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Specific Effect of Innovation Factors on Socioeconomic Development of Countries in View of the Global Crisis

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Abstract: Although the coronavirus pandemic has now faded into the background, the global crisis caused by COVID-19 has had the most devastating impacts worldwide. Given the potential relapse of such unexpected and uncertain events, it is vital to specify the patterns thereof and develop proactive measures for the countries to acquire an advanced readiness to deal with the related incidents. The most infected countries faced an increase in business bankruptcies, unemployment and inflation rates, low production volumes, and a decline in Gross Domestic Product (GDP). To withstand such socioeconomic consequences, the countries had to employ a number of measures, with innovation development acceleration being one. This paper aims to assess the dependency of an increase in GDP and a decrease in inflation and unemployment rates on the country-level growth of innovation development according to such Global Innovation Index (GII) pillars as institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs. The conducted research analysis covered the period from 2019 to 2022 based on the data for the GII pillar development level and economic performance indicators for 20 countries from five socioeconomic models. Descriptive and comparative statistics as well as correlation and regression analysis were used to prove the innovation development to be a key driver in increasing GDP and reducing inflation. To increase the GDP value, special attention should be paid to such GII pillars as institutions and human capital and research, while infrastructure and human capital and research are the pillars to reduce the inflation rates.

Keywords: innovation development; Global Innovation Index (GII); Gross Domestic Product (GDP) per capita; inflation rate; unemployment rate; socioeconomic model; socioeconomic development; crisis; pandemic; COVID-19; correlation and regression analysis

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1. Introduction

Currently, the modern world has been increasingly affected by various destructive factors, with the rise of infectious diseases being an example. These pose threats both to human health and life and to the regular operation of the global economy.

The recent coronavirus (COVID-19) pandemic has turned into a fast-growing global crisis for the whole world, and has required governments and organizations to urgently make decisions to protect their economies. There was a drop in the GDP value and an increase in inflation and unemployment in many countries. The pandemic outbreak also led to a sharp decrease in household incomes and a huge budget deficit.

To develop an effective economic policy for overcoming post-pandemic socioeconomic effects, it is vital to properly assess longer-term pandemic impacts and state capacities to combat such threats.

The accelerated innovation and economic development at the level of both an individual state and certain industries is exemplified as a measure to tackle the socioeconomic implications of the coronavirus pandemic. It is the introduction of innovative technologies that helps to create the most favorable conditions for GDP growth, increased labor productivity, and competent distribution of limited resources (Chundakkadan and Sasidharan 2023; Wang et al. 2021). Innovation is viewed as a component of economic development, with an emphasis on entrepreneurship and small business activity (Beynon et al. 2023). In addition, the conducted research has evidenced an innovation increase in the areas related to the crisis course (Rathi et al. 2024). Innovation development is inevitably linked with increased expectations from developers of artificial intelligence technologies (Sipior 2020).

The advancement of specific innovation components should be accompanied by an expectation of growth in socioeconomic indicators. On the one hand, it is essential to reliably assess the real dynamics of growth (or decline) in the values of innovative factors; on the other hand, it is urgent to objectively link them with the developmental change outcomes of states.

The purpose of this article is to determine the specific dynamics of innovative behavior of countries from different socioeconomic models during the global crisis, to identify the key innovation factors affecting the economic performance of the countries, and to calculate the expected potential for economic growth with the development of innovativeness.

Here are some specific research questions addressed in this study: Which innovation factors are most vulnerable in countries from different socioeconomic models during the global crisis? What are the specifics of the dynamics thereof in different crisis periods? Is it feasible to identify the innovation factors affecting the economic performance of the countries using statistical analysis? What are the existing patterns of influence? What is the potential for economic growth driven by the development level of innovation factors?

To consider these issues, the methods of descriptive and comparative statistics as well as correlation and regression analysis were used.

The remainder of the paper is organized as follows. Section 2 offers a comprehensive literature review on the current state of the research issue. Section 3 provides the applied materials and research methods. Section 4 highlights the major analysis outcomes. Discussion on the results obtained and the key findings of the study are reported in Section 5.

2. Literature Review

2.1. Approaches to Assessing the Level of Innovation

Various techniques and methods to determine the level of innovativeness of social, economic, and production processes have been proposed and employed by scholars investigating specific aspects of societal innovation development. In some cases, it is quite demanding to choose a particular assessment methodology to understand both the extent of innovation usage and implementation and the effect of the integration thereof into the relevant business processes. This is mainly due to diverse purposes of determining the level of innovation development and different objects of such assessments.

Thus, a number of studies have been devoted to assessing the readiness of countries, regions, and economic entities, including small- and medium-sized businesses, to introduce innovations and the related prospects. Using the constellation graph index approach, Beynon et al. (2023) identified principal component drivers of innovation in Europe such as innovation system, absorptive capacity, and IP protection. The assessment and roles of various innovation activity components were not discussed. Vasin and Gamidullaeva (2015) developed a structural basic model of an innovation system, with a knowledge development subsystem being a key component. Here, the innovator, the organization, and the external environment are the unifying structures, while the innovation system should be integrated into the economic one. However, the relationships between the innovation components have not been decided yet. In turn, Zofio et al. (2023) identified the bottlenecks that constrain the overall performance of innovation systems from the input and output perspectives. The authors computed the cost of bottlenecks in terms of the Productivity Innovation Index, decomposed the system into innovation components, and assessed each to determine the bottlenecks and calculate the final innovation indicators. However, the impact of these indicators on the performance of economic systems was not assessed. When analyzing the innovation performance of small- and medium-sized enterprises, Singh et al. (2022) examined the mediating roles of innovation and internationalization between network cooperation and firm performance. However, the assessment was carried out on the basis of surveys, which led to many resulting errors.

Assessing the level of innovativeness of certain processes might yield varying degrees of localization, from assessing innovative activity in individual industries to evaluating integrated approaches to determining the innovativeness of individual states, the groups thereof, or the world as a whole.

In particular, Manohar et al. (2023) developed a generalized 22-item scale named INNOSERV for perceived service innovation. A mixed-method approach was adopted, where qualitative techniques like in-depth interviews and focus group discussions were used for item generation and purification, followed by quantitative tests like principal component analysis (PCA), exploratory factor analysis (EFA), and path analysis to establish the item validation. The resulting typologies to measure service innovation could be adopted by the service industry to understand how their customers perceive or diffuse their innovation activity. This scale organization understands that non-technological innovation also plays a major role in contributing to economic, social, and environmental sustainability. The presented methodology is limited, firstly due to industry specificity and secondly due to a fairly high degree of subjectivity in the assessments, which requires alternative techniques.

Noteworthy are the studies related to input–output metrics that consider innovation performance based on the Productivity Innovation Index (Zofio et al. 2023). The authors criticize studies based on the so-called linear model of innovation (Edquist 2014), driven by a "more-the-better" rationale. Actually, this is true because innovation performance is governed by the law of diminishing returns.

The intellectual sphere is another obvious area for assessing innovative activity. Thus, Ma et al. (2023) proposed a global intelligence innovation index to evaluate the global landscape of intelligence innovation.

The Global Innovation Index (GII) is among the most frequently used methods for analyzing current global trends in innovation against a background of the COVID-19 pandemic and other existing threats and challenges (Strielkowski et al. 2023). The Global Innovation Index was compiled by Cornell University (USA), INSEAD business school (France), and a specialized agency of the United Nations—the World Intellectual Property Organization (WIPO). Since its inception in 2007, the GII results have been published annually by the WIPO (World Intellectual Property Organization 2023).

The GII reveals the most innovative economies in the world while highlighting innovation strengths and weaknesses. Recognizing that innovation is a key driver of economic development, the GII aims to provide an innovation ranking of the innovation capabilities and results of world economies. The GII is an integral indicator that is based on two sub-indices (the innovation input sub-index and the innovation output sub-index) and seven pillars, each consisting of three sub-pillars. It measures innovation based on criteria that include institutions, human capital and research, infrastructure, credit, investment, and linkages; the creation, absorption, and diffusion of knowledge; and creative outputs. Envisioned to capture as complete a picture of innovation as possible, the Index comprises around 80 indicators, including measures on the political environment, education, infrastructure, and knowledge creation of each economy (World Intellectual Property Organization 2023).

The institutions pillar implies an assessment of the political conditions, legislative framework, and business environment of a country. The human capital and research pillar involves an assessment of education (including tertiary education) and scientific research and development (R&D). The infrastructure pillar indicates an assessment of information and communication technologies (ICTs), general infrastructure, and ecological sustainability of a country. The availability of credit and an environment that supports investment, access to the international market, competition, and market scale are critical for the market sophistication pillar. The business sophistication pillar tries to capture the level of business sophistication to assess how conducive the firms are to innovation activity. The knowledge and technology outputs pillar includes knowledge creation, impact, and diffusion. The creative outputs pillar involves all intangible assets, creative goods and services, and online creativity (Vlasova et al. 2023).

As evidenced by the 2022 Global Innovation Index rankings, investment in innovation was revealed to be highly resilient. Switzerland, the United States, Sweden, the United Kingdom, the Kingdom of the Netherlands, South Korea, Singapore, Germany, Finland, and Denmark were still among the leading countries in the implementation of innovation (Tereshkina 2021).

2.2. Pandemic and Innovation

The COVID-19 pandemic has posed unprecedented challenges to global economies. Due to coronavirus-related restrictions, there was a drop in the GDP during 2020: by 9.9% in the United Kingdom, by 5% in Germany, by 4.8% in Japan, by 3.5% in the USA, and by 3.1% in the Russian Federation (Federal State Statistics Service 2023).

The emerged social and economic problems acted as a powerful stimulus for targeted innovation activity in such areas as healthcare, distance learning, remote work, and e-commerce. At the same time, both the volume of investments in R&D and the number of COVID-19-related publications have increased (Sharma et al. 2022). Moreover, government and foundation funds were redirected to pandemic-related issues.

The COVID-19 pandemic has had an adverse effect on the global economy, particularly the hotel industry (Ahmad et al. 2023; Khalil et al. 2023). To prevent the development of a viral infection, the focus was given to minimizing the mobility of people through, for example, closing borders, limiting the issuance of visas, suspending flights, and introducing general self-isolation. According to Ahmad et al. (2023), relying on innovations, especially those related to countering the pandemic, would help to reduce pandemic risks. Such innovations include, but are not limited to, vaccines, masks, sanitizers, and all digital solutions that help to prevent the risk of a pandemic. For example, the Chinese app Alipay helps to detect the travel history of people in the past 14 days and determine the color of the code (i.e., green if there has been no travel to risky areas; yellow if movement has been in risky areas; and red if the candidate has been in risky areas, must be quarantined, and needs their health situation to be monitored).

Based on factual evidence, in contrast to the rapidly declining tourism industry, the pharmaceutical industry began to actively grow since the pandemic unintentionally accelerated the introduction of innovative technologies in pharmaceutical production (Rathi et al. 2024; Medeiros et al. 2022). For instance, Recursion Pharmaceuticals, a clinical-stage biotechnology company that combines artificial intelligence (AI), experimental biology, and automation to discover and develop drugs at scale, announced progress in its collaboration with Takeda Pharmaceutical Company Limited to evaluate and identify novel preclinical candidates for rare diseases (Rathi et al. 2024).

During the economic crisis and quarantine-related restrictions, numerous companies, specifically small- and mid-sized enterprises (SMEs), had to find solutions to survive and learn how to act in adverse situations (Rubio-Andrés et al. 2023; Li et al. 2023; Akindinova et al. 2021), largely due to a lack of resources and official backing. Innovations are among the most important means through which SMEs contribute to increased employment, economic growth, and economic dynamics (Keizer et al. 2002; Amit and Zott 2012). According to Bodlaj and Čater (2019), market turbulence, technological turbulence, and competitive intensity affect the perceived importance of innovation and innovativeness, and, thus, SMEs' business performance.

2.3. The Impact of Innovation on Socioeconomic Indicators

However, there is a challenging issue regarding innovation components that have the greatest impact on the economic development of countries. In particular, using the generalized least squares and panel data from 2000 to 2020, Khan et al. (2023) identified some proxies of innovation (resident patent applications, nonresident patent applications, scientific and technical journal articles, and research and development expenditures). The findings of the study revealed that three proxies of innovation (i.e., resident patent applications, nonresident patent applications, and scientific and technical journal articles) have a significant positive role in improving trade openness in the BRICS economies. The fourth proxy of innovation, i.e., research and development expenditures, had a negative impact on the degree of trade openness. However, the small number of initial indicators of innovativeness seriously limited the results of this study. Some researchers have paid special attention to green innovations and the impact thereof on the economy. For example, Deng et al. (2023) explored the dependence of trade credit activity on green innovation. The conducted empirical analysis revealed green innovation to have a positive and statistically significant relationship with both trade receivables and trade payables. It is evident that specific conditions in each sector and each company can significantly affect the performance of trade and credit activities, so such findings are typically insufficient. According to Gillanders and Whelan (2014), it is business-friendly economic policies rather than legal and political institutions that are the key determinants of the level of income per capita. Based on the auto-regressive distributive lags (ARDL) approach, Ifa and Guetat (2018) evidenced the impact of public education expenditures on the GDP per capita of Tunisia and Morocco for 1980–2015. This research period provided a context to smooth out crisis deviations, but lacked the ability to assess the effect of educational policy and related innovations on GDP per capita during the years of crisis. Moreover, the experiences of individual African countries are quite unique, and it is arduous to transfer them to other countries to unite them within some socioeconomic models. However, particular cases are quite interesting, as they complement the patterns identified during the research process. Finally, having analyzed a sample of 120 countries, Dempere et al. (2023) provided a holistic evaluation of national innovation using generalized linear and panel-corrected standard-error models. The obtained results showed that innovation positively influenced the GDP, domestic institutional framework, local infrastructure, local knowledge and technology, and creative outputs. In contrast, innovation negatively correlated with domestic self-employment, often associated with necessity-driven entrepreneurship. It should be noted that the chosen 2013–2019 period allowed the researchers to conduct the analysis during a period of relative economic stability, excluding the confounding impacts of significant global crises.

Having upheld the choice of the researchers, the authors of this paper adhere to alternative claims to investigate the performance of innovation factors precisely during cataclysmic periods and to study the resulting economic responses of the countries to changes in the level of innovation. It should be noted that some scientists have made attempts to assess the likelihood of the influence of certain innovation factors on various socioeconomic indicators during the crisis, in particular the COVID-19 pandemic. For example, Sargento and Lopes (2024) examined the role of innovation in achieving territorial resilience to the impacts of the pandemic crisis in Portugal. The indicators of innovation used in this study are R&D networks, the number of researchers, the quality of researchers and research, etc. There are studies regarding forecasts of socioeconomic development under the influence of innovations using artificial intelligence (AI) methods. For example, Nahar (2024) forecasts AI-based innovation's impact on SDGs up to 2030 using system dynamics modeling.

3. Data and Methodology

Statistical data employed in the research for the countries depended on the socioeconomic models thereof (Anglo-Saxon, Rhenish (German), Scandinavian (Swedish), Japanese, and Chinese). Previously, assigning countries to a particular socioeconomic model according to certain and fairly clear criteria was used as a tool for pattern searching in the responses of various states to pandemic manifestations. Thus, a number of patterns related to the specific performances of the countries from different models were obtained and proven (Vasin 2022). In the context of this research, a list of countries within the same socioeconomic models was expanded. To generate the data for each model, the indicators of the following countries, being the most prominent representatives of each socioeconomic model, were used:

- The Anglo-Saxon model: Ireland, United Kingdom, Canada, United States of America, Australia, and New Zealand;
- The Rhenish (German) model: Belgium, Germany, the Kingdom of the Netherlands, and Switzerland;
- The Scandinavian (Swedish) model: Denmark, Finland, Iceland, Norway, and Sweden;
- The Japanese model: Indonesia, Japan, and Malaysia;
- The Chinese model: China and Vietnam.

The following methodological steps were implemented for the purpose of further research:
1. An analysis of some indicators for the level of innovation development of the countries:

- The values of the Global Innovation Index (GII);
- The values of such GII pillars as institutions, human capital and research, infrastructure, market sophistication, business sophistication, knowledge and technology outputs, and creative outputs.

The analysis was aimed at studying the following aspects:

- The dynamics of the GII pillars during the pandemic period versus the pre-pandemic one;
- The dynamics of the GII pillars during the post-pandemic period versus the pandemic one;
- The differences in the GII pillar ranking for the countries from various socioeconomic models;
- The differences in GII pillar rankings for countries from the same socioeconomic models.

To quantify the differences between socioeconomic models in the dynamics of the GII pillars, the paired-samples *t*-test was carried out. The independent samples were represented by the average values of the GII pillars for each model. Since various models are not related to each other, this method was used due to the possibility of pairwise comparison of individual GII pillars without violating the requirements for conducting t-analysis.

2. An assessment of the impact of innovation indicators on some indices of socioeconomic development for 20 countries from the analyzed socioeconomic models, namely:

- GDP per capita;
- Unemployment rate;
- Inflation rate.

To assess the impact of innovation on the economic development of the countries, data from the 2019–2022 period were studied. This period was chosen due to the expected patterns in the dynamics of indicators and the relationships thereof in view of the pandemic (the pre-pandemic year (2019) versus the post-pandemic year (2022) following the acute stage).

The correlation analysis was used to investigate the above indicators and determine the relationship between innovation development procedures and the economies of the countries. Regression analysis was carried out to determine the effect of innovation development level on economic indicators and to predict the values of the latter.

The investigated data were grouped according to the criterion of delayed effect of innovativeness values of the countries on the economies thereof (Figure 1).

A correlation and regression analysis was performed in terms of the close relationship between 2019 innovation indicators and economic performance indicators for 2020 (the effect on the economy delayed by 1 year relative to the year of assessment of innovation factors); for 2021 (the effect on the economy delayed by 2 years relative to the year of assessment of innovation factors); and for 2022 (the effect on the economy delayed by 3 years relative to the year of assessment of innovation factors). Such a delayed analysis over a period of several years is urgent to understand the importance of establishing a system of innovation development prior to the onset of the crisis. It also provides insight into the inherent potential of innovation development to improve the sustainability of economic performance indicators during the crisis period.

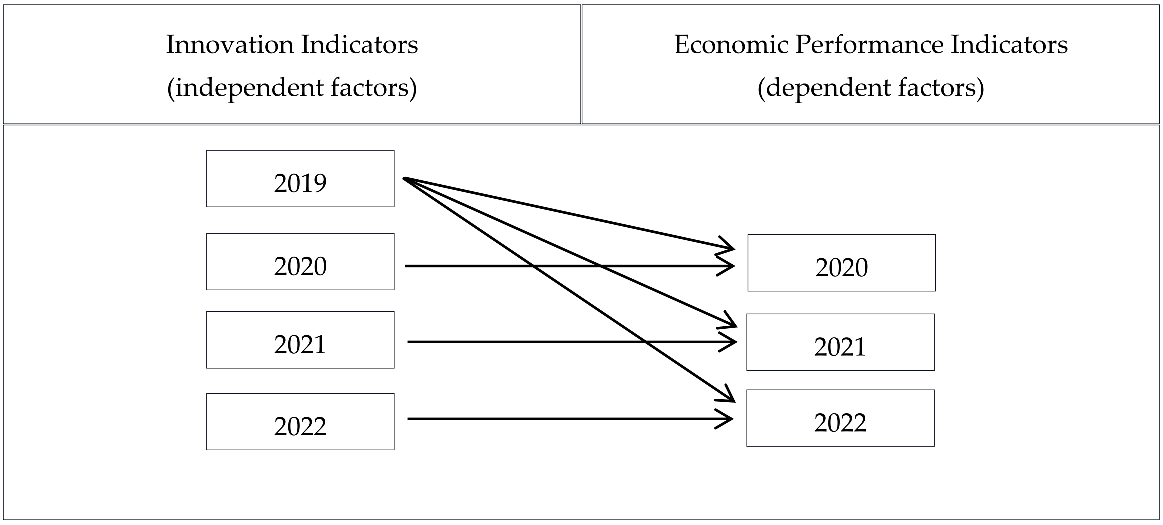

Figure 1. Analytic groups to denote the effects of innovation indicators of the countries on the economic performance indicators.

A correlation and regression analysis was also carried out within a year (without any delay) to analyze the close relationship between the level of innovation factor development and economic performance: between 2020 innovation indicators and economic performance indicators for 2020; between 2021 innovation indicators and economic performance indicators for 2021; and between 2022 innovation indicators and economic performance indicators for 2022. A quick positive response of the economy is extremely important during a crisis; hence, it is vital to identify the key factors in innovation development. The initial quantitative values for the indicators of the designated periods that underwent correlation and regression analysis are given in Appendix A.

As a result, a list of innovation factors which were influential to economic development was determined, and the reliability of the identified connections was proven. A number of econometric regression models were built and presented graphically.

3. The potential values of economic performance indicators were calculated when changing the levels of individual innovation factors based on the obtained econometric regression models. The calculation was made for the minimum and maximum initial values of innovation levels for each GII pillar.

The research results have evidenced the effect of each specific indicator of innovation activity for a certain year on socioeconomic indicators measured during the global crisis.

4. Results

4.1. Innovation Performance of the Countries from Various Socioeconomic Models

Having selected and grouped statistical data, the dynamics of the GII pillars for the countries from the considered socioeconomic models for the 2019–2022 period were analyzed (Appendix A).

Despite ambiguous changes in the GII pillar values during the considered period, there are certain differences in the dynamics thereof depending on the related socioeconomic model.

Changes in the GII pillar values for the countries from the Anglo-Saxon model are presented in Figure 2.

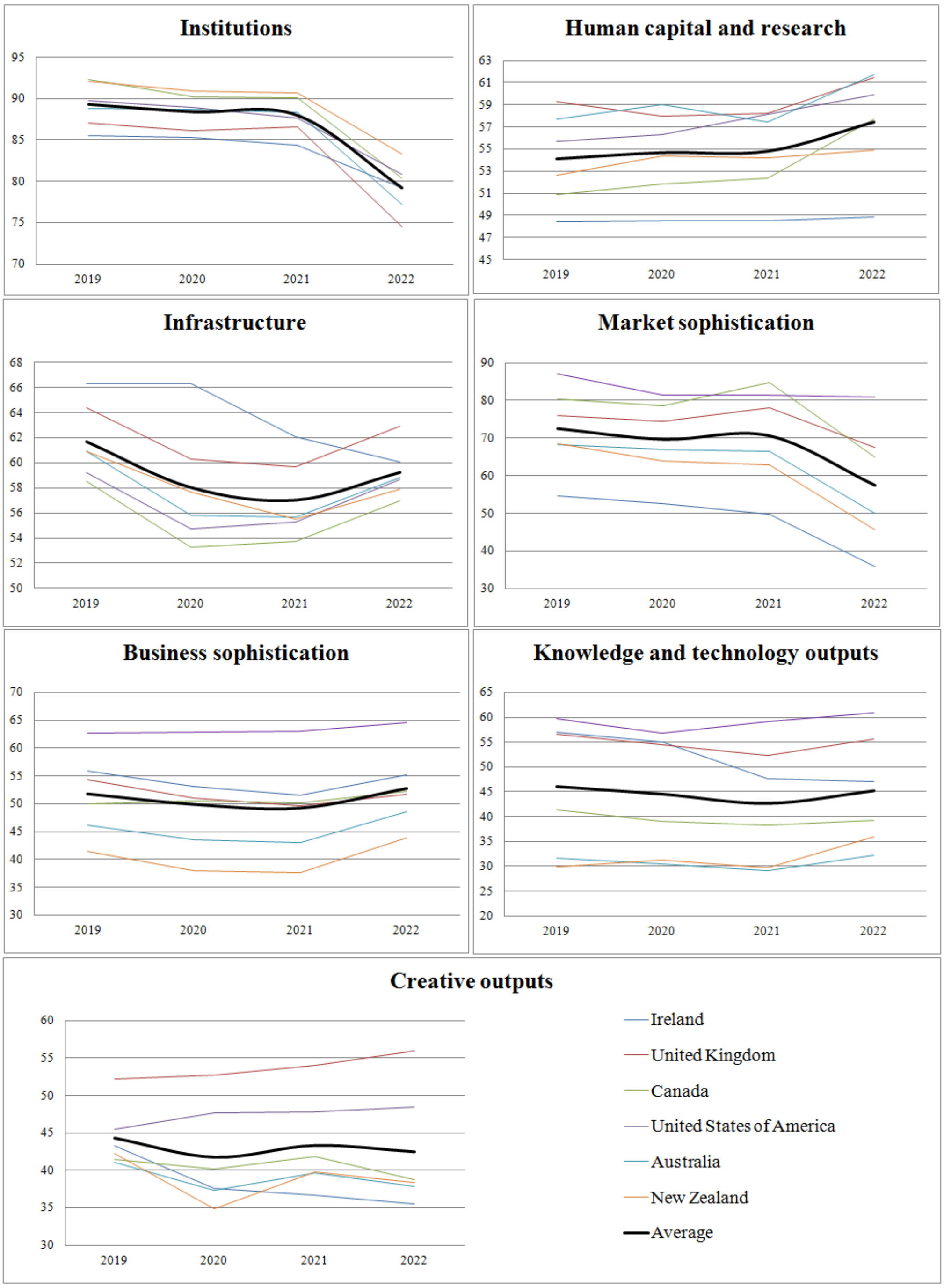

Figure 2. Changes in the GII pillar values for the countries from the Anglo-Saxon model. Source: own elaboration based on World Intellectual Property Organization (2019, 2020, 2021, 2022).

It is noteworthy that the countries from the Anglo-Saxon socioeconomic model have similar dynamics of development trajectories. There are minor deviations from the average trajectory in the dynamics of the infrastructure and market sophistication pillar values in terms of delayed decline and recovery in Ireland, as well as in the dynamics of the knowledge and technology outputs and creative outputs pillar values in terms of early recovery (for the former pillar); alternatively, neither declined (for the latter pillar) in the USA. In general, the crisis behavior of the countries from this group can be considered quite natural.

Changes in the GII pillar values for the countries from the Scandinavian (Swedish) model are presented in Figure 3.

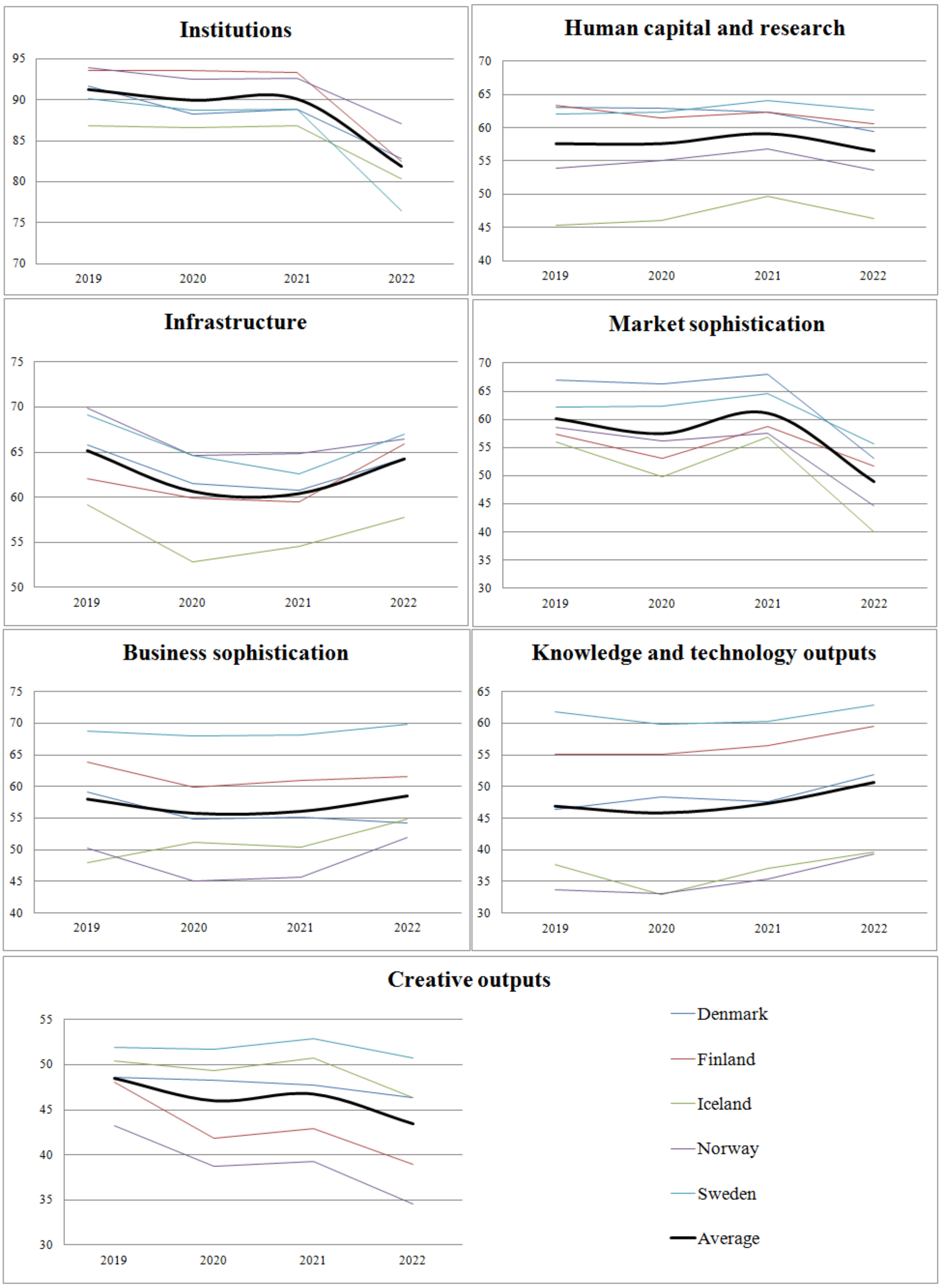

Figure 3. Changes in the GII pillar values for the countries from the Scandinavian (Swedish) model. Source: own elaboration based on World Intellectual Property Organization (2019, 2020, 2021, 2022).

There are minor differences in the development dynamics of the countries from the Scandinavian (Swedish) model. Namely, there are some deviations from the average trajectory in the dynamics of the human capital and research and creative outputs pillar values (no growth) as well as the knowledge and technology outputs pillar values (growth in 2020 and minimal decrease in 2021) in Denmark, and in the dynamics of the business sophistication pillar values (growth instead of decline in 2020) in Iceland.

Changes in the GII pillar values for the countries from the Rhenish (German) model are presented in Figure 4.

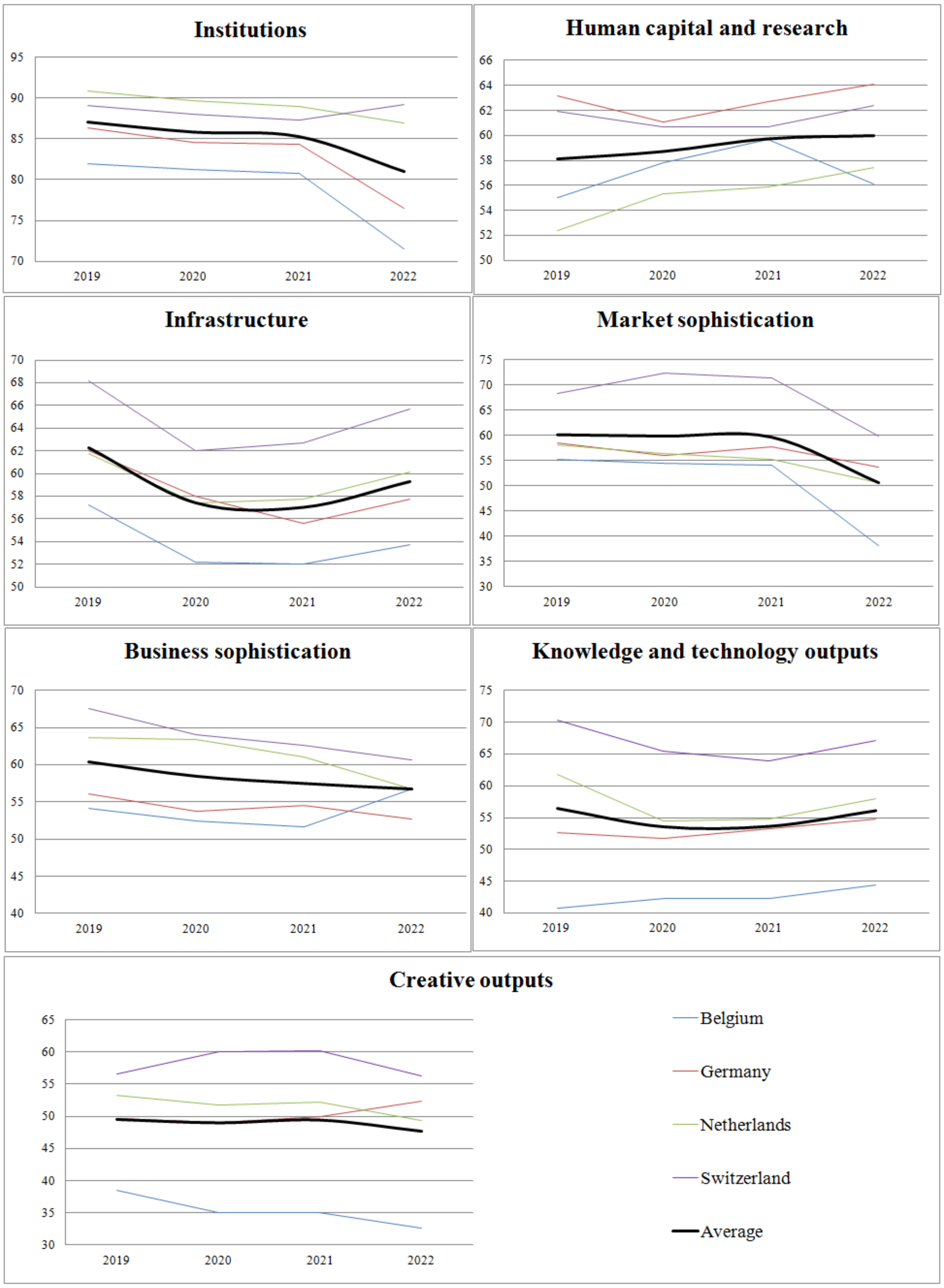

Figure 4. Changes in the GII pillar values for the countries from the Rhenish (German) model. Source: own elaboration based on World Intellectual Property Organization (2019, 2020, 2021, 2022).

Here, deviations are visible for the institutions (growth in 2022), human capital and research (slight decrease in 2020 and 2021), and creative outputs (growth in 2020) pillar values in Switzerland. There is a decrease in the human capital and research pillar values (in 2020), a slight increase in the business sophistication pillar values (in 2021), and an increase in the creative outputs pillar values (in 2022) in Germany, as well as a decrease in the human capital and research pillar values (in 2022) and an increase in the business sophistication pillar values (in 2022) in Belgium.

Changes in the GII pillar values for the countries from the Japanese model are presented in Figure 5.

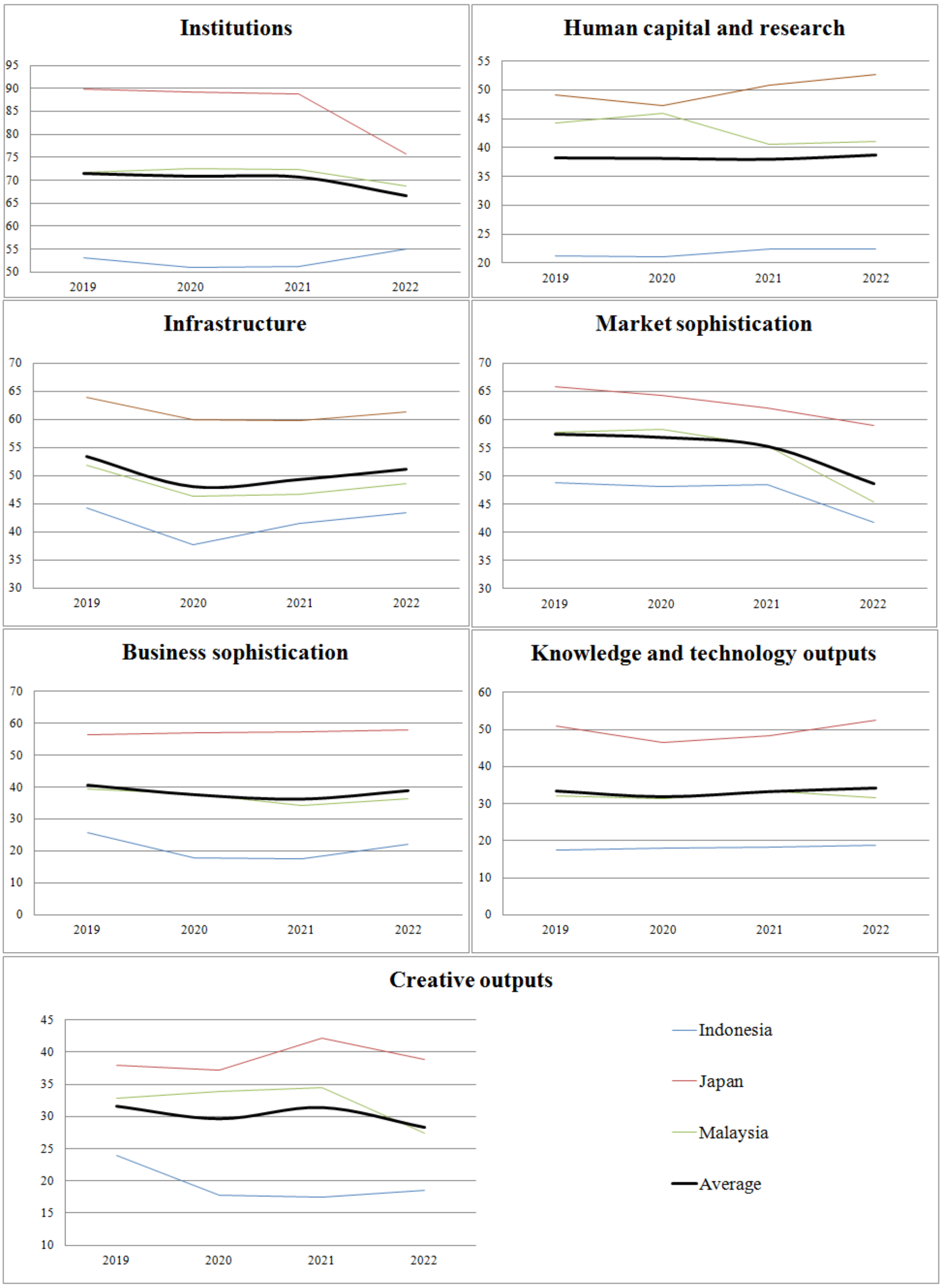

Figure 5. Changes in the GII pillar values for the countries from the Japanese model. Source: own elaboration based on World Intellectual Property Organization (2019, 2020, 2021, 2022).

While the trajectories in the dynamics of the GII pillar values are generally similar, minor deviations can be observed for the institutions (growth in 2022) and creative outputs (growth in 2022) pillar values in Indonesia and for the human capital and research pillar values (growth in 2020, and decline in 2021) in Malaysia.

Changes in the GII pillar values for the countries from the Chinese model are presented in Figure 6.

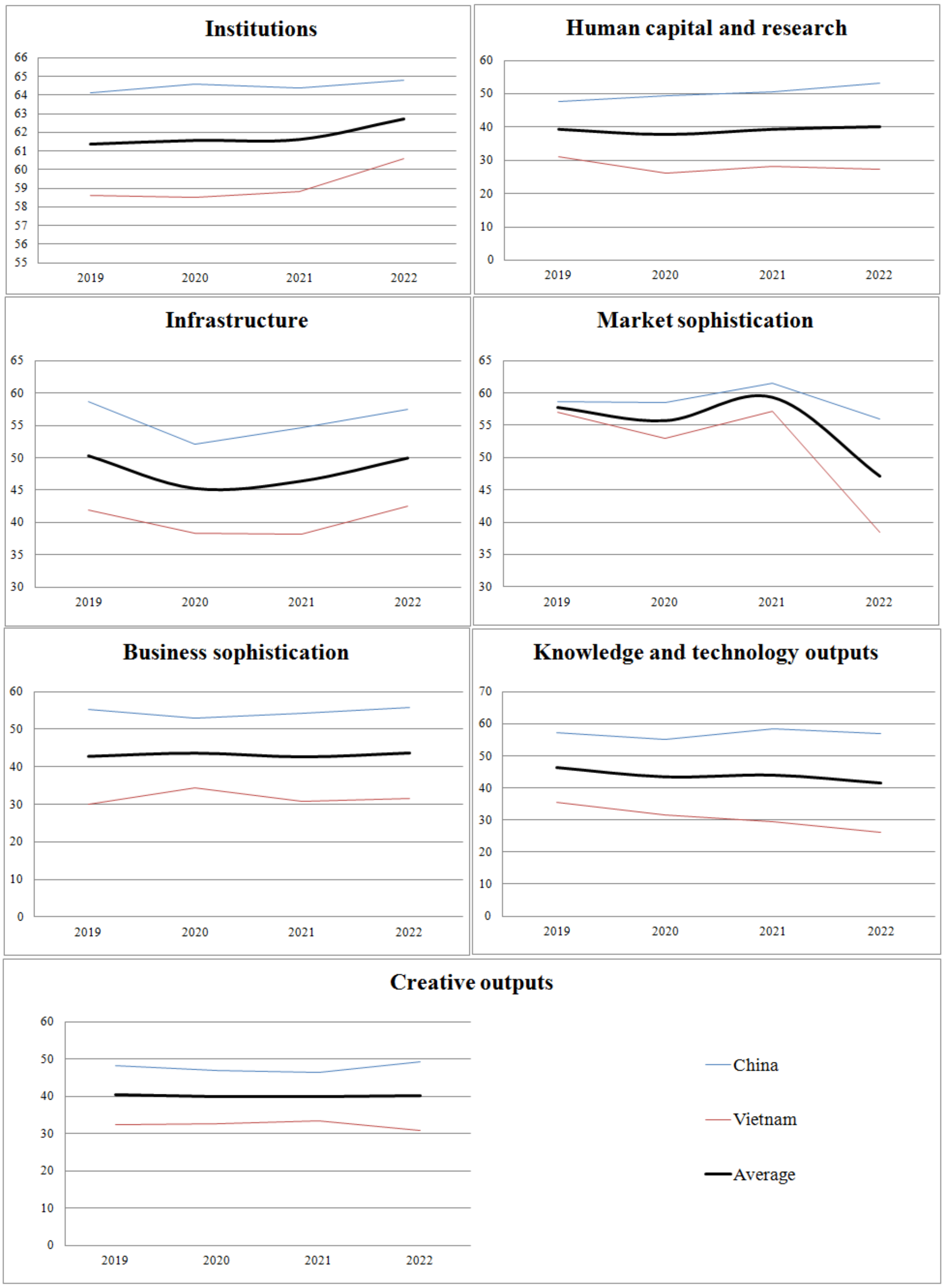

Figure 6. Changes in the GII pillar values for the countries from the Chinese model. Source: own elaboration based on World Intellectual Property Organization (2019, 2020, 2021, 2022).

There are no significant deviations in the pillar trajectories for the countries from the Chinese model, with the exception of the divergent dynamics in the creative outputs pillar values in China and Vietnam.

Table 1 presents the dynamics of average values of the GII pillars for the countries from different socioeconomic models.

Table 1. Comparative dynamics * of average GII pillar values for the countries from various socioeconomic models. Source: own elaboration based on World Intellectual Property Organization (2020, 2021, 2022).

GII Pillar	Socioeconomic Model				
	The Anglo-Saxon Model	**The Scandinavian (Swedish) Model**	**The Rhenish (German) Model**	**The Japanese Model**	**The Chinese Model**
Institutions	Minimal decline in 2020, recovery in 2021, drastic decline in 2022	Minimal decline in 2020, recovery in 2021, drastic decline in 2022	Minimal decline in 2020, neither dynamic in 2021, decline in 2022	Minimal decline in 2020, neither dynamic in 2021, decline in 2022	Minimal increase in 2020, neither dynamic in 2021, increase in 2022
Human capital and research	Minimal increase in 2020, neither dynamic in 2021, sharp increase in 2022	Neither dynamic in 2020, minimal increase in 2021, decline to 2020 level in 2022	Increase in 2020 and 2021, minimal increase in 2022	On average—neither dynamic in 2020 and 2021, minimal increase in 2022	Minimal decline in 2020, recovery in 2021, minimal increase in 2022
Infrastructure	Drastic decline in 2020, decline in 2021, increase in 2022	Drastic decline in 2020, neither dynamic in 2021, sharp increase in 2022	Drastic decline in 2020, minimal decline in 2021, increase in 2022	Decline in 2020, increase in 2021 and 2022	Decline in 2020, neither dynamic in 2021, recovery in 2022
Market sophistication	Minimal decline in 2020, recovery in 2021, drastic decline in 2022	Decline in 2020, increase in 2021, drastic decline in 2022	On average—neither dynamic in 2020 and 2021, drastic decline in 2022	Minimal decline in 2020 and 2021, decline in 2022	Minimal decline in 2020, increase in 2021, drastic decline in 2022
Business sophistication	Minimal decline in 2020 and 2021, recovery in 2022	Minimal decline in 2020, neither dynamic in 2021, recovery in 2022	Decline in 2020, minimal decline in 2021 and 2022	Minimal decline in 2020 and 2021, increase in 2022	Minimal increase in 2020, minimal decline in 2021, minimal increase in 2022
Knowledge and technology outputs	Minimal decline in 2020, decline in 2021, increase in 2022	Minimal decline in 2020, minimal increase in 2021, increase in 2022	Decline in 2020, minimal increase in 2021, increase in 2022	Minimal decline in 2020, minimal increase in 2021 and 2022	Minimal decline in 2020, minimal increase in 2021, minimal decline in 2022
Creative outputs	Decline in 2020, increase in 2021, minimal decline in 2022	Decline in 2020, increase in 2021, decline in 2022	Minimal decline in 2020, recovery in 2021, decline in 2022	Decline in 2020, increase in 2021, decline in 2022	Neither noticeable dynamic during the overall 3-year period

* Quantifiable dynamic metrics: neither dynamic—changes within 1 unit of pillar values, minimal decline (decrease)/minimal increase (growth)—changes within 1–2 units of pillar values, decline (decrease)/increase (growth)—changes within 2–5 units of pillar values, drastic decline (decrease)/sharp increase (growth)—changes within 5 or more units of pillar values, recovery—reduction to the previous year's value.

Thus, according to the values for the 2020 and 2021 crisis years, the innovation indicators included in the infrastructure, knowledge and technology outputs, and creative outputs pillars suffered the largest drop for the countries from the Anglo-Saxon model; the infrastructure, market sophistication, and creative outputs pillars for the countries from the Scandinavian (Swedish) model; the infrastructure, business sophistication, and knowledge and technology outputs pillars for the countries from the Rhenish (German) model; and the creative outputs pillar for the countries from the Japanese model. There were no significant negative changes revealed for the countries from the Chinese model.

Appendix B presents quantitative assessment results for the differences between socioeconomic models in the dynamics of the GII pillars based on the paired-samples t-test.

Differences between the models generally appeared in relation to the following pillars:

- Business sophistication and creative outputs: statistically significant differences were found in all paired cases, except one—between the Rhenish (German) and the Scandinavian (Swedish) models;
- Knowledge and technology outputs: differences between the models were not identified in one case—between the Anglo-Saxon and the Chinese models;
- Human capital and research: no differences were identified in two tests—between the Rhenish (German) and Scandinavian (Swedish) models and between the Japanese and Chinese models;
- Institutions: statistically significant differences were not detected in three paired cases—between the Anglo-Saxon and Rhenish (German) models, between the Anglo-Saxon and Scandinavian models, and between the Rhenish (German) and Scandinavian (Swedish) models.

Greater similarities appeared between the models regarding the following pillars:

- Infrastructure: no differences were found between the Anglo-Saxon and Rhenish (German) models, the Anglo-Saxon and Scandinavian (Swedish) models, the Rhenish (German) and Scandinavian (Swedish) models, or the Japanese and Chinese models;
- Market sophistication: the *t*-test showed differences only between the Anglo-Saxon and Japanese models and between the Anglo-Saxon and Chinese models.

4.2. The Impact of Innovativeness on the Economic Performance Indicators of the Countries

The presence and relationship closeness between innovation development procedures and economies of the countries using correlation analysis were determined. The level of statistical dependence of the economic performance indicators of the countries on the GII pillar values provided a reliable relationship between them, and was determined using the regression analysis (Appendix C).

It is noteworthy that the relationship closeness in multiple comparisons turned out to be either insignificant or unconfirmed by verification tests. Thus, only statistically significant relationships and dependencies are presented below. Finally, the potential values of the countries' economic indicators in terms of a certain increase in the GII pillar values was calculated.

4.2.1. The Impact of 2019 Innovation Indicators on the Economic Performance Indicators for 2020

Some 2019 innovation indicators have shown their impact on the economic performance indicators of the countries in 2020.

1. The impact of the 2019 GII institutions pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -76.396 + 1.4604 \times Institutions_{2019} \quad (1)$$

It follows that the GDP per capita would have a growth potential of 60.1% for the GII institutions pillar, increased by 1% at the minimum initial value level (x_{min} = 53.2) and by 2.26% at the maximum value level (x_{max} = 93.9).

2. The impact of the 2019 GII human capital and research pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -22.2496 + 1.3163 \times Human\ capital\ and\ research_{2019} \quad (2)$$

It follows that the GDP per capita would have a growth potential of 4.8% for the GII human capital and research pillar, increased by 1% at the minimum initial value level (x_{min} = 21.3) and by 1.4% at the maximum value level (x_{max} = 63.4).

3. The impact of the 2019 GII infrastructure pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -102.7365 + 2.4676 \times Infrastructure_{2019} \quad (3)$$

It follows that the GDP per capita would have growth potential of 63.23% for the GII infrastructure pillar, increased by 1% at the minimum initial value level (x_{min} = 42) and by 2.45% at the maximum value level (x_{max} = 69.9).

4. The impact of the 2019 GII business sophistication pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -22.4939 + 1.30815 \times Business\ sophistication_{2019} \quad (4)$$

It follows that the GDP per capita would have a growth potential of 3.02% for the GII business sophistication pillar, increased by 1% at the minimum initial value level (x_{min} = 25.7) and by 1.33% at the maximum value level (x_{max} = 68.8).

5. The impact of the 2019 GII knowledge and technology outputs pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = 8.70526 + 0.8044 \times Knowledge\ and\ technology\ outputs_{2019} \quad (5)$$

It follows that the GDP per capita would have a growth potential of 0.59% for the GII Knowledge and technology outputs pillar, increased by 1% at the minimum initial value level (x_{min} = 17.6) and by 0.86% at the maximum value level (x_{max} = 70.3).

6. The impact of the 2019 GII creative outputs pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -30.32549 + 1.7345 \times Creative\ outputs_{2019} \quad (6)$$

It follows that the GDP per capita would have a growth potential of 3.68% for the GII creative outputs pillar, increased by 1% at the minimum initial value level (x_{min} = 24) and by 1.45% at the maximum value level (x_{max} = 56.6).

Scatter diagrams graphically representing the calculated dependencies of the GDP per capita level (in thousand of USD) in 2020 on the 2019 GII pillar indicators are shown in Figure 7.

7. The impact of the 2019 GII human capital and research pillar indicator on the inflation rate in 2020 is expressed by the following linear regression equation:

$$Inflation_{2020} = 3.5484 - 0.0507 \times Human\ capital\ and\ research_{2019} \quad (7)$$

It follows that the inflation would have a reduction potential of 0.44% for the GII human capital and research pillar, increased by 1% at the minimum initial value level (x_{min} = 21.3) and by 9.62% at the maximum value level (x_{max} = 63.4).

8. The impact of the 2019 GII infrastructure pillar indicator on the inflation rate in 2020 is expressed by the following linear regression equation:

$$Inflation_{2020} = 5.1957 - 0.071 \times Infrastructure_{2019} \quad (8)$$

It follows that the inflation would have a reduction potential of 1.35% for the GII infrastructure pillar, increased by 1% at the minimum initial value level (x_{min} = 42) and by 21.32% at the maximum value level (x_{max} = 69.9).

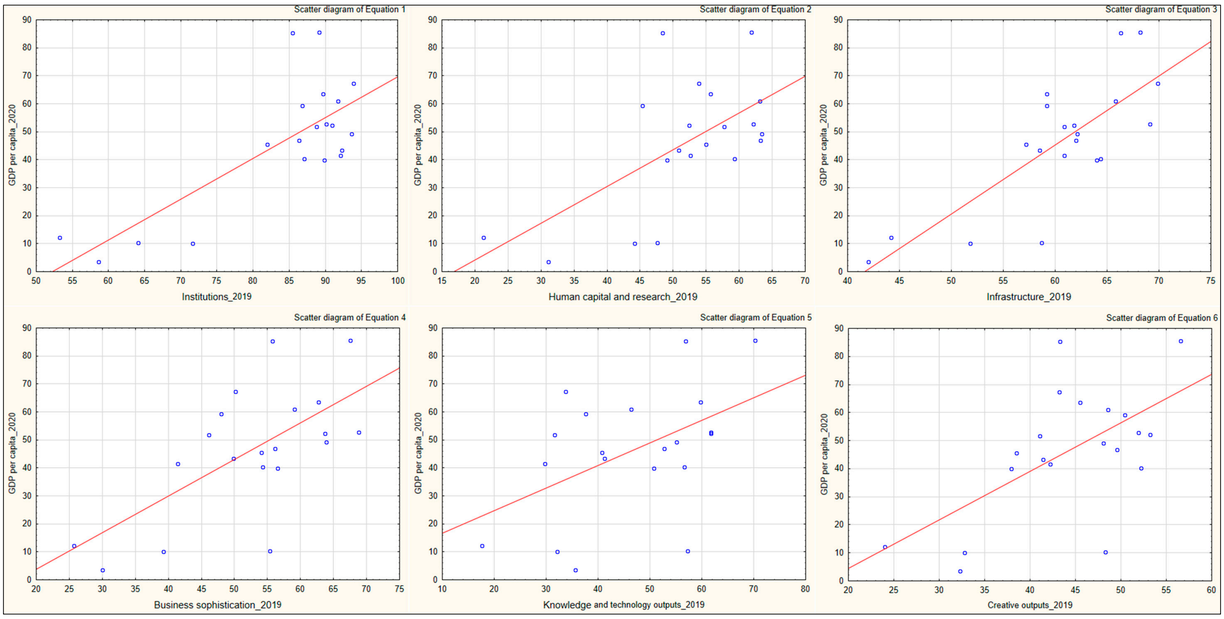

Figure 7. Regression models for the dependence of the GDP per capita level (in thousand USD) in 2020 on the 2019 GII pillar indicators (points—distribution of two variables, line—linear regression plot). Source: own elaboration based on World Intellectual Property Organization (2019, 2020).

Scatter diagrams graphically representing the calculated dependencies of the inflation rate in 2020 on the 2019 GII pillar indicators are shown in Figure 8.

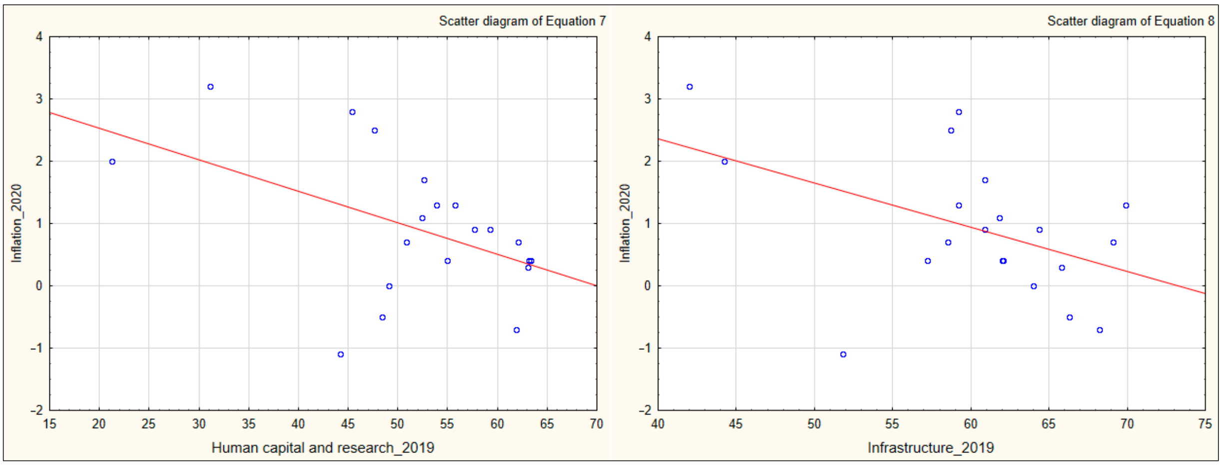

Figure 8. Regression models for the dependence of the inflation rate in 2020 on the 2019 GII pillar indicators (points—distribution of two variables, line—linear regression plot). Source: own elaboration based on World Intellectual Property Organization (2019, 2020).

4.2.2. The Impact of 2020 Innovation Indicators on the Economic Performance Indicators for 2020

Some 2020 innovation indicators have shown their impact on the economic performance indicators of the countries for 2020.

1. The impact of the 2020 GII institutions pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -75.9112 + 1.4706 \times Institutions_{2020} \tag{9}$$

It follows that the GDP per capita would have a growth potential of 8.38% for the GII institutions pillar, increased by 1% at the minimum initial value level (x_{min} = 51) and by 2.23% at the maximum value level (x_{max} = 93.5).

2. The impact of the 2020 GII human capital and research pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -20.161 + 1.2732 \times Human\ capital\ and\ research_{2020} \tag{10}$$

It follows that the GDP per capita would have a growth potential of 4.03% for the GII human capital and research pillar, increased by 1% at the minimum initial value level (x_{min} = 21) and by 1.34% at the maximum value level (x_{max} = 62.9).

3. The impact of the 2020 GII infrastructure pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -81.555 + 2.3027 \times Infrastructure_{2020} \tag{11}$$

It follows that the GDP per capita would have a growth potential of 16.34% for the GII infrastructure pillar, increased by 1% at the minimum initial value level (x_{min} = 37.7) and by 2.21% at the maximum value level (x_{max} = 64.6).

4. The impact of the 2020 GII business sophistication pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -13.1003 + 1.1699 \times Business\ sophistication_{2020} \tag{12}$$

It follows that the GDP per capita would have a growth potential of 5.71% for the GII business sophistication pillar, increased by 1% at the minimum initial value level (x_{min} = 17.8) and by 1.2% at the maximum value level (x_{max} = 68).

5. The impact of the 2020 GII knowledge and technology outputs pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = 6.4485 + 0.888 \times Knowledge\ and\ technology\ outputs_{2020} \tag{13}$$

It follows that the GDP per capita would have a growth potential of 0.7% for the GII knowledge and technology outputs pillar, increased by 1% at the minimum initial value level (x_{min} = 17.9) and by 0.9% at the maximum value level (x_{max} = 65.5).

6. The impact of the 2020 GII creative outputs pillar indicator on the level of the GDP per capita (in thousand of USD) in 2020 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2020} = -7.136 + 1.2603 \times Creative\ outputs_{2020} \tag{14}$$

It follows that the GDP per capita would have a growth potential of 1.47% for the GII creative outputs pillar, increased by 1% at the minimum initial value level (x_{min} = 17.8) and by 1.1% at the maximum value level (x_{max} = 60).

Scatter diagrams graphically representing the calculated dependencies of the GDP per capita level (in thousand of USD) in 2020 on the 2020 GII pillar indicators are shown in Figure 9.

7. The impact of the 2020 GII human capital and research pillar indicator on the inflation rate in 2020 is expressed by the following linear regression equation:

$$Inflation_{2020} = 3.4709 - 0.0491 \times Human\ capital\ and\ research_{2020} \tag{15}$$

It follows that the inflation would have a reduction potential of 0.42% for the GII Human capital and research pillar, increased by 1% at the minimum initial value level (x_{min} = 21) and by 8.07% at the maximum value level (x_{max} = 62.9).

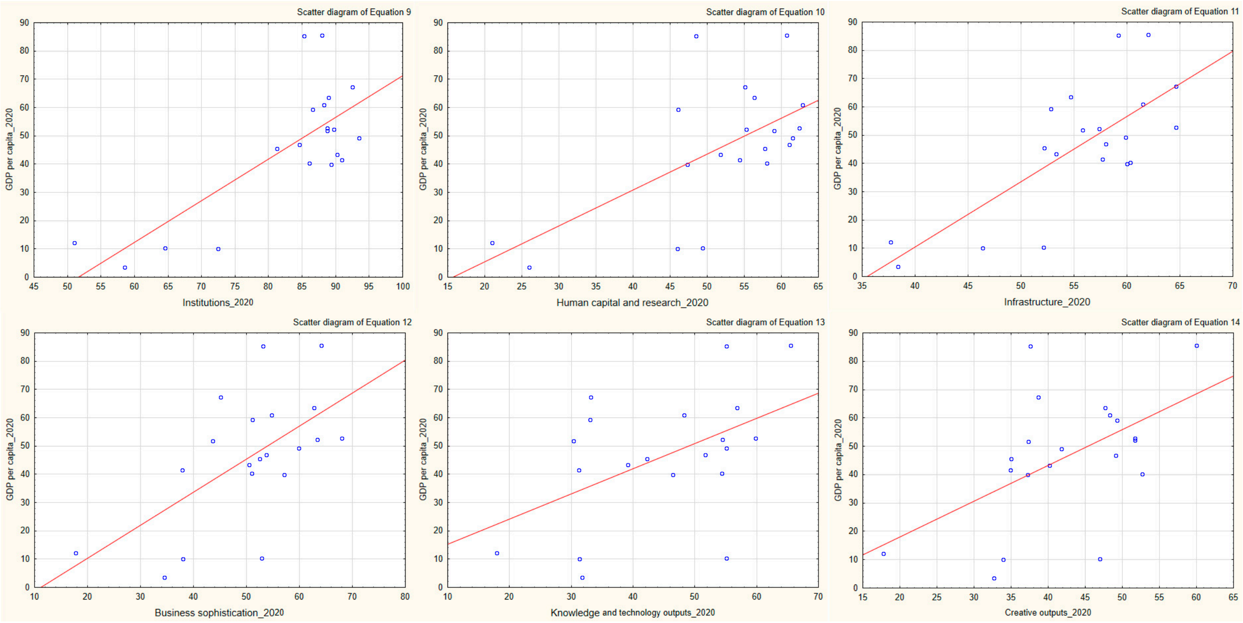

Figure 9. Regression models for the dependence of the GDP per capita in 2020 on the 2020 GII pillar indicators (points—distribution of two variables, line—linear regression plot). Source: own elaboration based on World Intellectual Property Organization (2020).

8. The impact of the 2020 GII infrastructure pillar indicator on the inflation rate in 2020 is expressed by the following linear regression equation:

$$Inflation_{2020} = 4.6832 - 0.068 \times Infrastructure_{2020} \quad (16)$$

It follows that the inflation would have a reduction potential of 1.21% for the GII infrastructure pillar, increased by 1% at the minimum initial value level (x_{min} = 37.7) and by 15.13% at the maximum value level (x_{max} = 64.6).

Scatter diagrams graphically representing the calculated dependencies of the inflation rate in 2020 on the 2020 GII pillar indicators are shown in Figure 10.

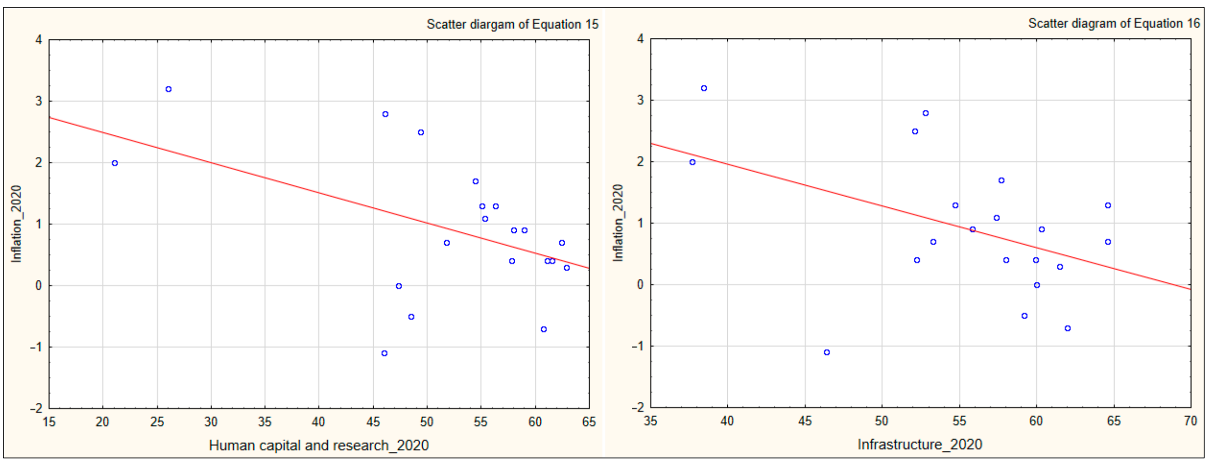

Figure 10. Regression models for the dependence of the inflation rate in 2020 and the 2020 GII pillar indicators (points—distribution of two variables, line—linear regression plot). Source: own elaboration based on World Intellectual Property Organization (2020).

4.2.3. The Impact of 2019 Innovation Indicators on the Economic Performance Indicators for 2021

Some 2019 innovation indicators have shown their impact on the economic performance indicators of the countries for 2021.

1. The impact of the 2019 GII institutions pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -89.3626 + 1.692 \times Institutions_{2019} \tag{17}$$

It follows that the GDP per capita would have a growth potential of 10.06% for the GII institutions pillar, increased by 1% at the minimum initial value level (x_{min} = 58.6) and by 2.28% at the maximum value level (x_{max} = 93.9).

2. The impact of the 2019 GII human capital and research pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -23.952 + 1.4734 \times Human\ capital\ and\ research_{2019} \tag{18}$$

It follows that the GDP per capita would have a growth potential of 4.19% for the GII human capital and research pillar, increased by 1% at the minimum initial value level (x_{min} = 21.3) and by 1.34% at the maximum value level (x_{max} = 63.4).

3. The impact of the 2019 GII infrastructure pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -121.88 + 2.8921 \times Infrastructure_{2019} \tag{19}$$

It follows that the GDP per capita would have a growth potential of 1.11% for the GII Infrastructure pillar, increased by 1% at the minimum initial value level (x_{min} = 42) and by 1.06% at the maximum value level (x_{max} = 69.9).

4. The impact of the 2019 GII business sophistication pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -21.4784 + 1.4119 \times Business\ sophistication_{2019} \tag{20}$$

It follows that the GDP per capita would have a growth potential of 2.45% for the GII business sophistication pillar, increased by 1% at the minimum initial value level (x_{min} = 25.7) and by 1.28% at the maximum value level (x_{max} = 68.8).

5. The impact of the 2019 GII creative outputs pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -32.5997 + 1.9326 \times Creative\ outputs_{2019} \tag{21}$$

It follows that the GDP per capita would have a growth potential of 3.37% for the GII Creative outputs pillar, increased by 1% at the minimum initial value level (x_{min} = 24) and by 1.42% at the maximum value level (x_{max} = 56.6).

Scatter diagrams graphically representing the calculated dependences of the GDP per capita level (in thousand of USD) in 2021 on the 2019 GII pillar indicators are shown in Figure 11.

4.2.4. The Impact of 2021 Innovation Indicators on the Economic Performance Indicators for 2021

Some 2021 innovation indicators have shown their impact on the economic performance indicators of the countries for 2021.

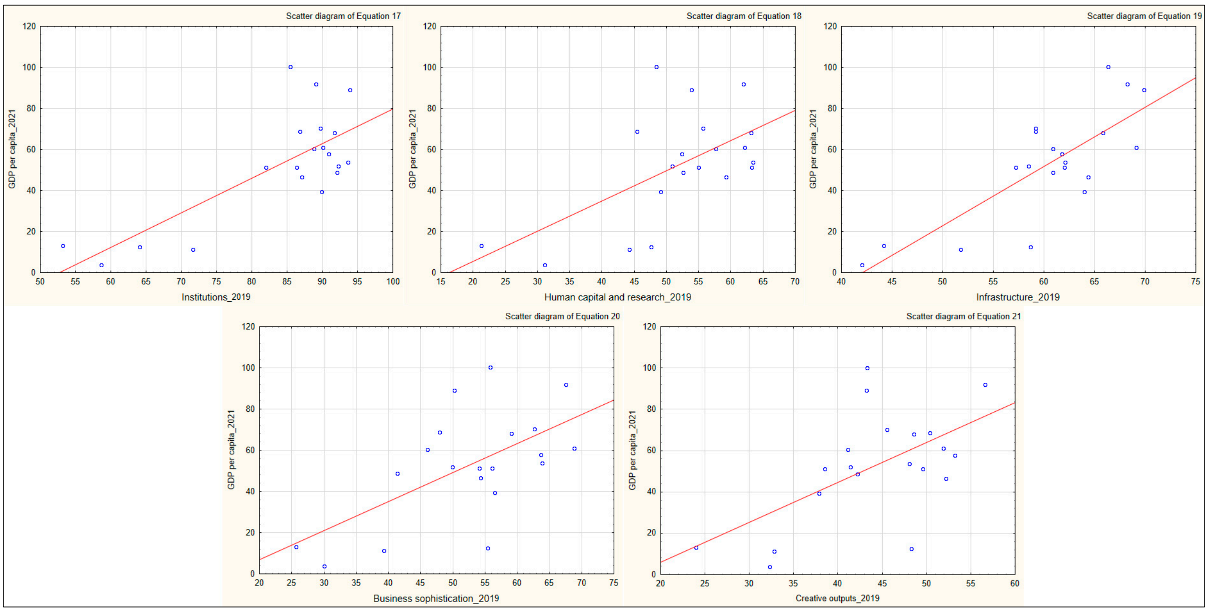

Figure 11. Regression models for the dependence of the GDP per capita level in 2021 on the 2019 GII pillar indicators (points—distribution of two variables, line—linear regression plot). Source: own elaboration based on World Intellectual Property Organization (2019, 2021).

1. The impact of the 2021 GII institutions pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -88.5497 + 1.7053 \times Institutions_{2021} \quad (22)$$

It follows that the GDP per capita would have a growth potential of 8.59% for the GII institutions pillar, increased by 1% at the minimum initial value level (x_{min} = 58.8) and by 2.26% at the maximum value level (x_{max} = 93.3).

2. The impact of the 2021 GII human capital and research pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -27.7316 + 1.5209 \times Human\ capital\ and\ research_{2021} \quad (23)$$

It follows that the GDP per capita would have a growth potential of 5.35% for the GII human capital and research pillar, increased by 1% at the minimum initial value level (x_{min} = 22.4) and by 1.4% at the maximum value level (x_{max} = 64.1).

3. The impact of the 2021 GII infrastructure pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -118.8231 + 3.0796 \times Infrastructure_{2021} \quad (24)$$

It follows that the GDP per capita would have a growth potential of 1.11% for the GII infrastructure pillar, increased by 1% at the minimum initial value level (x_{min} = 38.2) and by 1.07% at the maximum value level (x_{max} = 62.1).

4. The impact of the 2021 GII business sophistication pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -8.113 + 1.2141 \times Business\ sophistication_{2021} \quad (25)$$

It follows that the GDP per capita would have a growth potential of 1.6% for the GII business sophistication pillar, increased by 1% at the minimum initial value level (x_{min} = 17.5) and by 1.11% at the maximum value level (x_{max} = 68.1).

5. The impact of the 2021 GII creative outputs pillar indicator on the level of the GDP per capita (in thousand of USD) in 2021 is expressed by the following linear regression equation:

$$GDP\ per\ capita_{2021} = -4.695 + 1.3237 \times Creative\ outputs_{2021} \quad (26)$$

It follows that the GDP per capita would have a growth potential of 1.25% for the GII creative outputs pillar, increased by 1% at the minimum initial value level (x_{min} = 17.5) and by 1.06% at the maximum value level (x_{max} = 60.2).

Scatter diagrams graphically representing the calculated dependencies of the GDP per capita level (in thousand of USD) in 2021 on the 2021 GII pillar indicators are shown in Figure 12.

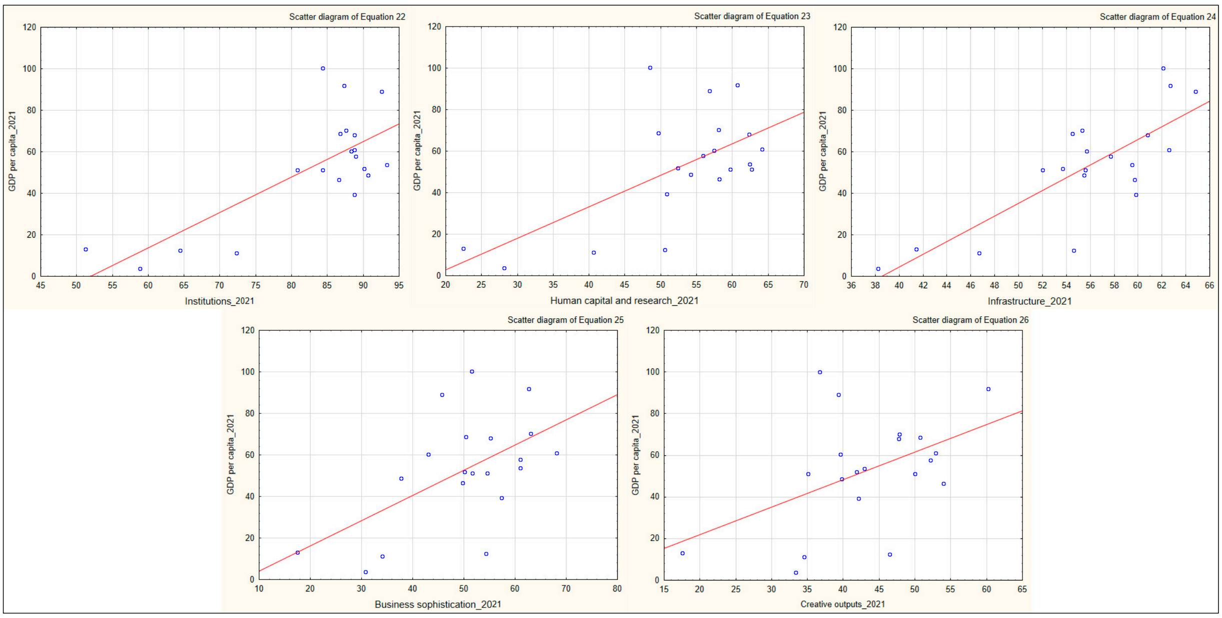

Figure 12. Regression models for the dependence of the GDP per capita level in 2021 on the 2021 GII pillar indicators (points—distribution of two variables, line—linear regression plot). Source: own elaboration based on World Intellectual Property Organization (2021).

Thus, the correlation and regression analysis conducted herein has revealed the following outcomes:

- The GII human capital and research and infrastructure innovation pillars had the greatest effects on the GDP per capita level and the inflation rate, while the institutions, business sophistication, and creative outputs pillars only influenced the GDP per capita level. The knowledge and technology outputs pillar sporadically influenced the GDP per capita level.
- The 2019 GII pillars had the most lasting effects on the economic performance indicators for 2019, 2020, and 2021 (e.g., the GDP per capita level in 2021). The innovation potential inherent to the pre-pandemic year 2019 influenced the economic development of the countries during the crisis years, but this potential had been exhausted by 2022.
- There was no statistically significant impact of the innovation indicators for 2019–2022 on the economic performance in 2022.
- There was no statistically significant impact of innovation indicators on the unemployment rate regardless of the analysis horizon.
- There was no revealed effect of the GII market sophistication pillar on the economic performance of the countries.

5. Discussion and Conclusions

The global crisis caused by the COVID-19 pandemic has drastically affected the economy worldwide, bringing economic activity to a near-standstill. Most countries have implemented full or partial lockdown measures to slow the spread of disease. Many businesses were never able to recover after returning to the pre-quarantine lifestyle and went bankrupt. This, in turn, led to high unemployment, decreased consumer spending, increased inflation, and an overall drop in the GDP levels.

However, the conducted analysis has revealed that innovation development of the countries proceeded despite having changed. This is in line with the research results on the experience from 18 Central and Eastern European (CEE) countries from 1990 to 2020, which focused on the pandemic crises (Lu et al. 2023). The authors highlighted that governments and businesses had to develop innovative solutions to keep their economies stable. The researchers were mainly concerned with analyzing novel digital solutions in various areas (business, education, finance, etc.), and they investigated the negative impact of pandemic-related uncertainty on information globalization. However, the research outcomes were rather limited, since the whole large-scale period of the COVID-19 pandemic fell outside the investigation. Our research findings have significantly expanded the range of key innovations regarding the impact on economic performance.

Having compared the dynamics of the GII pillar values and the impact thereof on the economic performance indicators, it was evidenced that the innovative behavior of the countries was most appropriate when it was focused on the most influential pillars. In particular, these were highly ranked countries in terms of the human capital and research pillar (those from the Anglo-Saxon and the Rhenish (German) models) and the infrastructure pillar (those from the Japanese and the Chinese models). The countries developing innovations as per the institutions pillar (those from the Chinese, the Anglo-Saxon, and the Scandinavian (Swedish) models), the business sophistication pillar (those from the Chinese, the Scandinavian (Swedish), and the Japanese models), and the creative outputs pillar (those from the Chinese and the Rhenish (German) models) also succeeded. There were some priorities for the countries advancing innovations in terms of the knowledge and technology outputs pillar (those from the Scandinavian (Swedish) and the Japanese models). Most of the above-mentioned countries were from the Chinese, the Japanese, and the Scandinavian (Swedish) models. Having paid full attention to the key innovation development factors, these countries were able to maintain their economic performance indicators at an acceptable level. Identical rules for managing innovation development in the countries from the same model might suggest a certain effect of innovation activity on the economic performance indicators. There was neither relevant research conducted previously nor related literature sources found. However, certain works implicitly confirmed some conclusions of our study. In particular, it is important for organizations from the real sector of the economy to participate in business communities both for the economic performance and for the residence countries. It can be assumed that the activity of business communities correlates in some way with the development level of the GII business sophistication pillar. Presumably, such activity previously discovered in Japan, Korea, Hong Kong, Indonesia, Malaysia, and China had some positive impact on the economic development and growth of these countries (Harada 2015). This, in part, verifies the patterns we discovered regarding the Japanese and the Chinese models, since the obtained results were only related to the crisis period. Hilmawan et al. (2023) found a positive impact of the proportion of locals from some regions of Indonesia attaining higher education on the GDP per capita. Since the human capital and research pillar involves an assessment of education (including tertiary education), these findings broadly confirm our results despite a specific region of study and a wider period of coverage.

The growth potential of the countries' economies regarding innovation development is worth addressing. The conducted regression analysis demonstrates that the infrastructure, institutions, and human capital and research pillars had the greatest potential effects during the crisis. The higher the values, the more feasible a great increase in the GDP per capita indicator and a decrease in the inflation rate become. Recent research on the ease of doing business as a factor of institutional development has evidenced its lagged impact on the GDP per capita (Adhikari and Whelan 2023). In turn, an increase in the sub-index values for the development of information and communication technologies, general infrastructure, and ecological sustainability would induce an increase in the GII infrastructure pillar values. The positive dynamics of such sub-index values as institutional environment, regulatory environment, and business environment would promote an increase in the GII institutions pillar value. Accordingly, an improvement in education (including tertiary education) and research and development sub-index values would stimulate an increase in the GII human capital and research pillar value (World Intellectual Property Organization 2023).

Related studies which have focused on finding relationships between innovation pillar values and economic performance indicators have unveiled heterogeneous outcomes. In particular, Colla-De-Robertis and Rivera (2021) attempted to assess the effect of a free trade agreement (FTA) with the United States on member countries' per capita GDP. The authors revealed a positive FTA impact on Chile, Jordan, and Singapore and a negative FTA impact on Mexico, Canada, Honduras, and Guatemala; alternatively, neither effect was observed. Hakimi et al. (2024) examined the relationship between innovation and economic growth and proved that domestic investment, trade openness, and infrastructure substantially stimulate growth in African countries. Similarly, the impact of infrastructure development components on economic growth in lower-to-middle-income countries through investment in telecommunication, electricity power consumption, and transportation was evidenced (Irshad et al. 2022). Law et al. (2020) empirically investigated and highlighted the effect of innovation on economic growth for Malaysia.

Thus, the growth in GDP per capita during the global crisis was highly dependent on the innovation development level of a certain country, as determined by the Global Innovation Index. A strong correlation between these indicators was noted by Borisova (2010), Nikonova (2016), and Serpukhovitin (2020). However, the authors used alternative methods for assessing this relationship than those applied in the presented research. Having analyzed the nature of innovation influences on economic sustainability during the pandemic crisis through the prism of the tourism industry, Ahmad et al. (2023) proposed to reduce the level of pandemic uncertainty via more confident management decision making and, accordingly, accelerating economic development. In addition, the authors revealed a fairly rapid response of pandemic indicators to the impact of innovation. This confirms our findings on the short-term effects of innovative solutions on the economic performance of the countries during the pandemic, as well as the absence of the impact thereof on the economy for the following two years.

No statistical relationship was found between the GII pillars and the unemployment rate for the studied countries (Appendix C). Apparently, innovations seem to have had no profound effect on the unemployment rate during the pandemic-induced global crisis. Instead, some research findings that confirm the impact of various innovations on unemployment highlight factors other than large-scale crisis events which have caused serious blows to the labor market (Guliyev et al. 2023; Rafiee et al. 2024). Parvez et al. (2022) featured some reasons for an increase in unemployment due to the pandemic disruption in the hospitality industry stemming from an upsurge in service automation. However, the latter is rapidly advancing, and robot-induced unemployment could be caused by other factors rather than the pandemic.

As for the exposed investigation, it fully correlates with the aforementioned studies via underlining the GII pillars and categorizing the specific effects of innovation factors on countries using various socioeconomic models. The calculated statistical potential for economic growth regarding changes in innovation indicators would allow for the development of recommendations for economic and social development.

However, there are some limitations regarding the achieved outcomes.

Firstly, crisis uncertainty enormously hinders estimates due to multiple factors influencing the performance of socioeconomic systems. It is evident that there might be no justification for the findings on specific innovation components influencing the development of individual countries during the global crisis. However, due to the lack of alternative forecasts, the obtained research results could serve as a tool for forecasting and taking critical economic and political measures.

Secondly, grouping countries into particular socioeconomic models is not indicative of identical mechanisms nor the nature of the decisions made. The observed differences in socioeconomic dynamics fail to ensure the effectiveness of the regulatory measures taken countries from the same model. However, provided the differences between countries from various models are more critical, it allows for the recommendations to be developed with a higher probability of effective enforcement.

Finally, the calculated dynamics of the GDP per capita and the inflation rate values regarding an increase in the GII pillar indicators are averaged according to the specifics of the regression analysis methodology. Nevertheless, these values could serve as predictive guidelines when changing innovation policies.

Few studies devoted to the issue of the impact of innovation activity on the socioeconomic performance of countries have indicated it to be relevant due to a high degree of environmental factor variability and a strong likelihood of errors in reaching conclusions. In particular, it is advisable to use alternative analysis methods to increase the reliability of the results obtained and to enhance the predictive features of the calculated models. For effective forecasting, it is vital to carry out such calculations both for the COVID-19 pandemic crisis and for other global crisis-induced outcomes. Provided the obtained research results are confirmed, it is feasible to conclude that the level of innovativeness of the economy has a profound effect on its performance.

The obtained results have practical significance for the development of strategic and tactical measures to stimulate innovation development. Firstly, the governments of countries from different socioeconomic models should pay attention to the innovation pillars that were most affected during the crisis (these factors differ depending on the model a particular country belongs to). Secondly, when forming a budget for supporting innovation, one should focus on the presented key innovation groups influencing socioeconomic performance. Finally, to forecast economic development, in particular GDP per capita or inflation, one should consider the potential for growth with an increase in the values of innovation pillars, including the inherent specific indicators.

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Data Availability Statement: Data and methods used in the research presented in sufficient detail in the manuscript. Other researchers can replicate work.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A. Global Innovation Index Pillar Indicators (2019–2022)

Table A1. Pillar 1: Institutions.

Country	2019	2020	2021	2022
Australia	88.8	88.7	88.3	77.2
Belgium	82.0	81.2	80.8	71.5
Canada	92.3	90.2	90.1	80.4
China	64.1	64.6	64.4	64.8
Denmark	91.7	88.3	88.8	82.8
Finland	93.6	93.5	93.3	82.5
Germany	86.4	84.6	84.3	76.5

Table A1. *Cont.*

Country	2019	2020	2021	2022
Iceland	86.8	86.6	86.8	80.4
Indonesia	53.2	51.0	51.2	55.1
Ireland	85.5	85.3	84.3	79.2
Japan	89.9	89.3	88.8	75.8
Malaysia	71.6	72.5	72.3	68.8
Netherlands (Kingdom of the)	90.9	89.7	88.9	86.9
New Zealand	92.1	90.9	90.7	83.3
Norway	93.9	92.5	92.6	87.1
Sweden	90.1	88.7	88.8	76.5
Switzerland	89.1	88.0	87.3	89.2
United Kingdom	87.1	86.1	86.6	74.5
United States of America	89.7	88.9	87.6	80.9
Vietnam	58.6	58.5	58.8	60.6

Table A2. Pillar 2: Human capital and research.

Country	2019	2020	2021	2022
Australia	57.7	59.0	57.4	61.7
Belgium	55.0	57.8	59.7	56.1
Canada	50.9	51.8	52.4	57.7
China	47.6	49.4	50.6	53.1
Denmark	63.1	62.9	62.3	59.4
Finland	63.4	61.5	62.4	60.6
Germany	63.2	61.1	62.7	64.1
Iceland	45.4	46.1	49.7	46.4
Indonesia	21.3	21.0	22.4	22.4
Ireland	48.4	48.5	48.5	48.9
Japan	49.1	47.3	50.8	52.7
Malaysia	44.2	46.0	40.6	41.0
Netherlands (Kingdom of the)	52.4	55.3	55.9	57.4
New Zealand	52.6	54.4	54.2	54.9
Norway	53.9	55.1	56.8	53.6
Sweden	62.1	62.4	64.1	62.6
Switzerland	61.9	60.7	60.7	62.4
United Kingdom	59.3	58	58.2	61.5
United States of America	55.7	56.3	58.1	59.9
Vietnam	31.1	26	28.1	27.2

Table A3. Pillar 3: Infrastructure.

Country	2019	2020	2021	2022
Australia	60.9	55.8	55.7	58.8
Belgium	57.2	52.2	52	53.7
Canada	58.5	53.3	53.7	57
China	58.7	52.1	54.6	57.5
Denmark	65.8	61.5	60.8	64.3
Finland	62.1	59.9	59.5	65.9
Germany	62	58	55.6	57.7
Iceland	59.2	52.8	54.5	57.8
Indonesia	44.2	37.7	41.4	43.4
Ireland	66.3	59.2	62.1	60.1
Japan	64	60	59.8	61.3
Malaysia	51.8	46.4	46.7	48.6
Netherlands (Kingdom of the)	61.8	57.4	57.7	60.1
New Zealand	60.9	57.7	55.5	57.9
Norway	69.9	64.6	64.8	66.5
Sweden	69.1	64.6	62.6	67
Switzerland	68.2	62	62.7	65.7
United Kingdom	64.4	60.3	59.7	62.9
United States of America	59.2	54.7	55.3	58.7
Vietnam	42	38.4	38.2	42.5

Table A4. Pillar 4: Market sophistication.

Country	2019	2020	2021	2022
Australia	68.3	67.1	66.4	50.1
Belgium	55.3	54.5	54.1	38.2
Canada	80.4	78.5	84.7	65
China	58.6	58.5	61.5	56
Denmark	66.9	66.3	68	53.1
Finland	57.3	53.1	58.7	51.7
Germany	58.6	56.1	57.8	53.7
Iceland	56	49.8	56.8	40
Indonesia	48.8	48.1	48.5	41.7
Ireland	54.6	52.5	49.7	35.8
Japan	65.8	64.3	62.1	59
Malaysia	57.8	58.3	55.3	45.3
Netherlands (Kingdom of the)	58.2	56.5	55.2	50.7
New Zealand	68.5	63.9	63	45.7
Norway	58.6	56.1	57.6	44.6
Sweden	62.1	62.3	64.6	55.6
Switzerland	68.4	72.3	71.5	59.8
United Kingdom	76	74.4	78.1	67.6
United States of America	87	81.4	81.5	80.8
Vietnam	57	53	57.2	38.4

Table A5. Pillar 5: Business sophistication.

Country	2019	2020	2021	2022
Australia	46.1	43.6	43	48.6
Belgium	54.1	52.5	51.7	56.7
Canada	49.9	50.5	50.1	52.3
China	55.4	52.9	54.3	55.9
Denmark	59.1	54.8	55.2	54.3
Finland	63.9	59.9	61	61.6
Germany	56.1	53.7	54.5	52.7
Iceland	48	51.1	50.4	54.8
Indonesia	25.7	17.8	17.5	22.1
Ireland	55.8	53.1	51.5	55.1
Japan	56.5	57.1	57.3	58.1
Malaysia	39.3	38	34.1	36.3
Netherlands (Kingdom of the)	63.7	63.4	61	56.8
New Zealand	41.4	37.9	37.7	43.8
Norway	50.2	45.1	45.7	52
Sweden	68.8	68	68.1	69.8
Switzerland	67.5	64.1	62.6	60.6
United Kingdom	54.3	51	49.7	51.7
United States of America	62.7	62.8	63	64.5
Vietnam	30	34.5	30.8	31.6

Table A6. Pillar 6: Knowledge and technology outputs.

Country	2019	2020	2021	2022
Australia	31.6	30.4	29.1	32.2
Belgium	40.8	42.3	42.3	44.4
Canada	41.3	39.1	38.3	39.3
China	57.2	55.1	58.5	56.8
Denmark	46.4	48.3	47.6	51.9
Finland	55.1	55.1	56.5	59.6
Germany	52.7	51.7	53.3	54.8
Iceland	37.6	33	37	39.7
Indonesia	17.6	17.9	18.3	18.9
Ireland	56.9	55.1	47.6	47
Japan	50.8	46.4	48.3	52.6
Malaysia	32.1	31.3	33.4	31.5
Netherlands (Kingdom of the)	61.8	54.5	54.8	57.9
New Zealand	29.8	31.2	29.7	36
Norway	33.7	33.1	35.4	39.3
Sweden	61.8	59.8	60.3	62.9

Table A6. *Cont.*

Country	2019	2020	2021	2022
Switzerland	70.3	65.5	63.9	67.1
United Kingdom	56.6	54.4	52.3	55.7
United States of America	59.7	56.8	59.2	60.8
Vietnam	35.6	31.7	29.4	26

Table A7. Pillar 7: Creative outputs.

Country	2019	2020	2021	2022
Australia	41.1	37.3	39.6	37.8
Belgium	38.5	35	35.1	32.6
Canada	41.4	40.2	41.9	38.7
China	48.3	47	46.5	49.3
Denmark	48.6	48.3	47.7	46.3
Finland	48.1	41.8	42.9	39
Germany	49.6	49.1	50	52.3
Iceland	50.4	49.3	50.7	46.4
Indonesia	24	17.8	17.5	18.6
Ireland	43.3	37.6	36.7	35.5
Japan	37.9	37.2	42.1	38.9
Malaysia	32.8	33.9	34.5	27.4
Netherlands (Kingdom of the)	53.2	51.7	52.2	49.4
New Zealand	42.2	34.9	39.8	38.4
Norway	43.2	38.7	39.3	34.6
Sweden	51.9	51.7	52.9	50.7
Switzerland	56.6	60	60.2	56.3
United Kingdom	52.2	52.7	54	55.9
United States of America	45.5	47.7	47.8	48.4
Vietnam	32.3	32.7	33.4	30.8

Table A8. GDP per capita, USD.

Country	2019	2020	2021	2022
Australia	54,941.43	51,720.37	60,443.11	60,798.00
Belgium	46,638.68	45,517.79	51,247.01	53,156.00
Canada	46,328.67	43,258.26	51,987.94	44,910.44
China	10,143.84	10,408.67	12,556.33	11,560.00
Denmark	59,592.98	60,915.42	68,007.76	60,113.00
Finland	48,629.86	49,170.75	53,654.75	47,088.00
Germany	46,793.69	46,772.83	51,203.55	43,032.00
Iceland	68,853.72	59,200.18	68,727.64	55,887.00
Indonesia	12,484	12,235	13,159	14,687
Ireland	80,927.07	85,420.19	100,172.08	988,562.00
Japan	40,458.00	39,918.17	39,312.66	36,032.00
Malaysia	11,132.02	10,160.78	11,109.26	11,372.00
Netherlands (Kingdom of the)	52,476.27	52,162.57	57,767.88	49,980.00
New Zealand	42,865.23	41,596.51	48,781.03	42,272.00
Norway	75,719.75	67,328.68	89,154.28	79,639.00
Sweden	51,939.43	52,837.90	61,028.74	55,482.00
Switzerland	84,121.93	85,656.32	91,999.60	88,464.00
United Kingdom	42,747.08	40,318.56	46,510.28	47,232.00
United States of America	65,120.39	63,530.63	70,248.63	62,867.00
Vietnam	3491.09	3586.35	3756.49	3655.00

Table A9. Inflation rate, %.

Country	2019	2020	2021	2022
Australia	1.6	0.9	2.8	6.6
Belgium	1.2	0.4	3.2	10.3
Canada	1.9	0.7	3.4	6.8
China	2.9	2.5	0.9	1.9
Denmark	0.7	0.3	1.9	8.5

Table A9. *Cont.*

Country	2019	2020	2021	2022
Finland	1.1	0.4	2.1	7.2
Germany	1.4	0.4	3.2	8.7
Iceland	3	2.8	4.5	8.3
Indonesia	2.8	2	1.6	4.2
Ireland	0.9	−0.5	2.4	8.1
Japan	0.5	0	−0.2	2.5
Malaysia	0.7	−1.1	2.5	3.4
Netherlands (Kingdom of the)	2.7	1.1	2.8	11.6
New Zealand	1.6	1.7	3.9	7.2
Norway	2.2	1.3	3.5	5.8
Sweden	1.7	0.7	2.7	8.1
Switzerland	0.4	−0.7	0.6	2.8
United Kingdom	1.8	0.9	2.6	9.1
United States of America	1.8	1.3	4.7	8
Vietnam	2.8	3.2	1.8	3.2

Table A10. Unemployment rate, %.

Country	2019	2020	2021	2022
Australia	5.2	6.5	5.1	3.7
Belgium	5.4	5.6	6.3	5.5
Canada	5.7	9.7	7.5	5.3
China	3.6	4.2	4	4.2
Denmark	5	5.6	5.1	4.5
Finland	6.7	7.8	7.6	6.8
Germany	3	3.6	3.6	3.1
Iceland	3.9	6.4	6	3.8
Indonesia	5.2	7.1	6.5	5.9
Ireland	5	5.9	6.3	4.5
Japan	2.4	2.8	2.8	2.6
Malaysia	3.3	4.5	4.7	3.8
Netherlands (Kingdom of the)	4.4	4.9	4.2	3.5
New Zealand	4.1	4.6	3.8	3.3
Norway	3.7	4.6	4.4	3.3
Sweden	7	8.5	8.8	7.5
Switzerland	2.3	3.2	3	2.2
United Kingdom	3.8	4.6	4.5	3.7
United States of America	3.7	8.1	5.4	3.5
Vietnam	2.2	2.5	3.2	2.3

Appendix B. Paired-Samples *t*-Test of the GII Pillar Values for Various Socioeconomic Models (2019–2022)

Paired Sample Name *	Average Group 1	Average Group 2	*t*-Value	*p*	S Group 1	S Group 2	F Crit
A-S, Ins. (av) vs. Rhen, Ins. (av)	86.19500	84.83500	0.5075	0.629893	4.662628	2.642303	3.11384
A-S, Ins. (av) vs. Sc, Ins.(av)	86.19500	88.26500	−0.6520	0.53530	4.662628	4.309567	1.17056
A-S, Ins. (av) vs. Jap, Ins. (av)	86.19500	69.96000	6.2527	0.000776	4.662628	2.286278	4.15914
A-S, Ins. (av) vs. Chin, Ins.(av)	86.19500	61.80000	10.3757	0.000047	4.662628	0.609645	58.49354
Rhen, Ins. (av) vs. Sc, Ins.(av)	84.83500	88.26500	−1.3570	0.223595	2.642303	4.309567	2.66012
Rhen, Ins. (av) vs. Jap, Ins. (av)	84.83500	69.96000	8.5143	0.000144	2.642303	2.286278	1.33569
Rhen, Ins. (av) vs. Chin, Ins.(av)	84.83500	61.80000	16.9892	0.000003	2.642303	0.609645	18.78502
Sc, Ins.(av) vs. Jap, Ins. (av)	88.26500	69.96000	7.5044	0.000290	4.309567	2.286278	3.55311
Sc, Ins.(av) vs. Chin, Ins.(av)	88.26500	61.80000	12.1609	0.000019	4.309567	0.609645	49.97049
Jap, Ins. (av) vs. Chin, Ins.(av)	69.96000	61.80000	6.8972	0.000459	2.286278	0.609645	14.06386

Paired Sample Name *	Average Group 1	Average Group 2	t-Value	p	S Group 1	S Group 2	F Crit
A-S, HC (av) vs. Rhen, HC (av)	55.25000	59.15250	−4.5281	0.003983	1.484790	0.875457	2.87647
A-S, HC (av) vs. Sc, HC (av)	55.25000	57.69000	−2.6891	0.036096	1.484790	1.043392	2.02505
A-S, HC (av) vs. Jap, HC (av)	55.25000	38.23250	22.3733	0.000001	1.484790	0.330996	20.12261
A-S, HC (av) vs. Chin, HC (av)	55.25000	39.13750	17.8335	0.000002	1.484790	1.029866	2.07859
Rhen, HC (av) vs. Sc, HC (av)	59.15250	57.69000	2.1475	0.075361	0.875457	1.043392	1.42045
Rhen, HC (av) vs. Jap, HC (av)	59.15250	38.23250	44.7037	0.000000	0.875457	0.330996	6.99559
Rhen, HC (av) vs. Chin, HC (av)	59.15250	39.13750	29.6149	0.000000	0.875457	1.029866	1.38386
Sc, HC (av) vs. Jap, HC (av)	57.69000	38.23250	35.5507	0.000000	1.043392	0.330996	9.93687
Sc, HC (av) vs. Chin, HC (av)	57.69000	39.13750	25.3096	0.000000	1.043392	1.029866	1.02644
Jap, HC (av) vs. Chin, HC (av)	38.23250	39.13750	−1.6732	0.145312	0.330996	1.029866	9.68092
A-S, Infr. (av) vs. Rhen, Infr. (av)	58.98750	59.00000	−0.00793	0.993933	2.025066	2.417988	1.425706
A-S, Infr. (av) vs. Sc, Infr.(av)	58.98750	62.66000	−2.30756	0.060470	2.025066	2.455742	1.470574
A-S, Infr. (av) vs. Jap, Infr. (av)	58.98750	50.44000	5.57596	0.001412	2.025066	2.301840	1.292028
A-S, Infr. (av) vs. Chin, Infr.(av)	58.98750	48.00000	6.73395	0.000522	2.025066	2.558971	1.596807
Rhen, Infr. (av) vs. Sc, Infr.(av)	59.00000	62.66000	−2.12399	0.077854	2.417988	2.455742	1.031471
Rhen, Infr. (av) vs. Jap, Infr. (av)	59.00000	50.44000	5.12815	0.002161	2.417988	2.301840	1.103464
Rhen, Infr. (av) vs. Chin, Infr.(av)	59.00000	48.00000	6.24884	0.000779	2.417988	2.558971	1.120011
Sc, Infr.(av) vs. Jap, Infr. (av)	62.66000	50.44000	7.26111	0.000347	2.455742	2.301840	1.138191
Sc, Infr.(av) vs. Chin, Infr.(av)	62.66000	48.00000	8.26687	0.000170	2.455742	2.558971	1.085839
Jap, Infr. (av) vs. Chin, Infr.(av)	50.44000	48.00000	1.41781	0.206027	2.301840	2.558971	1.235892
A-S, MS. (av) vs. Rhen, MS. (av)	67.49250	57.55750	2.41844	0.051973	6.778655	4.642509	2.131972
A-S, MS. (av) vs. Sc, MS.(av)	67.49250	56.96000	2.40911	0.052637	6.778655	5.523163	1.506299
A-S, MS. (av) vs. Jap, MS. (av)	67.49250	54.58500	3.26946	0.017046	6.778655	4.048905	2.802927
A-S, MS. (av) vs. Chin, MS.(av)	67.49250	55.02500	2.87279	0.028324	6.778655	5.421024	1.563595
Rhen, MS. (av) vs. Sc, MS.(av)	57.55750	56.96000	0.16562	0.873893	4.642509	5.523163	1.415371
Rhen, MS. (av) vs. Jap, MS. (av)	57.55750	54.58500	0.96509	0.371772	4.642509	4.048905	1.314711
Rhen, MS. (av) vs. Chin, MS.(av)	57.55750	55.02500	0.70966	0.504548	4.642509	5.421024	1.363506
Sc, MS.(av) vs. Jap, MS. (av)	56.96000	54.58500	0.69360	0.513872	5.523163	4.048905	1.860804
Sc, MS.(av) vs. Chin, MS.(av)	56.96000	55.02500	0.50006	0.634839	5.523163	5.421024	1.038038
Jap, MS. (av) vs. Chin, MS.(av)	54.58500	55.02500	−0.13006	0.900771	4.048905	5.421024	1.792617
A-S, BS. (av) vs. Rhen, BS. (av)	50.84000	58.23250	−6.5253	0.000618	1.624582	1.579417	1.058010
A-S, BS. (av) vs. Sc, BS.(av)	50.84000	57.09000	−5.8991	0.001054	1.624582	1.360441	1.426014
A-S, BS. (av) vs. Jap, BS. (av)	50.84000	38.31500	10.3756	0.000047	1.624582	1.785954	1.208530
A-S, BS. (av) vs. Chin, BS.(av)	50.84000	43.17500	8.7826	0.000121	1.624582	0.638357	6.476728
Rhen, BS. (av) vs. Sc, BS.(av)	58.23250	57.09000	1.0962	0.315045	1.579417	1.360441	1.347827
Rhen, BS. (av) vs. Jap, BS. (av)	58.23250	38.31500	16.7082	0.000003	1.579417	1.785954	1.278636
Rhen, BS. (av) vs. Chin, BS.(av)	58.23250	43.17500	17.6779	0.000002	1.579417	0.638357	6.121616
Sc, BS.(av) vs. Jap, BS. (av)	57.09000	38.31500	16.7254	0.000003	1.360441	1.785954	1.723381
Sc, BS.(av) vs. Chin, BS.(av)	57.09000	43.17500	18.5192	0.000002	1.360441	0.638357	4.541840
Jap, BS. (av) vs. Chin, BS.(av)	38.31500	43.17500	−5.1249	0.002168	1.785954	0.638357	7.827321
A-S, Know. (av) vs. Rhen, Know. (av)	44.58750	54.88250	−9.8449	0.000063	1.396266	1.557099	1.243645
A-S, Know. (av) vs. Sc, Know.(av)	44.58750	47.70500	−2.4881	0.047282	1.396266	2.080857	2.220999
A-S, Know. (av) vs. Jap, Know. (av)	44.58750	33.25750	13.0914	0.000012	1.396266	1.022982	1.862947
A-S, Know. (av) vs. Chin, Know.(av)	44.58750	43.78750	0.6434	0.543738	1.396266	2.057658	2.171753
Rhen, Know. (av) vs. Sc, Know.(av)	54.88250	47.70500	5.5234	0.001482	1.557099	2.080857	1.785879
Rhen, Know. (av) vs. Jap, Know. (av)	54.88250	33.25750	23.2143	0.000000	1.557099	1.022982	2.316844
Rhen, Know. (av) vs. Chin, Know. (av)	54.88250	43.78750	8.5994	0.000136	1.557099	2.057658	1.746280
Sc, Know. (av) vs. Jap, Know. (av)	47.70500	33.25750	12.4616	0.000016	2.080857	1.022982	4.137603
Sc, Know. (av) vs. Chin, Know. (av)	47.70500	43.78750	2.6773	0.036666	2.080857	2.057658	1.022676
Jap, KNOW. (av) vs. Chin, Know. (av)	33.25750	43.78750	−9.1648	0.000095	1.022982	2.057658	4.045860

Paired Sample Name *	Average Group 1	Average Group 2	*t*-Value	*p*	S Group 1	S Group 2	F Crit
A-S, CO. (av) vs. Rhen, CO. (av)	42.94000	48.86500	−8.5547	0.000140	1.099909	0.842002	1.7064
A-S, CO. (av) vs. Sc, CO.(av)	42.94000	46.12500	−2.6941	0.035859	1.099909	2.093060	3.6212
A-S, CO. (av) vs. Jap, CO. (av)	42.94000	30.21750	13.4052	0.000011	1.099909	1.546984	1.9781
A-S, CO. (av) vs. Chin, CO.(av)	42.94000	40.03750	5.1982	0.002018	1.099909	0.193111	32.4416
Rhen, CO. (av) vs. Sc, CO.(av)	48.86500	46.12500	2.4290	0.051232	0.842002	2.093060	6.1793
Rhen, CO. (av) vs. Jap, CO. (av)	48.86500	30.21750	21.1749	0.000001	0.842002	1.546984	3.3756
Rhen, CO. (av) vs. Chin, CO.(av)	48.86500	40.03750	20.4373	0.000001	0.842002	0.193111	19.0114
Sc, CO.(av) vs. Jap, CO. (av)	46.12500	30.21750	12.2238	0.000018	2.093060	1.546984	1.8306
Sc, CO.(av) vs. Chin, CO.(av)	46.12500	40.03750	5.7922	0.001159	2.093060	0.193111	117.4766
Jap, CO. (av) vs. Chin, CO.(av)	30.21750	40.03750	−12.5979	0.000015	1.546984	0.193111	64.1741

* Notes: A-S—Anglo-Saxon model, Rhen—Rhenish (German) model, Sc—Scandinavian (Swedish) model, Jap—Japanese model, Chin—Chinese model, Ins—institutions, HC—human capital and research, Infr—infrastructure, MS—market sophistication, BS—business sophistication, Know—knowledge and technology outputs, CO—creative outputs.

Appendix C. The Impact of Innovativeness on Socioeconomic Indicators of the Countries

Table A11. The impact of the 2019 GII pillar indicators on the GDP per capita (in thousand of USD) (GDPPC) in 2020.

Regression Model	Correlation
GDPPC_2020 = −76.396 + 1.4604 × Institutions_2019	0.766914 * p = 0.00008 R^2 = 0.588 t = 5.0701 F = 25.70591
GDPPC_2020 = −22.2496 + 1.3163 × Human capital and research_2019	0.619737 * p = 0. 003563 R^2 = 0. 384074 t = 3.35026 F = 11.22427
GDPPC_2020 = −102.7365 + 2.4676 × Infrastructure_2019	0.788879 * p = 0.000036 R^2 = 0.62233 t = 5.44616 F = 29.66065
GDPPC_2020 = 6.7962 + 0.62157 × Market sophistication_2019	0.257437
GDPPC_2020 = −22.4939 + 1.30815 × Business sophistication_2019	0.659651 * p = 0. 001554 R^2 =0.43514 t = 3.72375 F = 13.866
GDPPC_2020 = 8.70526 + 0.804.4 × Knowledge and technology outputs_2019	0.484597 * p = 0.030357 R^2= 0.2348338 t = 2.350383 F = 5.524302
GDPPC_2020 = −30.32549 + 1.7345 × Creative outputs_2019	0.614040 * p = 0. 00398 R^2 = 0. 37705 t = 3.30069 F = 10.89455

* Validation tests and coefficients are presented only for statistically significant correlations.

Table A12. The impact of the 2019 GII pillar indicators on the unemployment rate in 2020.

Regression Model	Correlation
Unemployment_2020 = 2.2359 + 0.03934 × Institutions_2019	0.240321
Unemployment_2020 = 4.5249 + 0.01946 × Human capital and research_2019	0.106571
Unemployment_2020 = 4.5364 + 0.01656 × Infrastructure_2019	0.061583
Unemployment_2020 = 1.8666 + 0.05804 × Market sophistication_2019	0.279637
Unemployment_2020 = 4.1312 + 0.02678 × Business sophistication_2019	0.157094
Unemployment_2020 = 5.8429 − 0.0066 × Knowledge and technology outputs_2019	−0.046442
Unemployment_2020 = 5.4098 + 0.00284 × Creative outputs_2019	0.011704

Table A13. The impact of the 2019 GII pillar indicators on the inflation rate in 2020.

Regression Model	Correlation
Inflation_2020 = 4.1980 − 0.0391 × Institutions_2019	−0.417990
Inflation_2020 = 3.5484 − 0.0507 × Human capital and research_2019	−0.485629 * p = 0.029954 R^2 = 0. 23583 t = 3.1125 F = 5.555142
Inflation_2020 = 5.1957 − 0.0710 × Infrastructure_2019	−0.461407 * p = 0.040579 R^2 = 0.212897 t = 2.65952 F = 4.868662
Inflation_2020 = 1.8098 − 0.0142 × Market sophistication_2019	−0.119219
Inflation_2020 = 3.1708 − 0.0430 × Business sophistication_2019	−0.441215
Inflation_2020 = 2.2082 − 0.0278 × Knowledge and technology outputs_2019	−0.340909
Inflation_2020 = 1.8435 − 0.0211 × Creative outputs_2019	−0.151727

* Validation tests and coefficients are presented only for statistically significant correlations.

Table A14. The impact of the 2019 GII pillar indicators on the GDP per capita (GDPPC) (in thousand of USD) in 2021.

Regression Model	Correlation
GDPPC_2021 = −89.3626 + 1.692 × Institutions_2019	0.761359 * p = 0.000096 R^2 = 0.58 t = 4.98229 F = 24.82322
GDPPC_2021 = −23.952 + 1.4734 × Human capital and research_2019	0.594438 * p = 0.005708 R^2 = 0.353356 t = 3.136247 F = 9.836047
GDPPC_2021 = −121.88 + 2.8921 × Infrastructure_2019	0.792250 * p = 0.000031 R^2 = 0.62766 t = 5.5084 F = 30.34299
GDPPC_2021 = 10.530 + 0.66463 × Market sophistication_2019	0.235873
GDPPC_2021 = −21.4784 + 1.4119 × Business sophistication_2019	0.610080 * p = 0. 004285 R^2 =0.3721 t = 3.26672 F = 10.671
GDPPC_2021 = 14.881 + 0.81043 × Knowledge and technology outputs_2019	0.418353
GDPPC_2021 = −32.5997 + 1.9326 × Creative outputs_2019	0.586271 * p = 0. 006593 R^2 = 0.3437 t = 3.07035 F = 9.427046

* Validation tests and coefficients are presented only for statistically significant correlations.

Table A15. The impact of the 2019 GII pillar indicators on the unemployment rate in 2021.

Regression Model	Correlation
Unemployment_2021 = 3.6558 + 0.01770 × Institutions_2019	0.129264
Unemployment_2021 = 4.5623 + 0.01113 × Human capital and research_2019	0.072876
Unemployment_2021 = 4.3539 + 0.01303 × Infrastructure_2019	0.057962
Unemployment_2021 = 5.6816 − 0.0086 × Market sophistication_2019	−0.049361
Unemployment_2021 = 4.0345 + 0.02109 × Business sophistication_2019	0.147902
Unemployment_2021 = 5.3557 − 0.0046 × Knowledge and technology outputs_2019	−0.038895
Unemployment_2021 = 5.3222 − 0.0041 × Creative outputs_2019	−0.020367

Table A16. The impact of the 2019 GII pillar indicators on the inflation rate in 2021.

Regression Model	Correlation
Inflation_2021 = −0.3562 + 0.03459 × Institutions_2019	0.336925
Inflation_2021 = 1.3131 + 0.02368 × Human capital and research_2019	0.036266
Inflation_2021 = 2.1761 + 0.00612 × Infrastructure_2019	0.036266
Inflation_2021 = 0.43167 + 0.03343 × Market sophistication_2019	0.256828
Inflation_2021 = 2.7733 − 0.0044 × Business sophistication_2019	−0.040726
Inflation_2021 = 3.4385 − 0.0192 × Knowledge and technology outputs_2019	−0.214843
Inflation_2021 = 1.7625 + 0.01776 × Creative outputs_2019	0.116622

Table A17. The impact of the 2019 GII pillar indicators on the GDP per capita (GDPPC) in 2022.

Regression Model	Correlation
GDPPC_2022 = −75.1416 + 2.0029 × Institutions_2019	0.113836
GDPPC_2022 = 97.250 − 0.08496 × Human capital and research_2019	−0.004329
GDPPC_2022 = −380.5354 + 7.849 × Infrastructure_2019	0.271576
GDPPC_2022 = 338.2836 − 3.883 × Market sophistication_2019	−0.174056
GDPPC_2022 = −35.6919 + 2.4517 × Business sophistication_2019	0.133805
GDPPC_2022 = −60.9899 + 3.3103 × Knowledge and technology outputs_2019	0.215831
GDPPC_2022 = 43.303 + 1.1244 × Creative outputs_2019	0.043083

Table A18. The impact of the 2019 GII pillar indicators on the unemployment rate in 2022.

Regression Model	Correlation
Unemployment_2022 = 4.0667 + 0.00099 × Institutions_2019	0.008423
Unemployment_2022 = 3.6346 + 0.00993 × Human capital and research_2019	0.075452
Unemployment_2022 = 3.7363 + 0.00686 × Infrastructure_2019	0.035399
Unemployment_2022 = 6.0544 − 0.0301 × Market sophistication_2019	−0.201440
Unemployment_2022 = 3.1432 + 0.01920 × Business sophistication_2019	0.156342
Unemployment_2022 = 4.2604 − 0.0024 × Knowledge and technology outputs_2019	−0.023099
Unemployment_2022 = 4.5474 − 0.0090 × Creative outputs_2019	−0.051551

Table A19. The impact of the 2019 GII pillar indicators on the inflation rate in 2022.

Regression Model	Correlation
Inflation_2022 = −3.511 + 0.12074 × Institutions_2019	0.527280
Inflation_2022 = 0.76464 + 0.11269 × Human capital and research_2019	0.441218
Inflation_2022 = −0.6359 + 0.12023 × Infrastructure_2019	0.319628
Inflation_2022 = 4.6787 + 0.03063 × Market sophistication_2019	0.105506
Inflation_2022 = 2.0772 + 0.08656 × Business sophistication_2019	0.362972
Inflation_2022 = 4.9008 + 0.03689 × Knowledge and technology outputs_2019	0.184804
Inflation_2022 = 0.55329 + 0.13759 × Creative outputs_2019	0.405083

Table A20. The impact of the 2020 GII pillar indicators on the GDP per capita (GDPPC) in 2020.

Regression Model	Correlation
GDPPC_2020 = −75.9112 + 1.4706 × Institutions_2020	0.75832 * p = 0.000107 R^2 = 0.575 t = 4.93543 F = 24.35848
GDPPC _2020 = −20.161 + 1.2732 × Human capital and research_2020	0.62220 * p = 0.003396 R^2 = 0.387133 t = 3.37197 F = 11.37017
GDPPC_2020 = −81.555 + 2.3027 × Infrastructure_2020	0.75049 * p = 0.000138 R^2 = 0.56323 t = 4.81783 F = 23.21147
GDPPC_2020 = 0.0217 + 0.00047 × Market sophistication_2020	0.26240
GDPPC_2020 = −13.1003 + 1.1699 × Business sophistication_2020	0.60831 * p = 0.004429 R^2 = 0.37004 t = 3.251651 F = 10.573
GDPPC_2020 = 6.4485 + 0.88803 × Knowledge and technology outputs_2020	0.49829 * p = 0.025346 R^2 = 0.248292 t = 2.438336 F = 5.9455
GDPPC_2020 = −7.136 + 1.2603 × Creative outputs_2020	0.52605 * p = 0. 017197 R^2 = 0. 2767 t = 2.624295 F = 6.886923

* Validation tests and coefficients are presented only for statistically significant correlations.

Table A21. The impact of the 2020 GII pillar indicators on the unemployment rate in 2020.

Regression Model	Correlation
Unemployment_2020 = 2.4222 + 0.03752 × Institutions_2020	0.225101
Unemployment_2020 = 4.0933 + 0.02771 × Human capital and research_2020	0.157527
Unemployment_2020 = 4.7716 + 0.01377 × Infrastructure_2020	0.157527
Unemployment_2020 = 2.6705 + 0.04669 × Market sophistication_2020	0.225804
Unemployment_2020 = 4.4266 + 0.02191 × Business sophistication_2020	0.132539
Unemployment_2020 = 5.6072 − 0.0016 × Knowledge and technology outputs_2020	−0.010563
Unemployment_2020 = 6.0552 − 0.0123 × Creative outputs_2020	−0.059815

Table A22. The impact of the 2020 GII pillar indicators on the inflation rate in 2020.

Regression Model	Correlation
Inflation_2020 = 4.2569 − 0.0403 × Institutions_2020	−0.422405
Inflation_2020 = 3.4709 − 0.0491 × Human capital and research_2020	−0.488127 * p = 0. 028996 R^2 = 0. 23827 t = 3.1535 F = 5.630357
Inflation_2020 = 4.6832 − 0.0680 × Infrastructure_2020	−0.450520 * p = 0.046213 R^2 = 0.20297 t = 2.6382 F = 4.583800
Inflation_2020 = 2.7396 − 0.0297 × Market sophistication_2020	−0.251398
Inflation_2020 = 2.6417 − 0.0341 × Business sophistication_2020	−0.360865
Inflation_2020 = 2.4421 − 0.0342 × Knowledge and technology outputs_2020	−0.177414
Inflation_2020 = 1.7977 − 0.0209 × Creative outputs_2020	−0.419522

* Validation tests and coefficients are presented only for statistically significant correlations.

Table A23. The impact of the 2021 GII pillar indicators on the GDP per capita (GDPPC) in 2021.

Regression Model	Correlation
GDPPC_2021 = −88.5497 + 1.7053 × Institutions_2021	0.745526 * p = 0.000161 R^2 = 0.556 t = 4.74586 F = 22.52316
GDPPC_2021 = −27.7316 + 1.5209 × Human capital and research_2021	0.630992 * p = 0.002852 R^2 = 0.398151 t = 3.45078 F = 11.90786
GDPPC_2021 = −118.8231 + 3.0796 × Infrastructure_2021	0.795981 * p = 0.000027 R^2 = 0.633585 t = 5.57895 F = 31.12467
GDPPC_2021 = 20.536 + 0.51115 × Market sophistication_2021	0.190204
GDPPC_2021 = −8.113 + 1.2141 × Business sophistication_2021	0.561982 * p = 0. 009912 R^2 = 0.31582 t = 2.882534 F = 8.3090
GDPPC_2021 = 17.306 + 0.7872 × Knowledge and technology outputs_2021	0.377676
GDPPC_2021 = −4.695 + 1.3237 × Creative outputs_2021	0.470165 * p = 0. 036445 R^2 = 0. 2211 t = 2.260131 F = 5.108191

* Validation tests and coefficients are presented only for statistically significant correlations.

Table A24. The impact of the 2021 GII pillar indicators on the unemployment rate in 2021.

Regression Model	Correlation
Unemployment_2021 = 3.6823 + 0.01762 × Institutions_2021	0.125033
Unemployment_2021 = 4.2177 + 0.01747 × Human capital and research_2021	0.117685
Unemployment_2021 = 4.1576 + 0.01766 × Infrastructure_2021	0.074075
Unemployment_2021 = 4.8047 + 0.00535 × Market sophistication_2021	0.032343
Unemployment_2021 = 4.2030 + 0.01875 × Business sophistication_2021	0.140923
Unemployment_2021 = 5.1094 + 0.00068 × Knowledge and technology outputs_2021	0.005321
Unemployment_2021 = 6.2903 − 0.0266 × Creative outputs_2021	−0.153387

Table A25. The impact of the 2021 GII pillar indicators on the inflation rate in 2021.

Regression Model	Correlation
Inflation_2021 = −0.4027 + 0.03563 × Institutions_2021	0.337138
Inflation_2021 = 1.2527 + 0.02448 × Human capital and research_2021	0.219873
Inflation_2021 = 2.4961 + 0.00088 × Infrastructure_2021	0.004916
Inflation_2021 = 1.2416 + 0.02082 × Market sophistication_2021	0.167663
Inflation_2021 = 2.5172 + 0.00056 × Business sophistication_2021	0.005583
Inflation_2021 = 3.3103 − 0.0171 × Knowledge and technology outputs_2021	−0.177567
Inflation_2021 = 2.2321 + 0.00724 × Creative outputs_2021	0.055634

Table A26. The impact of the 2022 GII pillar indicators on the GDP per capita (GDPPC) in 2022.

Regression Model	Correlation
GDPPC_2022 = −187.2007 + 3.6511 × Institutions_2022	0.152886
GDPPC_2022 = 109.5689 − 0.3146 × Human capital and research_2022	−0.016883
GDPPC_2022 = −152.4557 + 4.2024 × Infrastructure_2022	0.137834
GDPPC_2022 = 384.0864 − 5.64 × Market sophistication_2022	−0.299954
GDPPC_2022 = −36.2047 + 2.4833 × Business sophistication_2022	0.131546
GDPPC_2022 = 51.538 + 0.88401 × Knowledge and technology outputs_2022	0.055794
GDPPC _2022 = 169.1489 − 1.845 × Creative outputs_2022	−0.086798

Table A27. The impact of the 2022 GII pillar indicators on unemployment rate in 2022.

Regression Model	Correlation
Unemployment_2022 = 6.0976 − 0.0254 × Institutions_2022	−0.158599
Unemployment_2022 = 3.7897 + 0.00678 × Human capital and research_2022	0.054239
Unemployment_2022 = 2.7397 + 0.02416 × Infrastructure_2022	0.118207
Unemployment_2022 = 4.6645 − 0.0100 × Market sophistication_2022	−0.079043
Unemployment_2022 = 2.9742 + 0.02263 × Business sophistication_2022	0.178787
Unemployment_2022 = 3.8660 + 0.00608 × Knowledge and technology outputs_2022	0.057221
Unemployment_2022 = 5.2495 − 0.0266 × Creative outputs_2022	−0.186548

Table A28. The impact of the 2022 GII pillar indicators on the inflation rate in 2022.

Regression Model	Correlation
Inflation_2022 = −3.473 + 0.13153 × Institutions_2022	0.423184
Inflation_2022 = 0.82766 + 0.10883 × Human capital and research_2022	0.448750
Inflation_2022 = −0.4028 + 0.12023 × Infrastructure_2022	0.302995
Inflation_2022 = 6.4429 + 0.00333 × Market sophistication_2022	0.013619
Inflation_2022 = 1.9222 + 0.09031 × Business sophistication_2022	0.367568
Inflation_2022 = 4.2550 + 0.05051 × Knowledge and technology outputs_2022	0.244965
Inflation_2022 = 3.2658 + 0.08097 × Creative outputs_2022	0.292710

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