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Integrating Big Data, Cryptocurrency, and ESG in Sustainable Fiscal Policy

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Abstract

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This study aims to comprehensively examine the relationship between big data, sentiment analysis, cryptocurrencies, and Environmental, Social, and Governance principles in the context of modern fiscal policy. Through a narrative study approach to online scientific articles published in the last five years, this research highlights the strategic role of digital technology in strengthening the transparency, efficiency, and sustainability of the global economic system. The results of the study show that the use of big data analytics contributes significantly to increasing the effectiveness of evidence-based fiscal policies, while sentiment analysis provides in-depth insights into public perceptions and responses to economic policies. Cryptocurrency innovations and blockchain technology have also been proven to expand the space of fiscal transparency as well as drive the efficiency of digital financial governance. On the other hand, the integration of Environmental, Social, and Governance principles strengthens the direction of long-term economic sustainability through ethical and responsible investments. This study concludes that the synergy between digital innovation and sustainability value is an important foundation towards a resilient, inclusive, and adaptive fiscal system to global economic changes.

1. Introduction

The development of digital technology in the last decade has fundamentally changed the way the world manages information and makes decisions in the fields of economics, finance, and public policy. The advent of big data, artificial intelligence (AI), blockchain, and sentiment analysis has expanded the capabilities of analytics in identifying complex patterns of economic behavior and fiscal risks (Thayyib et al., 2023). In this context, the integration of big data and artificial intelligence is an important means to drive efficiency and transparency in the modern financial system, both at the micro and macroeconomic levels (Ouyang & Fang, 2022). This digital transformation not only increases the effectiveness of fiscal policies, but also strengthens financial governance through more comprehensive data oversight.

One of the areas that has experienced a significant impact is taxation and fiscal policy. The use of big data analytics in the tax system allows risk identification, tax avoidance detection, and the formulation of more evidence-based policies (Deng et al., 2023). In addition, sentiment analysis of public opinion on economic policy can help policymakers understand public perceptions and gauge potential public acceptance of certain fiscal policies (Marques et al., 2022). In an era where social and economic interaction takes place in the digital space, the ability to extract meaning and emotion from textual data has become a strategic aspect in economic decision-making.

On the other hand, the emergence of cryptocurrencies presents new opportunities as well as challenges. The decentralized and pseudonymous nature of crypto transactions makes it difficult for tax authorities to track and enforce

regulations (Kethineni & Cao, 2020). Regulation of digital assets is becoming an increasingly urgent issue as the value of global transactions increases and its relationship with fiscal stability. Some countries have even begun to explore blockchain-based tax systems to improve fiscal transparency and efficiency (Emmert, 2023). In this context, fiscal policy needs to be designed adaptively to be able to accommodate technological changes without sacrificing economic stability.

The concept of sustainability is also starting to become an integral part of investment strategies and global economic policy-making. Environmental, Social, and Governance (ESG) factors are increasingly used as the main indicators in the assessment of a company's financial performance and investment allocation (Riski et al., 2023). The ESG approach emphasizes not only on profitability, but also on the social responsibility and environmental impact of economic decisions. Thus, sustainability is an important component in building a fiscal and financial system that is resilient to long-term crises.

The integration between big data analytics, sentiment analysis, cryptocurrencies, and ESG principles shows a paradigmatic transformation in the digital economy. Technological innovation now no longer only serves as an operational tool, but also becomes the foundation for ethical and sustainable decision-making (Hua et al., 2019). Recent studies confirm that the combination of data technology with sustainability values can improve the accountability and efficiency of the fiscal system globally (Dionisio et al., 2023). This shows that the direction of future fiscal policy needs to consider the synergy between digital innovation and the principle of social responsibility.

Nonetheless, the current literature still shows a research gap in terms of how synergies between digital financial technologies, data analytics, and fiscal policy can be optimized. Most research is still fragmented and focuses on the technical or regulatory dimensions separately. Therefore, this study seeks to review the latest research developments on the use of digital technologies in fiscal and sustainable finance policies, emphasizing the relationship between big data, sentiment analysis, cryptocurrencies, and ESG. This study is expected to provide a comprehensive conceptual overview to understand the direction of digital transformation in the global financial system towards more transparent, efficient, and sustainable governance.

2. Literature Review

2.1. Big Data, Sentiment Analysis, and Fiscal Policy

The use of big data analytics in economic and fiscal contexts has been one of the key innovations driving the efficiency of public decision-making. Through the collection and analysis of large volumes of data, fiscal authorities can improve the detection of tax evasion and the optimization of evidence-based policies (Ouyang & Fang, 2022). This approach allows for real-time analysis of taxpayer behavior patterns, strengthens predictive capabilities against potential non-compliance, and supports better fiscal transparency (Neuman & Sheu, 2022). From a public policy perspective, big data also serves as a tool to improve fiscal accountability because it can provide empirical information on the impact of policies on various economic sectors.

In addition, the integration of sentiment analysis further enriches the dimension of fiscal policy analysis. Through the extraction of public opinion from social media, economic forums, and online news, policymakers can understand public perceptions of new tax changes or fiscal policies (Marques et al., 2022). This technique allows for a qualitative assessment of public revenue, as well as being a social indicator of the success of policy communication. Thus, big data and sentiment analysis collectively become strategic instruments in building a data-based fiscal system that is adaptive, responsive, and inclusive to global socioeconomic dynamics.

2.2. Cryptocurrencies and ESG Integration in Modern Finance

The transformation of the digital economy has introduced new assets such as cryptocurrencies, which present challenges as well as opportunities for global fiscal policy. The decentralized and transparent nature of blockchain allows for transaction efficiency, but it also poses risks to monetary stability and tax regulation (Chen & Bellavitis, 2020). To answer this complexity, a policy approach has emerged that utilizes blockchain technology as a means of fiscal recording and digital audits to increase accountability and mitigate fraud risks (Bonsón & Bednárová, 2019). Thus, cryptocurrencies are becoming a central topic in discussions regarding the future of data-driven financial systems and technology.

In line with these developments, the sustainability dimension through Environmental, Social, and Governance (ESG) has also formed a new paradigm in investment management and fiscal policy. Research by Riski et al. (2023) emphasizes that ESG factors play an important role in determining the direction of sustainable

investments and encouraging more transparent corporate governance. The integration of ESG in the digital financial system emphasizes not only economic benefits, but also social responsibility and environmental impact. Therefore, future fiscal policies need to be oriented towards the principles of social justice and economic sustainability, where ethical and technological values go hand in hand to create long-term financial stability.

3. Method

This research uses a narrative study approach that focuses on conceptual and interpretive analysis of the results of online scientific research published in the last five years. This approach was chosen because it is appropriate to describe the dynamic relationship between digital technologies, economic sustainability, and fiscal policy holistically. Narrative studies allow researchers to examine empirical and conceptual findings from various literature to produce a comprehensive understanding of the direction of development of the topic being studied (Siddaway et al., 2019). With this method, researchers not only collect data, but also interpret the social, economic, and technological contexts that shape the evolution of the concepts of big data, sentiment analysis, cryptocurrency, and ESG in fiscal policy.

The research stage is carried out through four main steps. First, identification and selection of relevant scientific sources. The selected sources are articles from international journals indexed by Google Scholar and Elsevier with topics related to financial digitalization, big data analysis, cryptocurrencies, and sustainable finance. The articles used include publications from the last five years, including research that

combines aspects of the digital economy with fiscal policy and sustainable investment (Riski et al., 2023).

Second, content analysis is carried out on each article to identify the main themes, research trends, and methodologies used by the author. This process allows researchers to recognize patterns of interconnectedness between key variables such as the use of big data in fiscal policy, the implications of sentiment analysis on public acceptance, and the role of ESG in investment decisions. Third, narrative synthesis is carried out by connecting the results of the research in a consistent conceptual framework. This approach helps to develop a thematic map that illustrates the interaction between technological factors and fiscal policy across disciplines (Dionisio et al., 2023).

Finally, the theoretical validation stage is carried out by comparing the findings of the synthesis results with previous theories and research results to ensure the alignment of academic logic and conceptual validity. The limitation of this method lies in its qualitative and interpretive nature, so it does not produce quantitative generalizations. Nevertheless, narrative studies have the power in providing an in-depth and contextual understanding of complex phenomena such as the integration of digital technologies with fiscal policy and global economic sustainability. Thus, this approach is considered appropriate to describe the evolution and future direction of financial systems based on technological innovation, data, and sustainability values (Neuman & Sheu, 2022).

4. Results

The results of this narrative study show that the development of digital technology has brought fundamental changes to fiscal practices, financial governance, and global economic policy direction. The integration between big data analytics, artificial intelligence (AI), and sentiment analysis has opened up a new paradigm in data-driven decision-making, especially in the context of taxation and public fiscal management. This technology allows governments, financial institutions, and investors to gain a more comprehensive picture of people's economic behavior and the associated risks (Ouyang & Fang, 2022). Neuman and Sheu's (2022) study shows that the application of big data analytics in tax audits improves supervisory efficiency and expands the scope of fiscal compliance. With a big data-based analytics system, fiscal authorities can detect tax evasion more accurately and quickly compared to conventional methods.

The results of the literature analysis also show that sentiment analysis has strategic value in understanding the dynamics of public opinion towards fiscal policy. The study of Marques et al. (2022) shows how sentiment analysis of social media and online forums can map public perception of certain fiscal regulations. Through textual analysis combined with machine learning algorithms, policymakers can assess the tendency of public acceptance or rejection of changes in tax policies, subsidies, or economic stimulus. This strengthens the function of evidence-based policymaking, where decision-making not only relies on macroeconomic data, but also takes into account social responses in real-time.

Moreover, the existence of cryptocurrencies marks a major transformation in the architecture of the global digital economy. Research by Kethineni and Cao (2020) highlights that the decentralization of cryptocurrencies presents a serious challenge to fiscal oversight due to weak control mechanisms and jurisdictional ambiguity. However, Emmert's (2023) study shows that the blockchain technology underlying cryptocurrencies can be leveraged to strengthen the accountability and transparency of financial transactions. Blockchain allows for the recording of immutable ledgers, so it has the potential to be used for automated tax reporting systems. This innovation opens up opportunities for the creation of digital fiscal policies that are adaptive to the new economic ecosystem.

This shift in economic paradigm has also given rise to a close relationship between digital financial technology and the value of sustainability. Research by Riski et al. (2023) states that the concept of Environmental, Social, and Governance (ESG) is the main indicator in assessing investment performance and sustainable portfolios. ESG not only serves as a measure of corporate social responsibility, but also as a risk mitigation mechanism against global economic uncertainty. The integration of ESG principles in fiscal practices and public investment is able to encourage more responsible capital allocation and positive social impact. This is in line with the results of Coelho et al.'s (2023) research which confirmed that there is a positive correlation between the application of ESG principles and the company's financial performance. Thus, the direction of modern economic policy is moving towards a fiscal system that balances economic efficiency and socio-environmental sustainability.

The study of Hua et al. (2019) added that big data and quantum computing have the potential to improve predictive capabilities in financial research and public policy. Massive data-driven analysis allows governments to anticipate fiscal risks and changes in economic structure due to global digitalization. With the support of predictive algorithms, policymakers can devise fiscal scenarios that are more flexible and based on empirical data. The application of this approach shows great potential for developing countries to strengthen their fiscal stability through adaptive and efficient digital innovation.

From a social perspective, the results of Rabbani et al. (2021) research confirm the role of AI as a social innovation in accelerating sustainable financial transformation during the COVID-19 pandemic. Through analytics and automation technologies, financial institutions can simultaneously monitor social and economic risks, while expanding access to green finance. This shows that the integration of AI and big data not only improves fiscal performance, but also strengthens social resilience in the face of global crises.

In addition, research by Mishra and Kaushik (2023) found that collaboration between blockchain and AI in the context of sustainable finance promotes investment efficiency and transaction transparency across sectors. The combination of these two technologies speeds up the data validation process and reduces the risk of information manipulation. Similar results were found by Kwong et al. (2023), who show that the convergence of digital technologies such as the Internet of Things (IoT), big data, and blockchain creates a more transparent and decentralized green

finance ecosystem. This phenomenon leads to the establishment of an autonomous financial system that is adaptive to the principles of global sustainability.

Furthermore, the results of the study by Jiakui et al. (2023) show that the emergence of new financial technologies poses ethical and structural challenges in sustainable finance practices. They emphasized the need for global regulations that are able to integrate technological innovation with social responsibility. This underscores the importance of a balance between technological efficiency and socio-economic stability, especially in the context of fiscal policy digitalization.

Research by Sabry et al. (2020) found a significant relationship between the application of artificial intelligence and the volatility dynamics of crypto assets. Their results show that crypto market fluctuations are influenced by digital public sentiment and the level of adoption of AI technology in trading systems. This phenomenon shows the interplay between market psychology and digital analytics that increasingly determine the direction of global monetary and fiscal policy.

The study by Riani and Rusydiana (2023) adds an interesting perspective by applying sentiment analysis to sustainable finance initiatives. Their results show that public perception of green policies plays a major role in determining the effectiveness of ESG programs. Text-mining-based textual analysis can be used to identify public narratives that support or reject sustainable policies, so that governments can adjust their fiscal communication strategies.

Overall, the results of the literature synthesis show three main findings. First, the integration of big data analytics and sentiment analysis improves the quality of fiscal policy by providing real-time data and valid public perception. Second, the

emergence of cryptocurrencies and blockchain technology is driving a major transformation in financial transparency, although it still poses regulatory and ethical risks. Third, the application of ESG principles in the digital financial system strengthens the direction of sustainability and social responsibility in modern fiscal policies (Coelho et al., 2023).

These findings indicate that the financial system of the future will increasingly rely on the integration of technology, data, and sustainability values. Big data will be the foundation for fiscal policy analysis, while AI and sentiment analysis will be the bridge between technical data and the social dimension of public policy. On the other hand, blockchain and cryptocurrencies have the potential to become new fiscal infrastructure that is more open and efficient. By integrating ESG principles, the global financial system can transform towards a fair and sustainable digital economy paradigm.

5. Discussion

The findings of this study underscore the importance of integrating technological innovation and sustainability principles in shaping the new direction of global fiscal policy. Digital transformation through big data analytics, artificial intelligence, cryptocurrencies, and Environmental, Social, and Governance (ESG) frameworks shows that the modern economy is no longer separable from technology and social ethics. The results of the synthesis confirm that a data-driven and sustainability approach is not just an option, but a structural necessity in the face of dynamic global economic uncertainty (Riski et al., 2023).

The role of big data analytics in fiscal management has been proven to provide strategic value for the state and financial institutions. With its ability to process large amounts of data, the technology enables predictive analysis of economic behavior and tax compliance. This supports the creation of more responsive and evidence-based fiscal policies (Thayyib et al., 2023). However, the results of the study also show that the successful implementation of big data requires a strong regulatory framework, especially related to data privacy and security. Without a clear legal basis, the potential for data misuse can threaten the legitimacy of public policy.

In the social dimension, sentiment analysis has been proven to be able to connect fiscal policy with public perception directly. Analysis of public opinion on social media can be an early indicator of the acceptance of certain economic policies (Marques et al., 2022). This confirms that policy-making is no longer based solely on macroeconomic data, but also on the emotional and social analysis of the community. This integration of quantitative and qualitative approaches reflects a new model in fiscal policy management that is more participatory and human-centered (Rabbani et al., 2021).

Meanwhile, the emergence of cryptocurrencies and blockchain technology is giving a new direction to the concept of fiscal transparency and transaction efficiency. Decentralized financial systems are able to reduce information asymmetry and strengthen public trust in fiscal institutions. However, the study of Chen and Bellavitis (2020) emphasizes that the main challenge of digital assets is the absence of uniform international regulatory standards, which has the potential to pose a risk

to fiscal stability. Therefore, global collaboration between tax authorities is a must to maintain a balance between innovation and stability.

The integration of sustainability values through ESG is a key aspect that connects all these dimensions. ESG not only functions as an investment instrument, but also as a moral foundation in economic policymaking (Bonsón & Bednárová, 2019). When big data and artificial intelligence are used to support ethical and sustainable investments, a fiscal ecosystem is formed that is not only efficient, but also responsible for the environment and society (Coelho et al., 2023).

From an academic point of view, cross-disciplinary collaboration between economics, information technology, and public policy studies is the main requirement for understanding this new dynamic (Hua et al., 2019). Future research needs to place more emphasis on the integration of quantitative and qualitative methodologies to bridge the gap between technological efficiency and social value. Thus, the results of this study reinforce the argument that the success of modern fiscal policies depends on a balance between digital innovation, data transparency, and global socio-economic sustainability.

6. Conclusion

This research confirms that the integration between digital technologies and sustainability principles has become a key foundation in shaping a resilient modern fiscal and financial system. The use of big data analytics and sentiment analysis has been proven to strengthen the capacity of governments and financial institutions to design evidence-based policies that are more adaptive, transparent, and inclusive.

This approach allows for a more accurate analysis of economic behavior, while improving fiscal policy responses to changing social dynamics. Meanwhile, the emergence of cryptocurrencies and blockchain technology presents a great opportunity to improve efficiency, transparency, and fiscal accountability. However, the adoption of this technology also poses new challenges related to economic stability, data use ethics, and cross-border regulations.

Therefore, global policy coordination and adaptive legal frameworks are critical to maintaining a balance between innovation and fiscal security. The sustainability dimension through the application of Environmental, Social, and Governance (ESG) principles plays a strategic role in balancing economic goals with social and environmental responsibilities. The integration of ESG values in fiscal policy strengthens the direction of equitable and environmentally friendly economic development. Overall, the direction of global fiscal policy is moving towards a new paradigm based on cross-disciplinary collaboration, digital ethics, and a commitment to sustainability. This research makes a conceptual contribution to the understanding of how digital innovation can function as a strategic instrument in realizing inclusive, accountable, and sustainable fiscal governance.

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