are "banked" and they are increasingly using digital channels for payments, remittances, or shopping. Furthermore, results of this study are in accordance with the findings of the Shahbaz et al. (2022) and Wang and Guo (2022), since it is found that an increase in digital financial inclusion can decrease CO₂ emissions.

Consequently, suggestion for policy makers would be to further improve digital financial inclusion in the Republic of Serbia and integrate directions for those improvements into climate change policies. The limitations of this study are a small sample size and examination of only one country. Previous research has found region specific results, and therefore some further research should include much broader geographical area into the analysis. Moreover, different regions of the Republic of Serbia can be explored in this context. Furthermore, some other study should use different indicators related to the fintech which can suggest the scope of the financial inclusion as well.

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