






Cyber-Environment in the Human Rights System: Modern Challenges to Protect Intellectual Property Law and Ensure Sustainable Development of the Region



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ABSTRACT

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The purpose of the article is to assess the various factors influencing the sustainable development of innovation in the region and the challenges it brings. The object of the study is the sustainable development of innovations in Ukraine. The scientific task is to search for relationships and features of the influence of various factors on the level of sustainable development in the region. The article evaluates the factors affecting innovation's sustainable development in Ukraine, focusing on the role of intellectual property protection and its challenges. By employing a nonlinear programming method (Hoerl Model) and trend line forecasting with the Statistica 6.0 program, this study investigates the dynamics between various indicators and sustainable innovation growth. Cybersecurity emerges as pivotal in protecting the integrity of intellectual property and ensuring the secure dissemination of innovative solutions, directly influencing sustainable progress and human rights preservation. The research uniquely contributes by incorporating a multifaceted approach to understanding and forecasting sustainable development trends within a context of rapid technological change and evolving legal frameworks. However, the study's scope is somewhat constrained by its reliance on a limited dataset, potentially impacting the findings' generalizability. The limited data might not fully represent the complexity of regional variations in innovation practices and cybersecurity measures, suggesting a need for broader data collection to enhance the study's robustness and applicability across different socio-economic contexts.

1. INTRODUCTION

The development of the modern world is characterized by a significant level of integration with cyberspace and digital technologies, which have become an integral part of the life of every person. Given this, ensuring a high level of cybersecurity as a new paradigm for respecting human rights in the modern world is becoming increasingly important. This relevance is due to the fact that the cyber threats that exist today in one way or another affect every aspect of a person's life, from his personal life to economic stability. In addition, this is especially relevant in the context of the protection of intellectual property and innovation, which today has become a key aspect of sustainable regional development.

Intellectual property itself, as one of the rights of a citizen, provides his guarantee that only the author has the opportunity to receive financial and other types of benefits from his work. However, enforcement of intellectual property rights is a significantly more difficult process in cyberspace, given that

the dissemination of information in the latter is massive and difficult to control. In this regard, ensuring property rights in cyberspace is becoming a key task for modern legislation and cybersecurity policy in most countries of the world and a determining factor in the sustainable development of regions.

Ensuring a high level of cybersecurity, as well as the protection of intellectual property rights in the context of regional development, is complicated by the fact that each country has its own level of technological development and individual characteristics of the legal system. In this context, the development of international communications in this area and the formation of international legislation on the issue of ensuring cybersecurity and intellectual property protection is an important element of sustainable development. Another important issue is the impact of cybersecurity on sustainable innovation. Cyberattacks on manufacturing and research facilities can have far-reaching consequences, from production shutdowns to the loss of confidential research data. Not only does this create immediate financial and operational

harm, but it can also stifle innovation by reducing opportunities for the development of new technologies and products. In this context, the development of effective cybersecurity strategies and their implementation in regional innovation systems becomes a key aspect of ensuring sustainable development and protecting the intellectual potential of the regions.

Thus, cybersecurity in the human rights framework is a complex but critical area of study that requires an integrated approach covering technical, legal, ethical and social aspects. It plays a key role in promoting sustainable development and innovation, while protecting fundamental human rights and freedoms in the digital world.

The purpose of the article is to assess the various factors influencing the sustainable development of innovation in the region and the challenges it brings. The object of the study is the sustainable development of innovations in Ukraine.

The structure of the article includes a review of existing literature, a description of the research methodology, a presentation of the results, their comparison with the existing literature and conclusions.

2. LITERATURE REVIEW

In the context of the rapid development of technology and its impact on human rights, a review of modern scientific sources becomes necessary for a deep understanding of the topics of cybersecurity, intellectual property protection and innovative development. This section of the study focuses on examining recent scientific work that illuminates various aspects of these complex interactions. Analysis of contemporary literature allows not only to assess the current state of research, but also to identify previously undocumented trends and challenges, which is important for the development of effective strategies and policies in the field of cybersecurity and innovation. Therefore, this section is key to structuring and critically analyzing existing studies that form the basis for further research.

Thus, Saleh et al. [1] study the legal aspects of cryptocurrency management in the context of national security. They analyze how cryptocurrency can impact financial stability and legal regulations, which is important for understanding modern cybersecurity challenges, especially in the context of intellectual property protection and innovation. In turn, Kronivets et al. [2] focus on the legal basis for the use of artificial intelligence in education. This study is important for assessing the impact of technology on legal and educational systems, which is directly related to innovative development in the region.

Interesting studies by Yesimov and Borovikova [3], which consider the administrative and legal implementation of the rights of business entities. They explore how government regulation influences economic development and the creation of an enabling environment for innovation, which is key to understanding the broader context of sustainable development.

Krupa et al. [4] analyze the effectiveness of e-business in tourism in the digital era. Their approach to studying digital transformation in tourism provides valuable insights into the opportunities and challenges of e-business, which is of great importance for understanding changes in the sustainable innovation development paradigm.

An interesting study is by Rushchyshyn et al. [5], who consider the management of innovative development of

enterprises based on their financial and resource capabilities. Their work is important for understanding how resource constraints and financial strategies influence innovation activities critical to sustainable development.

In the work of Alazzam et al. [6] are developing an information model for e-commerce, focusing on modern socio-economic systems in the context of global digitalization. This study helps to understand how digital transformation and legal compliance affect e-commerce, which is important for analyzing innovation processes in the issue of cybersecurity in the human rights framework.

In a study by Bazyliuk et al. [7] a comparison is made of the institutional dynamics of regional development of publishing and printing activities in Ukraine. This study highlights the importance of institutional factors in the development of innovation, providing a unique perspective on the influence of state and regional policies on the innovation landscape. The work of Rushchyshyn et al. [8] focus on the regulatory and legal component in ensuring the financial security of the state. Their findings are important for assessing the impact of legal regulation on economic stability and innovation potential, especially in the context of cybersecurity and intellectual property protection in the region. In turn, Alazzam et al. [9] explore the nature of electronic contracts using blockchain technology, with the example of the Bitcoin cryptocurrency. This resource provides a deeper understanding of how emerging technologies, particularly blockchain, impact the legal aspects of doing business and managing intellectual property, as well as the broader context of cybersecurity in the context of sustainable innovation in the region. Sylkin et al. [10] evaluate the financial security of engineering enterprises as a prerequisite for the use of crisis management. The study focuses on the practical aspect of ensuring the stability of enterprises, which is important for understanding the economic aspects of sustainable development and innovation in the region. Zbigniew [11] examines the issue of human rights in the light of natural law concepts. This study is important for understanding the fundamental aspects of human rights, key to analyzing the impact of cybersecurity and innovation on individual rights and freedoms in the modern world.

Kopytko Sylkin [12] delve into the role of information support systems in combating corruption within the economic security management of states. Their research, published in Social and Legal Studies, emphasizes the significance of modeling information support systems to enhance the effectiveness of anti-corruption measures. This study is particularly relevant in understanding the broader framework within which intellectual property law operates, as corruption can significantly hinder the enforcement of such laws and, consequently, affect sustainable development. Zyhrii et al. [13] address the dynamic interplay between law, technology, and innovations, analyzing their collective impact on the legal system and its regulatory mechanisms. The authors argue that innovations, while beneficial, pose challenges to existing legal frameworks, necessitating ongoing adaptations to adequately regulate new technologies and protect intellectual property rights. This perspective is crucial for understanding the complexities of legal adaptations in the face of rapid technological advancements and their implications for intellectual property law [12, 13].

Barabash et al. [14] investigate the socioeconomic, cultural, and labor rights implications of enterprise relocation, both within Ukraine and internationally. Their findings highlight

the multifaceted impacts of such relocations on the realization of these rights, pointing to the need for policies that mitigate adverse effects and promote sustainable development. The study underscores the interconnectedness of economic activities, labor rights, and sustainable development, offering insights into the broader context within which intellectual property law must function.

Taking this into account, today the issue of ensuring cybersecurity in the human rights system for the protection of intellectual property and sustainable development of innovation in the region is relevant. But, despite this, this topic has a number of gaps and insufficiently explored areas (Figure 1).

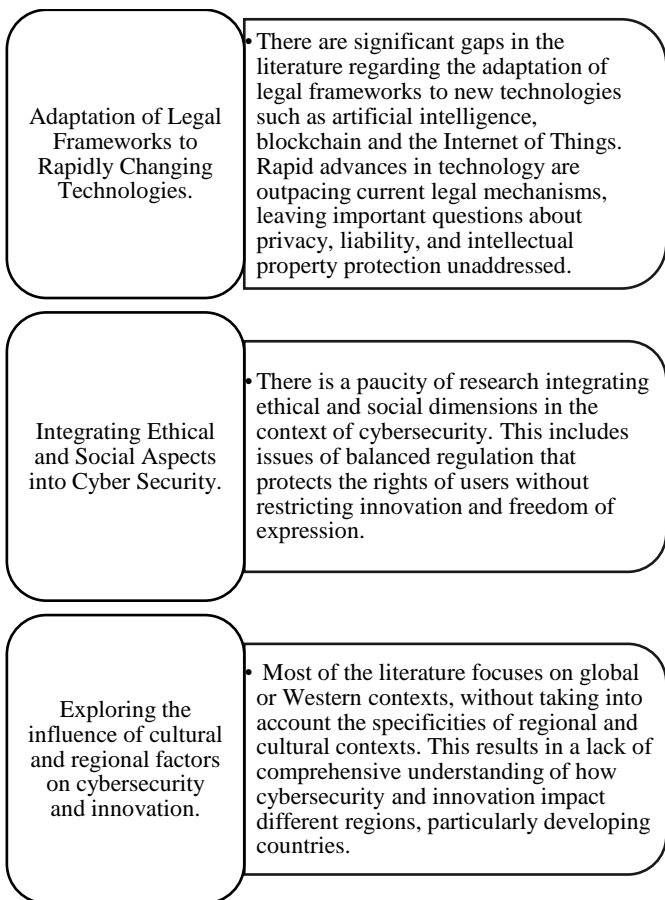


Figure 1. The main gaps in modern research into the issue of cybersecurity in the human rights system in the context of protection of intellectual property and sustainable development of innovation in the region

Despite significant achievements and extensive research in the field of cybersecurity, intellectual property protection and sustainable development of innovation, an analysis of modern scientific works reveals the existence of certain gaps in this topic. This is especially true in the context of rapid technological developments and the constantly changing legal and economic landscape. The dynamic nature of cyberspace, the growth of new forms of intellectual property and their interaction with sustainable development require constant updating of knowledge and approaches. Thus, existing research, while providing a valuable framework, cannot fully capture all aspects of this rapidly changing industry, highlighting the need for further research and analysis to fill these gaps.

The scientific task is to search for relationships and features

of the influence of various factors on the level of sustainable development in the region.

3. METHODOLOGY

In today's dynamic world, where the impact of cyber technologies on human rights and innovation processes is growing every day, the importance of using comprehensive and innovative research methods becomes key. In this context, our research methodology is based on the use of advanced analytical approaches that provide deep insight into the interaction between cybersecurity, intellectual property protection and sustainable innovation. The selected methods allow not only to accurately assess the current state of affairs, but also to predict future trends, taking into account rapid changes in the technological and social environment. This approach is integral to developing effective cybersecurity strategies that protect human rights and promote regional innovation.

So, this study uses several key methods of analysis, each of which has its own nature, advantages and disadvantages.

The first method is nonlinear programming in the context of using the Hearl model. In the context of our research, this method is used to assess the level of intellectual property protection and the level of sustainable development of innovation. The advantage of this method is its ability to model complex interactions and dependencies. This method is especially effective for identifying and systematizing non-obvious relationships that may be ignored by traditional linear models. Despite this, the key disadvantage of this method is its complexity and complexity, which requires performers to have a sufficient level of knowledge in the field of mathematical modeling and large amounts of data for analysis.

The second method is the trend line forecasting method, used for detailed analysis of historical data and determining future development trends. This method is relatively easy to use and further understand. This simplicity makes it accessible and acceptable for various scientific fields. Using this method allows you to trace future trends and development prospects, which is useful for strategic planning. The disadvantage of this method is the inability or limited ability to predict sudden and stochastic events, since it is based on the hypothesis that past trends will continue into the future.

The third research tool is Statistica 6.0 software used to perform statistical analysis of data collection. This program provides a wide range of possibilities for processing, organizing and analyzing data. The program's capabilities include regression analysis, cluster analysis and other statistical tests. The key advantage of this program is its versatility, flexibility and the ability to display complex dependencies. At the same time, using the program requires specific knowledge and experience working with such software.

Overall, the combination of these methods allows for a comprehensive approach to the analysis of complex cybersecurity issues, intellectual property protection and sustainable development of innovation. Each method makes a unique contribution to the study, allowing the problem to be viewed from different perspectives and providing a deeper understanding of the topic. However, it is important to consider the limitations of each method to ensure the accuracy and objectivity of the study's findings.

4. RESULTS OF RESEARCH

In the current period of sustainable development of Ukraine, the problems of ensuring cybersecurity are aggravated. This necessitates an in-depth analysis of destabilizing factors and economic processes that negatively affect innovation processes in the region. Figure 2 shows the structure of sources of financing innovations in the system of ensuring cybersecurity and human rights in Ukraine.

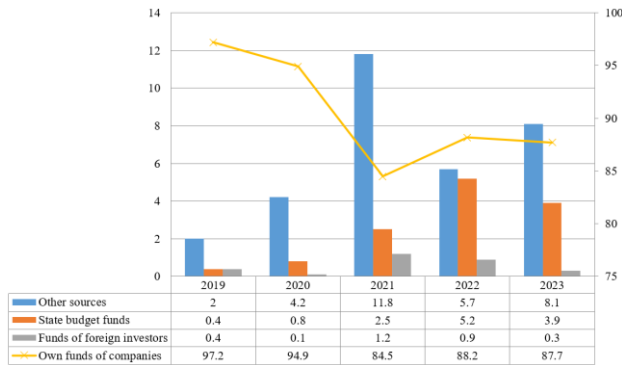


Figure 2. The structure of sources of funding for innovative activities in the field of cybersecurity and protection of human rights

In our study on the structure of funding sources for innovative activities in cybersecurity and human rights protection, we observed a notable decline in funding volumes over the past year. This downturn can be largely attributed to the ongoing state of war within the country, which has necessitated a significant reallocation of both public and private resources towards immediate national defense and emergency response efforts. Such circumstances have led to a prioritization of direct military and humanitarian aid over long-term investments in innovation, including those aimed at cybersecurity and human rights protections. Therefore, we consider it expedient to find out the impact on the sustainable development of funding volumes in the field of ensuring cybersecurity and the legal regime (Figure 3).

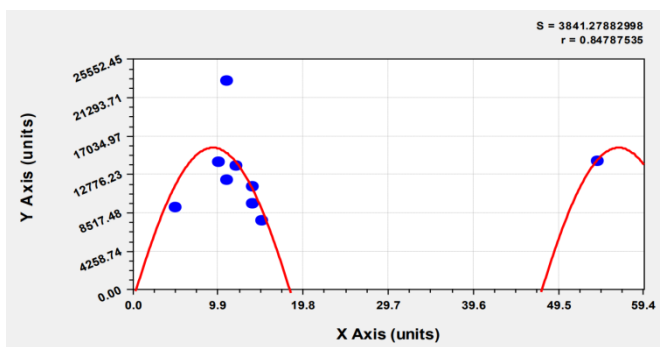


Figure 3. Non-linear programming (Hoerl model) of volume influence financing of cybersecurity and protection of human rights to the level of sustainable development in the region

The model incorporates variables such as the volume of financing, which represents the total financial resources allocated towards cybersecurity initiatives and human rights protection efforts within a specified timeframe. This includes both public and private investment sources. Another significant variable is the level of sustainable development,

which is evaluated based on a composite index that may include indicators like economic growth, social equity, and environmental sustainability within the region. The Hoerl model, known for its capacity to handle non-linear relationships, allows us to explore the intricate dynamics between increased financial investment in cybersecurity and human rights and the consequent effect on sustainable development. By analyzing these relationships, the model helps identify optimal investment levels that could potentially maximize sustainable development outcomes, considering the diminishing returns and synergistic effects that characterize the interaction between these variables.

The results of the calculations using nonlinear programming prove a directly proportional relationship between the volume of funding for cybersecurity in the field of protecting the rights of the population and the level of sustainable development (1):

$$Y = -94.3 + 25.18 \cos(0.13x - 1.24), \quad (1)$$

$$R = 0.85; \quad = 0.63; \quad F(1.26) = 54.08$$

In Figure 4 we consider it appropriate to reflect the structure of the influence of the main destabilizing factors on the level of sustainable development of Ukraine.

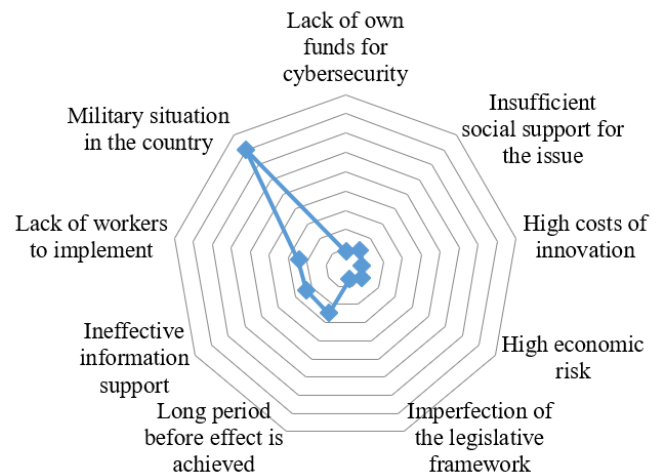


Figure 4. The structure of the influence of the main destabilizing factors on the level of sustainable development of Ukraine

Cybersecurity would play a significant role in this matter, but due to the high degree of risk, the sustainable development of the region remains excessively low. A thorough study of the factors influencing the level of sustainable development should be conducted using the Statistica 6.0 software package, based on vector autoregression. The use of vector autoregression models, as described in the article's research methodology, involves a statistical approach that captures the linear interdependencies among multiple time series datasets. This model is instrumental in examining the influence of various factors over time within a system, particularly useful in economic and financial analysis. By analyzing how each variable affects itself and other variables within the model, vector autoregression allows for the prediction of future values based on historical data. This capability is essential for understanding the dynamic interactions among economic indicators, facilitating comprehensive analysis and forecasting. Employing such models helps in identifying potential impacts of changes within one area on others, offering valuable

insights for informed decision-making and policy development in the context of sustainable innovation growth.

The results of such a study would allow for tracking the systemic connection between the level of innovation activity (RIA), the level of cybersecurity (REBP), the level of funding for intellectual property protection (RFID), the level of expenditure on innovations in the field of human rights (RVN), and the level of external investment attraction for sustainable development of innovations (RZI) (2):

$$\begin{cases} RIA = 18.3 + 1.9RIA(t-1) + 2.6RFID - 3.8RVN + 3.5RZI \\ (18.5) ** (8.1) ** (29.03) *** (24.5) ** (21.65) * \\ REBP = 28.6 + 3.5REBP(t-1) - 4.9RVN + 3.04RFID - 0.27RZI \\ (22.7) ** (12.7) ** (16.1) *** (21.8) ** (09.9) * \end{cases} \quad (2)$$

The Vector Autoregression (VAR) model is statistically significant, considering the values of the correlation coefficient $R=0.8$; adjusted coefficient of determination $R^2=0.9$; Fisher's F-criterion $F(23,7)=59.9$ and the Durbin-Watson coefficient of 1.91. Thus, based on the results of the analysis, there is every reason to assert that the level of funding for intellectual property protection has an equally positive (directly proportional) impact on both the level of innovation activity and the level of cybersecurity. The corresponding regression indicators are 2.6 and 3.1. It should be noted that an increase in funding volumes has a significantly stronger impact on the level of cybersecurity than on the level of innovation activity. A negative effect on both indicators studied is exerted by the level of expenditure on innovations in the field of human rights.

In this context, the search and timely identification of destabilizing factors in funding and sustainable development of innovations become highly significant. Undoubtedly, the macroeconomic stability indicators of Ukraine, particularly the increase in macroeconomic imbalance and the evident state of war, exert a considerable destructive impact. Therefore, it will be worthwhile to track the interrelation between the level of state cybersecurity and innovations in the field of population rights protection, which should be aptly illustrated in Figure 5.

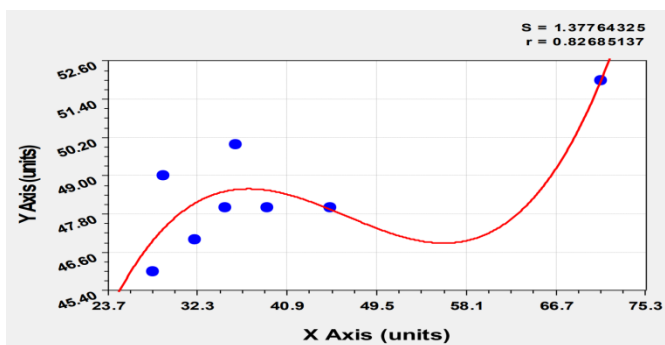


Figure 5. The interrelation between the level of state cybersecurity and the level of innovations in the field of human rights protection (nonlinear programming - polynomial model)

$$Y = 1.4 + 2.6x - 0.07x^2 + 0.04x^3 \quad (3)$$

The results of the conducted research on the interrelation between the level of state cybersecurity and the level of innovations in the field of population rights protection provide a basis for the conclusion that an increase in the level of cybersecurity will contribute to the strengthening of sustainable development of innovations.

Cybersecurity plays a pivotal role in fostering the sustainable development of innovations within a region. A robust cybersecurity framework ensures the protection of intellectual property, confidential data, and sensitive innovation processes from cyber threats and breaches. This security environment is crucial for nurturing a culture of trust and safety, encouraging businesses and individuals to invest in and pursue innovative projects. Moreover, effective cybersecurity measures prevent financial losses due to cyber-attacks, ensuring that resources are allocated efficiently towards innovative development rather than recovery from security incidents. As innovations increasingly rely on digital platforms and data-driven strategies, the significance of cybersecurity in protecting these assets and maintaining the integrity of innovative processes becomes paramount.

Parallel to cybersecurity, a well-established legal system for the protection of human rights significantly influences the sustainable development of innovations. Such a legal framework ensures that innovations are developed and implemented in a manner that respects and promotes human dignity, privacy, and individual freedoms. This not only fosters ethical innovation practices but also builds public trust in new technologies and processes. Furthermore, a strong legal system attracts global talent and investors who are more likely to engage with regions where their rights and contributions are protected. This influx of skills and capital accelerates innovative advancements, driving regional development. Overall, the synergy of effective cybersecurity and a robust legal system for human rights protection creates a conducive environment for sustainable, ethical, and impactful innovations.

5. DISCUSSIONS

The next step of our research is to compare the results obtained with the results of other scientific works. This step is extremely important in the context of any research, since it makes it possible not only to determine the suitability of the results obtained to modern trends in scientific research, but also to determine the significance and scientific novelty of the results obtained. In addition, conducting such a comparison of results allows for a detailed critical analysis of existing theories and hypotheses, identifying possible gaps, inaccuracies and limitations. Ultimately, such a comparison will be useful in shaping future research plans. In the context of our research on methods for protecting intellectual property, ensuring cybersecurity and stimulating sustainable innovation, making such a comparison will allow us to better assess the impact of these elements on the functioning of modern society and the economic system.

In a study by Alazzam et al. [15] a methodological approach to the selection of business management strategies in the context of a change in commercial activity is considered. Our research dives deeper into the impact of funding on human rights and intellectual property protection, highlighting its implications for sustainable innovation. The difference lies in the focus on integrating cybersecurity and human rights in the context of sustainable development, which allows for a more comprehensive assessment of the impact of these factors on innovation processes.

The study by Vashkevych et al. [16] focuses on the philosophical analysis of the intellectualization of human nature. Our study moves away from theoretical analysis to

more practical aspects, considering specific factors influencing the sustainable development of innovation in Ukraine. Our approach is superior in that it provides practical guidance for policies aimed at improving cybersecurity and intellectual property protection. Ghanem's work [17] analyzes human rights between the philosophies of natural law and legal positivism. While this study provides insightful theoretical insight, our study makes a more practical contribution by examining the real impact of funding on human rights protection. Thus, our study offers more specific application directions in the modern context of cybersecurity and innovation.

A study by Palvia et al. [18] focuses on the impact of information and communication technologies on socio-economic development from the citizens' perspective. Our research differs in that it focuses on specific aspects of cybersecurity and innovation in the context of human rights, allowing us to better understand the interaction between these factors at the national level, particularly in Ukraine.

Shackelford [19] focuses on human rights in the context of cybersecurity through comparative research. Our study appears to analyze more specifically the impact of funding on human rights and intellectual property protection. Our research complements Shackelford's work by providing more specific data and recommendations related to sustainable innovation and cybersecurity. Deibert's [20] work offers a human-centric approach to cybersecurity, emphasizing ethical and moral aspects. Our research differs in that it focuses on specific factors that influence the level of sustainable innovation, including cybersecurity. In this way, your work makes a more practical contribution by complementing Deibert's theoretical insights with concrete data and analysis. Dunn Cavely's [21] research focused on developing strategies to overcome the cybersecurity dilemma, particularly by addressing vulnerabilities and aligning security needs. Our research can be considered a step forward by analyzing the impact of funding on sustainable innovation and cybersecurity, providing concrete data and insights that can be used to strengthen the strategies described by Cavely. Pavlova [22] views cybersecurity through a human rights lens, focusing on risks to target groups. Our research is distinctive in that you explore the impact of cybersecurity on innovation development, including financing and the protection of intellectual property and human rights. This provides a more comprehensive understanding of the interactions between cybersecurity, innovation and human rights.

The study of Alazzam et al. [23] analyzes environmental management in the context of commercial bioeconomy development. Our research is distinguished by its focus on the interactions between cybersecurity, rights protection, and innovation. In addition, it complements the work of Aldrou et al. in understanding the relationship between technological development, rights protection and sustainable development.

Summarizing, Figure 6 depicts the key differences and advantages between the conducted research and existing ones.

After a thorough comparison of our research with existing scientific works, we can confidently assert that our research is relevant and brings significant scientific novelty to the study of cybersecurity, intellectual property protection and sustainable development of innovations. We uncovered key aspects that had not previously received sufficient attention and proposed new approaches and perspectives of analysis that expand existing research frameworks on these topics. This highlights the importance of our contribution to the scientific

community and confirms the importance of further research in this area to develop effective strategies and policies aimed at strengthening cybersecurity and supporting innovative development in a sustainable development system.



Figure 6. Advantages and differences of the conducted research

6. CONCLUSIONS

In this study, we focused on assessing various factors influencing the sustainable development of innovation in Ukraine. By analyzing the interaction between intellectual property protection and innovative development, we have had a significant impact on overall progress in this area. The use of nonlinear programming methods, in particular the Hoerl Model, allowed us to effectively evaluate these interactions, identifying key dependencies and trends.

An important aspect of our research was the identification of systemic connections between various indicators affecting sustainable development. This allowed us to understand not only individual aspects of this process, but also to delve more deeply into the broader interactions between economic, legal and technological factors that shape Ukraine's innovation landscape.

Our trendline forecasting approach using Statistica 6.0 has helped generate more accurate and objective forecasts of the future development of the innovation sector. This method has been effective in identifying potential opportunities and risks that are important for shaping strategies in this area.

As a result, a well-founded study of the factors influencing the level of sustainable development of Ukraine was carried out. The results of such a study will allow us to track the systemic relationship between various indicators affecting sustainable development. Based on the results of the analysis, there is every reason to assert that the level of funding for the protection of human rights and intellectual property has an equally positive impact on both the level of sustainable development of innovation and the level of cybersecurity in the region. The innovativeness of the research is presented in

the form of a methodological approach to assessing various factors influencing the level of sustainable development, in particular, cybersecurity in the human rights system, and the protection of intellectual development.

However, we acknowledge that our study has certain limitations, particularly with respect to the limited data set. To overcome this limitation, we plan to use additional data sources and conduct comparative analyzes with other regions or countries, which will provide a more complete understanding of the phenomena studied.

This research can be used in the future as a basis for the formation of optimized policies and strategies, which will play the role of a contributing factor in the issue of innovative development of Ukraine. In our opinion, the presented results can be applied to solve the most pressing problems in the field of cybersecurity, intellectual property protection and in the processes of formation of innovation policy. To maintain sustainable development and the continuity of the process of formation and implementation of innovations, an important problem for the government apparatus is to improve the protection of intellectual property rights, based on existing standards and norms of international law. Taking this into account, future policies should include effective mechanisms of incentives and incentives, which will be manifested in financial support, tax incentives, attracting local and international investment in relation to research and development in the development of innovative sectors. In addition, an important task in this context is to improve educational policies in this area. In particular, this concerns informing the population about the specifics of compliance with intellectual property rights. Such events will improve communication between the academic, public and private sectors, and will also create favorable conditions for further sustainable development and technological progress.

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