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THE ROLE OF DIGITAL TECHNOLOGIES IN THE ORGANIZATION OF CONTROL OVER TAX LIABILITY SETTLEMENTS OF BUDGETARY INSTITUTIONS

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Abstract. *Purpose* – the aim of the study was to assess the impact of digital technologies on the organization of control over tax liability settlements of state-financed institutions in the general fiscal discipline system.

Research methodology – specific methods of accounting and control of tax liabilities were used: Pareto analysis; cluster analysis of EU countries by fiscal discipline level.

Findings – the study proved a direct relationship between the extent at which digital technologies are applied in the control of tax liabilities and the level of fiscal discipline in the country. The clustering of the EU-27 countries confirmed the cophenetic correlation between the fiscal discipline violation rate and the total averaged amount of taxes.

Research limitations – caused by a large number of budgetary institutions and the difference in the territorial structure of the EU-27 countries, due to which federal Germany and unitary Bulgaria have different levels of subordination of budgetary institutions.

Practical implications – the study is analytical and managerial in nature; its results assess the contribution of the digital component in the overall decision-making system.

Originality/Value – the study is particularly useful for analysing the achievements, challenges and opportunities for digital transformation of the tax control system of the EU-27 in the field of control over public finance management.

Keywords: budgetary institutions, digital technologies, digitalization, tax control, tax culture, tax liabilities.

JEL Classification: H2, H83, O3.

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Introduction

The digital environment, being the main criterion for economic development, requires certain transformations in all spheres of socio-political life, as well as in the economic management, document management, reporting and administration of control. This especially applies to the control over the fulfilment of tax obligations of all economic entities, including budgetary institutions as the foundation of public administration. There are about 14 thousand institutions and organizations in the EU-27, which are fully or partially funded by European, national or local budgets (Rikhardsson & Yigitbasioglu, 2018). In comparison, there were about 1.87 thousand budgetary institutions in Ukraine as of the end of 2021. These institutions perform different functions related to the governance of the state and regions, the implementation of economic, social, environmental measures, ensuring law and order and inviolability of the state territory. They are assigned their specific functions and tasks, which are provided by funding from the budgets of different levels.

According to Mavlutova et al. (2021), the control of tax liabilities is especially important for budgetary institutions because of the transparency of activities in order to ensure public activity. As budgetary institutions are tax-financed at all levels, they are usually required to maximize the overall compliance with tax legislation. Because of the limited resources, budgetary institutions should make careful decisions about their use in order to achieve the best possible result in terms of compliance with tax legislation. Stewart and Clavey (2021) states that the critical importance of priority measures to comply with fiscal discipline and identify specific actions that need to be taken is directly related to this issue.

In the EU-27, Germany is a model of fiscal discipline that has fully overcome the obstacles to digital governance of fiscal policy in the country. This was achieved through the successful launch of a taxonomy project for the electronic standardization of all tax processes in Germany. This restructuring has provided enormous opportunities for companies to simplify settlements with the state, while for regulatory authorities – to facilitate the control (Appelbaum et al., 2017; Weber, 2011).

Stewart and Clavey (2021) notes that the digital tools are introduced in the budget accounting and tax control system in order to increase the efficiency of ongoing processes and procedures, as well as the quality and efficiency of the management process in budgetary organizations. Therefore, a system of accounting and control of tax liabilities is important as a part of the overall system of management of budgetary institutions (OECD, 2020).

The main changes in the system of public financial control include the elimination of technical and logical errors, streamlining of functions and appointment of regulatory authorities in connection with the reorganization of the fiscal service and improving the electronic account system, including:

- expanding the list of documents available through the electronic account, namely: notification of refusal to accept the tax return, inspection-based documents, individual tax consultations, etc. (Holmgren Caicedo et al., 2018);
- clarification of the procedure for delivery of the electronic document to the taxpayer through the electronic account (Goretzki & Messner, 2019);
- providing taxpayers with the opportunity to submit an electronic message (with documentary evidence) to correct inaccurate, incomplete or outdated information about

themselves, with the access provided through the electronic account (Goretzki et al., 2017);

- regulation of organizational processes related to the preparation and acceptance of reports submitted by budgetary institutions electronically (Korauš et al., 2017).

The aim of the study is to assess the impact of digital technologies on the organization of control over the tax liability settlements of budgetary institutions. This aim involves the following research objectives:

- determine the role of modern information and analytical resource of the fiscal service,
- study the effective cases of modern national tax control systems in the EU-27 on the effectiveness of the digital system of control over tax liabilities of budgetary institutions.

1. Literature review

Stewart and Clavey (2021) holds that the phenomenon of the “digital breakthrough” has emerged as the result of powerful influence of the digital age on daily life and activities. According to Mavlutova et al. (2021), this means that the digital age inevitably changes the way the economy operates, disrupting or interrupting traditional business models. This, in turn, requires adaptations and changes that are not always simple and painless, but are inevitable, whether in agriculture, manufacturing, trade, banking or service sector. Stewart and Clavey (2021) provides statistics evidencing that 9 out of 20 companies in the world are digital, while only one out of 20 companies was digital some ten years ago. Goretzki and Messner (2019) states that unlike the business sectors of the economy, where profits are the drivers of progressive change, the budgetary sphere is more conservative because it deals with taxpayers’ money.

The Association of Chartered Certified Accountants ([ACCA], 2021) has identified ten technology trends that could significantly change the professional environment of tax administration and control: mobile applications, big data, artificial intelligence and robotics, cybersecurity, education, cloud technologies, payment systems, virtual and augmented reality, digital services and social networks. Panasiuk et al. (2021) holds that the widespread introduction of cloud technologies, acceleration of automation, blockchain introduction are the trends of future accounting.

The main advantages of using modern information technologies for automation of fiscal procedures in budgetary institutions include:

- processing and storage of a large number of structurally identical units of accounting information (Korauš et al., 2017);
- the possibility of extracting the necessary information from a large amount of data (Goretzki et al., 2017);
- reliable and error-free performance of mathematical calculations (Zhyvets, 2018);
- prompt receipt of data necessary for making sound management decisions (Nazarova & Moyseyenko, 2020);
- multiple reproduction of actions, etc.

Bondarenko et al. (2020) notes that the use of automation allows to completely solve the problem of accuracy of accounting information and its efficient presentation by budgetary

institutions. This is especially important for the sound adoption of effective management decisions by civil servants and their implementation.

So, as Zhosan (2020) points out, simplified preparation of accounting documents by transferring certain operations to cloud electronic platforms, which will significantly change the information system of accounting and tax control, will save costs, which is especially true for budgetary institutions. Besides, Al-Htaybat and Von Alberti-Alhtaybat (2017) notes that cloud technologies create additional conditions and opportunities for the promotion of the real-time accrual-payment-control of taxes chain of the budgetary institutions.

Experts from the Financial Stability Board argue that artificial intelligence technology will allow budgetary institutions to accelerate management decision-making, provide advice to taxpayers, elaborate social development strategies that improve productivity in the public sector. Bondarenko et al. (2020) holds that this increases the accuracy and efficiency of the tax accounting process and the process of controlling tax settlements using artificial intelligence technology, creates conditions for effective control, while reducing operating costs and helping to generate more transparent information for the tax control purposes. Goretzki et al. (2017) notes that this is especially important because failures of digital tax system have significant consequences for the organization and functioning of the economy.

According to Bondarenko et al. (2021), the digitalization of tax administration and tax procedures should provide a background for further reforms of the tax system. Clarke (2020) states that the reform should be implemented in two parallel directions: first, the digitalisation of national tax administration and tax procedures, and second, the reform of tax policy and tax rates. At the same time, Aaskoven (2018) adds that tax policy reform should also provide digital taxation with a fair and sustainable tool adapted to economic growth.

Dobrovic et al. (2018) established causal links between the introduction of digital technologies in the system of accounting and control of tax liability settlements by budgetary institutions. According to his calculations, each automated accounting process makes management processes 3–7% more efficient. But here we must distinguish between objective processes of business development, which in the context of transferring certain business transactions to electronic format to increase efficiency are characterized by logical stages of digital transformation. Panasiuk et al. (2021) distinguish the following stages:

- digitization (use of electronic document form instead of digital; automatic document generation using accounting software),
- digitalization (creation of a legally significant electronic document with an electronic signature),
- digital transformation (introduction of a whole block of managerial innovations for decision-making using a set of software and cloud data storage services), which are consistent and represent a closed cycle of digital technology implementation in business processes.

A review of research on the system of accounting and control in cases of contingency revealed that the effects of digital technologies are determined, and this applies to all organizations, including budgetary ones. This means that digital technologies can promote qualitative changes in the system of accounting and control of tax liability settlements of budgetary institutions (Nazarova & Moyseyenko, 2020).

However, the researchers (Al-Htaybat & Von Alberti-Alhtaybat, 2017; Brown, 2019; Horton & Wanderley, 2018; Sudomyr et al., 2020) have an opinion about artificially reduced role of accounting, in particular, in the discussion and interpretation of data, as well as promotion of the role of control over tax liabilities. The reason is the globalization in the world, in particular in the European Union, where the Member States strive to unify tax systems. In this case, as Al-Htaybat and Von Alberti-Alhtaybat (2017) states, the “flexibility” of tax administration using digital technologies should include two main areas of activity. The first is the harmonization of the model of electronic (digital) tax control, which is used in the country, but must be adapted to the European system. The second area of harmonization involves amendments to the rules for the information exchange between tax authorities at the international level. This means the need for intensive cooperation between the tax authorities of different countries to effectively prevent tax evasion in the European Union. This is an effective measure to preserve the sovereignty of state tax bases and ensure the proper realization of subjective tax law under international treaties (Rieg, 2018). The current rules are based on the territoriality paradigm, which provides that the state has the right to tax certain income by source of income or place of the taxpayer’s registration. The territoriality paradigm loses its influence when it comes to transactions conducted on the Internet (Mergel, 2019).

It will be further emphasized in the article that digital control of tax liabilities is supposed to mean the preparation, presentation, and transfer of financial data electronically. At the same time, digitalization of tax control is supposed to mean the possibility of integrated use of computer software to control tax liabilities by budgetary institutions. So, technological advances enable interpreting, processing, and controlling data faster and more efficiently than ever before.

The introduction of full automation faces certain obstacles because of the significant coverage of tax liability accounting by digital technologies:

- Incomplete and inconsistent regulatory framework, mechanisms for implementing regulations and directives (Mergel, 2019);
- Institutional ambiguity that slows down the implementation of pan-European standards in each country’s tax liability system (Moll & Yigitbasioglu, 2019).

At the same time, the removal of obstacles and barriers to the full digitalization of the tax liability accounting system of budgetary institutions will undoubtedly provide a number of advantages, namely:

- Accuracy of information transfer operations;
- Remote access to accounting data (Brown, 2019);
- Secure information storage and flexible access;
- Integration and synchronization of accounting processes (Nazarova & Moyseyenko, 2020);
- Universality of operations.

According to Nazarova and Moyseyenko (2020), digitalization does not mean that tax officers need to understand, study and act in terms of the application of software solutions. This process will involve a “triple click”:

- the first click – specialist sends calculations of the financial situation in the institution for a certain period to the supervisory authorities;
- the second click – the specialist of the supervisory authority makes calculations on tax liabilities of the budgetary institution;

- the third click – the taxpayer (budgetary institution) receives a pop-up notification from the tax authority about the accrued taxes and has two options: a) click “objection” to provide reasonable grounds for incorrect accruals; b) click “pay” to send funds from the taxpayer’s account to the tax administration’s account, where the tax liability is automatically credited (Möll & Yigitbasioğlu, 2019).

The introduction of digital technologies in the control over tax liabilities of budgetary institutions will change the employment structure of tax administration services. There will no longer be a need for as many officers to handle paperwork. They will be retrained and reassigned to provide services for taxpayer control, asset verification and the fight against the shadow economy (Podgorna et al., 2020).

That is why the digitalization of tax accounting should be an imperative for total macroeconomic reforms. Globalization of the economic space and popularization of the remote workplace brings the concept of cloud technology to a new level. This concept implies that information is processed not from one computer or workplace but is shared by any number computers connected to the Internet (Syrtseva et al., 2021).

2. Research methodology

The following procedure was used to study the role of digital technologies in the organization of control over the tax liability settlements of budgetary institutions:

1. Budgetary institutions of all forms of subordination in the EU-27 were selected as the object of research.

2. A sample of 13,732 objects of analysis of tax deductions of budgetary institutions financed from the budgets of various levels of the EU-27 was created with the help of search filters on the European Statistical Database website. The analysis comprised 2019–2021. The obtained statistical data became the background for economic calculations of the study: correlations of variables, Pareto distribution, which was carried out in AnyLogic using the following Equation (1):

$$f(x) = \begin{cases} a \frac{\min^a}{x^{a+1}}, & x \geq \min \\ 0, & x < \min \end{cases}, \quad (1)$$

where x – tax burden in a particular country.

The Pareto distribution has a finite value at minimum x and decreases monotonically with increasing x (Wilkinson, 2006).

3. The national standards on which the practice of tax accounting in EU budgetary institutions is based were analysed. Practical examples of the organization of accounting and control of tax liability settlements of budgetary institutions, examples of resolving specific situations and errors in accounting are considered based on the information provided by budgetary institutions.

4. Selected groups of national digital systems of tax liability control in the EU-27 allowed advancing a research hypothesis: a condition for improving fiscal discipline in the implementation of state tax policy is the integration of the information society into the control system of tax liabilities of budgetary institutions through digital technology.

5. Clustering of EU countries by the level of quality of compliance with fiscal discipline was carried out using data mining. The % of tax violations (evasion, incorrect or late payment of liabilities by budgetary institutions) and the total amount of tax liabilities paid by budgetary institutions for the year were selected as the indicators.

6. Having compared the obtained results of grouping national digital systems of tax liability control in the EU-27 with the clustering of EU countries by the fiscal discipline quality level, it was proved that the lowest level of evasion, miscalculation or late payment of taxes by budgetary institutions were the consequence of high digitalization of the tax control in countries where the level of E-accounting and above (from the third to the fifth level according to the grouping) is achieved.

A set of general and special methods was used to achieve the aim: systemic analysis and formalization of complex structures; generalizations and scientific abstraction; statistical method of data processing, grouping method. In addition to general research methods, the research involved specific methods of tax liability accounting and control in budgetary institutions: continuous and local methods of control (Pareto analysis) used by EU countries; cluster analysis of EU countries into homogeneous groups in order to further assess and improve the control over tax liabilities by budgetary institutions.

3. Results

Budgetary institutions are full members of economic society, despite they are non-profit. This is why the control over their tax liabilities is a key component of the social contract between citizens (taxpayers) and the economy (state or local budget). Accountability of government budgetary institutions contributes to the effective management of tax liabilities and public finances.

In 2021, institutions from Germany made the largest cumulative contribution among budgetary taxpayers, while Bulgarian institutions – the smallest (Figure 1). This is due to many reasons, which are studied and described below, including: the country's tax culture, the country's tax base, the level of digitalization of payment, and control over tax liabilities by budgetary institutions.

The most important thing in the tax administration process is the choice of the general tax base. There is currently no unified pan-European tax case in the EU-27, although a taxonomy procedure has been conducted since 2017. Based on European experience, the digital profiles of national tax administrations were grouped in the following five levels (Figure 2).

So, different levels of automation of the control over tax liabilities differ significantly across the EU. The introduction of the digital service should minimize contacts between fiscal authorities and taxpayers, eradicate corruption in the state tax service, and create convenient conditions for tax collection from budgetary institutions. That is, transformational changes affect priorities: unpopular fiscal measures are replaced by new, progressive actions of the tax administration, which are aimed at expanding the range of services and improving the quality of service provided to taxpayers.

Comprehensive restructuring of control over tax liabilities requires budgetary institutions to digitize the components of the fiscal system digitalization, paying attention to

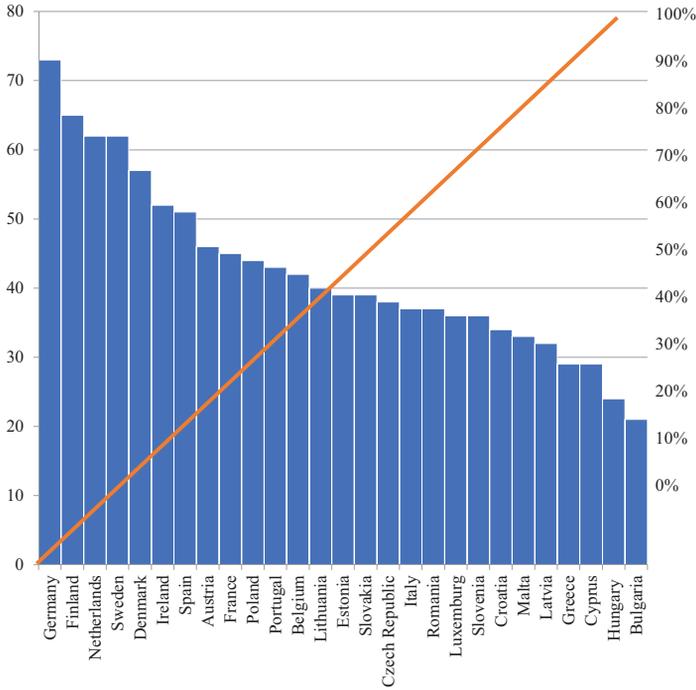


Figure 1. Pareto chart of tax liability payments by budgetary institutions in the EU-27 in 2021

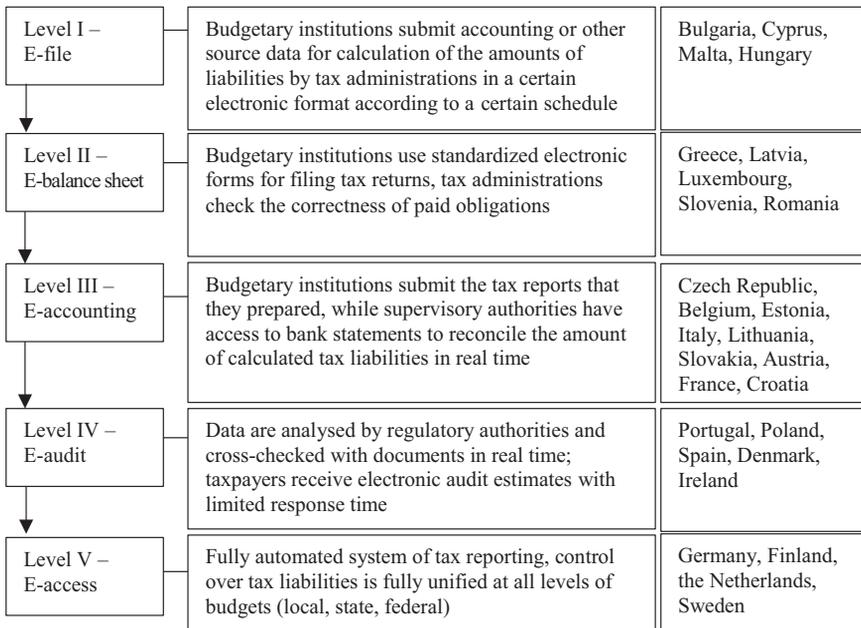


Figure 2. Grouping of national digital tax control systems in the EU-27

the optimization – efficiency – evolution triad, which will ensure effective restructuring of the accounting system for digital environment (Figure 3).

It should be noted that all these stages are not separated, they are an integrated complete system of transformation of tax liability accounting in the digital space.

For example, the German tax authorities do not review taxes accrued by companies on paper but analyse them based on electronic reports. Submission of a fully standardized Balance Sheet of the tax base and Cash Flow Statement (E-Bilanz) in digital format to the German tax authorities has been mandatory for German budgetary institutions since 2013. The advantages of control over tax liabilities have become obvious at that stage: calculation errors almost disappeared, because the human factor was eliminated from the calculation of tax liabilities; unlimited information storage time; reduction of administrative costs and staff salaries, etc.

Thanks to E-Bilanz, tax authorities receive fully standardized digital data sets for tax control. This data pool is constantly updated and allows the German tax authorities to conduct a detailed comparative analysis of payments, potential risks, time series by sector, industry, and to analyse trends. The analysis of tax data allows ensuring a high level of compliance, make forecasts and the ability to determine the savings, which leads to the potential for organizational restructuring of the budgetary institution. Therefore, it is a highly effective tool for managing tax liabilities of budgetary institutions at all levels (Figure 4). The largest taxpayers are the budgetary institutions of Germany through the federal system of the country.

In the digital age, tax administrations are no longer just consumers of financial data and financial information from fiscal accounting systems: they are becoming data managers who actively process, manage and evaluate tax-sensitive data against general indicators. Besides, the transparency of the control over tax liabilities creates a high level of tax culture in the country.

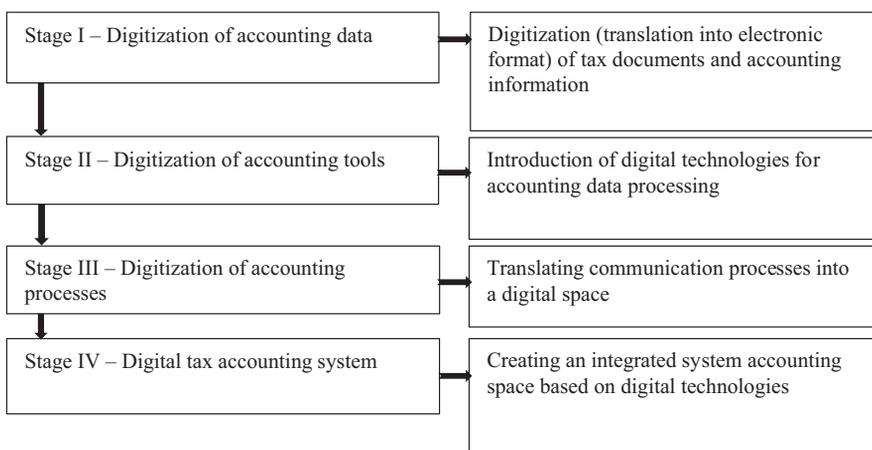


Figure 3. Stages of digitalization implementation into the process of control over tax liabilities of budgetary institutions

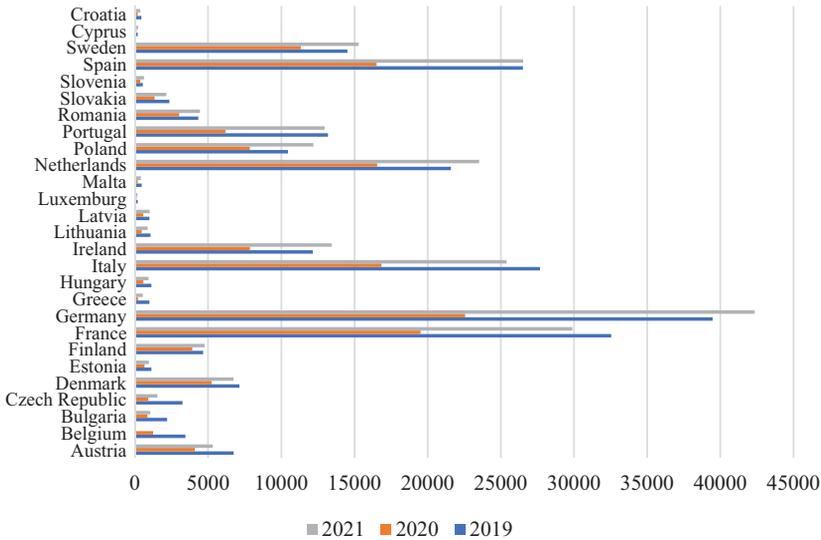


Figure 4. Tax payments by budgetary institutions in the EU countries, € million

For example, in Switzerland, civil courts are a useful source of information in such cases as divorce, where spouses often provide evidence of higher incomes than those declared through the tax system. The experience of the Swiss Federal Tax Administration evidences that victims of financial fraud are often fiscal fraudsters themselves. In this case, the courts turn to the tax authorities to collect information on financial fraud. The Swedish Tax Agency holds an annual press conference to report on its work during the year and outlining planned measures to maintain financial discipline in the country. The media pays much attention to this event, because not only transparency of fiscal policy is important for the population, but also the entire mechanism of public administration and the involvement of each taxpayer. The high level of digitalization of the control over tax liabilities resulted in the lowest level of tax evasion, miscalculation or late payment of taxes by budgetary institutions (Figure 5) in countries with the E-accounting level and above (from the third to the fifth level according to the grouping in Figure 2). The leading countries are Germany, Sweden, Denmark, Austria (Luxembourg is an exception: the country is in the E-balance group, but tax control is not difficult due to the small number of budget institutions compared to other countries). That is, there is a direct correlation between the degree of application of digital technologies in the control of tax liabilities and the level of fiscal discipline in the country ($r = 0.828710$).

Based on the data of Figures 4 and 5, the EU-27 countries were clustered according to the method of average group value by their compliance with the fiscal discipline (Figure 6). As a result, the cophenetic correlation was confirmed – the highest level of correlation between the defined criteria (% of violations of fiscal discipline and the total amount of taxes paid by budgetary institutions on the average for 2019–2021). According to the applied clustering methodology, Germany and Cyprus were identified as the “farthest neighbours”, which directly correlates ($r = 0.867331$) with the results presented in Figures 2 and 3 of this study.

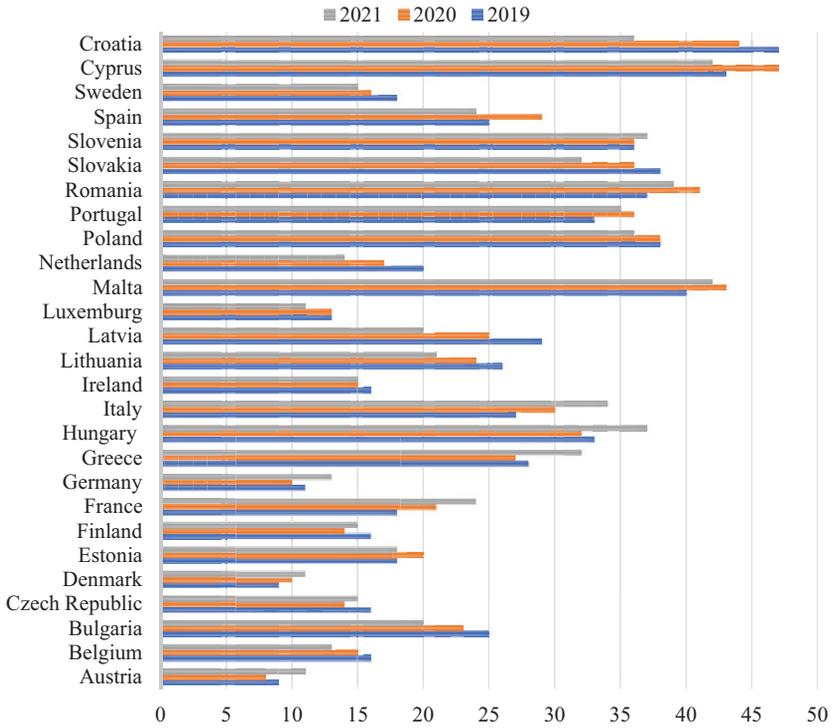


Figure 5. Violation of fiscal discipline in the payment of taxes by budgetary institutions in EU member states as a share of the total tax collection, %

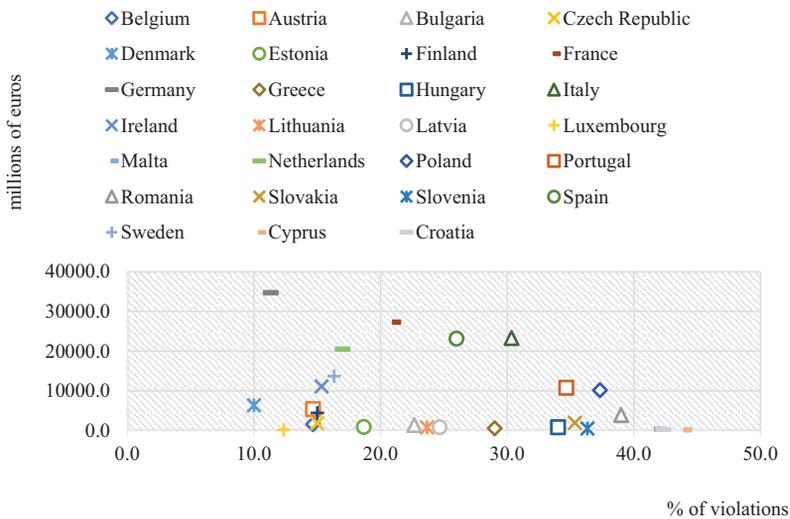


Figure 6. Clustering of EU-27 countries by the method of average group value by their compliance with fiscal discipline

Clustering data show that digital technologies applied in the control over tax liabilities of many countries allow more organized and effective counteraction to misuse, as well as improve the quality of tax reporting. On the other hand, many EU-27 countries with significant economic development indicators are at the beginning of a digital transformation of the organization of control over tax liabilities of budgetary institutions. For example, in 2021 Slovenia showed 7% GDP growth and got into the lower right cluster with the highest rates of violations of fiscal discipline by budgetary institutions, where underdeveloped control system of budget obligations was one of the reasons (Group II “E-balance sheet” according to classification presented in Figure 2).

4. Discussion

The literature review and the analysis of theoretical approaches to the study of the impact of digital technologies on the organization of control over tax liabilities by budgetary institutions showed that almost all researchers (Bondarenko et al., 2020; Mavlutova et al., 2021; Panasiuk et al., 2021; Prokopenko et al., 2019; Stewart & Clavey, 2021; Syrtseva et al., 2021) are unanimous about the need and inevitability of the transition of fiscal processes to the digital space using artificial intelligence (Mavlutova et al., 2021) and cloud services (Prokopenko et al., 2020; Syrtseva et al., 2021). Therefore, we agree that the use of such services allows the management system to make the calculation of tax liabilities of budgetary institutions transparent and efficient.

There is also no objection to the opinion of Bondarenko et al. (2020) that the use of automation can completely solve the problem of accuracy of preparation and efficiency of providing accounting information by budgetary institutions to civil servants for sound adoption and implementation of effective management decisions. This was confirmed by the clustering of EU-27 countries in terms of the quality of fiscal discipline, which is influenced by the level of implementation of digital technologies in the organization of control over tax liabilities. Therefore, we confirmed the opinion of Panasiuk et al. (2021) that digitalization creates an opportunity for active data management in the organization of control over tax liabilities by budgetary institutions in particular and public finances in general.

Dobrovic et al. (2018) established causal links between the introduction of digital technologies in the system of accounting and control of tax liability settlements by budgetary institutions. We have grouped national digital tax control systems in the EU-27 in order to confirm this. Besides, the example of Germany in the EU-27 proved the need for digital transformation of tax control, which was caused by internal and external factors. We agree that the most important internal factor has been the need to adapt tax administration to the general evolution, as digital technologies have become the flagship of development in various aspects of life in the last two decades, including the transformation of tax control, as Clarke (2020) states. Instead, external factors are related to the difficulties of public finances, pressure from global financial institutions or the adaptation of the national economy to the common standards of the European Union, as Al-Htaybat and Von Alberti-Alhtaybat (2017) mentioned in the study.

In turn, the imperfection of the organization of accounting and control of tax liability settlement, the inefficiency of tax administration leads to significant losses of the state due to tax evasion, which negatively affects the budget. Globalization processes not only in the EU but also in the world indicate the inevitability of changes in the fiscal system (Halkiv et al., 2021; Rieg, 2018) despite the suspicion of most taxpayers around the world that tax administrations are too conservative and unable to modernize and actively participate in the digitalization process (Hrechyn et al., 2021; Sudomyr et al., 2020). The experience of Sweden was provided as a contrast, where every taxpayer tries to be involved in the process of public finance management.

This study had a number of limitations. First – the large number of budgetary institutions in the EU-27. Second, the difference in the territorial organization of the EU-27. This is why federal Germany and unitary Bulgaria have different levels of subordination of budgetary institutions. This creates a wide field for further research.

Conclusions

Digital transformation is necessitated by external factors of economic development of EU countries. To promote economic growth and development, governments need to clearly understand the level of fiscal discipline in the country. Budgetary institutions are a kind of litmus test because, unlike business entities, they do not have flexibility in tax liabilities.

The study proved the need for implementing digital technologies in the organization of control of tax liabilities by budgetary institutions. The grouping of European experience in the use of digital tools in fiscal control identified five levels – from the simplest “E-file” to a fully automated control system “E-access”.

It was demonstrated that the countries with the level of E-accounting and above (from the third to the fifth level according to the grouping) have the lowest level of tax evasion, miscalculation or late payment by budgetary institutions as a result of the high level of digitalization of the tax control. The leading countries are Germany, Sweden, Denmark, Austria (Luxembourg is an exception: the country is in the E-balance group, but tax control is not difficult due to the small number of budget institutions compared to other countries). That is, there is a direct correlation between the degree of application of digital technologies in the control over tax liabilities and the fiscal discipline level in the country ($r = 0.828710$).

Besides, the EU-27 countries were clustered by the method of average group value for fiscal discipline. It confirmed the cophenetic correlation – the highest level of correlation between the defined criteria (% of violations of fiscal discipline and total amounts of taxes paid by budgetary institutions on average for 2019–2021). The applied clustering methodology revealed that Germany and Cyprus were the “farthest neighbours”, which directly confirms ($r = 0.867331$) the hypothesis of the study: a condition for improving fiscal discipline in the implementation of state tax policy is the integration of the information society into the control system of tax liabilities of budgetary institutions through digital technology.

Author contributions

Authors contributed equally. All authors have read and agreed to the published version of the manuscript.

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