LIUDMYLA SAHER
Tetiana VASYLIEVA
Inna TIUTIUNYK

INCLUSIVE ECONOMY AND MACROECONOMIC STABILITY: ECONOMIC AND ECOLOGICAL IMPERATIVES AND DEVELOPMENT PRIORITIES

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Reviewers:

Prof. Dr. Aleksandra Kuzior

Prof. Dr. Maxim Korneyev

Prof. Dr. Pedchenko Nataliya

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Liudmyla SAHER
Tetiana VASYLIEVA
Inna TIUTIUNYK

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INTRODUCTION

Today's strategic challenges have exacerbated the problem of transformation of the socio-ecological-economic model of global economic development, the transition from the post-industrial model of economic development to the model of systemic neo-industrialization, focused on the formation of a new industry based on the knowledge economy, achievements of scientific and technological progress and a new technological system.

The experience of developed countries shows that currently the most progressive model in the direction of ensuring economic growth is the model of inclusive development, which covers a wider range of social and economic processes, is focused on achieving sustainable development goals, accelerated poverty reduction, and attracting a larger share of the country's workforce.

Therefore, reforming the policy of ensuring the country's macroeconomic stability requires the development of a strategy for its inclusive development, generalization of the theoretical and methodological basis of the concept of an inclusive economy, which, in turn, is aimed at harmonizing interests in the chain “state - business – society”.

One of the threats to inclusive growth and macroeconomic stability is a significant share of energy consumption. The significant energy dependence of the economy and the penetration of energy into all areas of society's functioning make it necessary to reform the energy sector in accordance with modern requirements dictated by changing economic realities.

According to the International Energy Agency in 2019, world total electricity final consumption reached 22,848 TWh, up 135% from 1990, and is growing significantly every year.

In Ukraine, indicators of the development of the energy sector of the economy are significantly inferior to the countries of the European Union. In terms of the rate of reduction of final consumption of energy resources, Ukraine lags behind by almost two times, in terms of the share of use of alternative energy sources by almost 6 times, in terms of the rate of reduction of carbon emissions in the energy sector - by almost 4 times. First of all, this is due to the active implementation by EU countries of a unified energy policy, one of the basic elements of which is the development of smart energy networks and their full integration into the European energy system.

This is accompanied by the lack of coordinated actions and coordination of the interests of state authorities, local governments, enterprises and consumers, the implementation of systemic state policy regarding the organizational and economic stimulation of the transfer of energy innovations through the introduction of smart energy networks, insufficient amount of financial resources aimed at these goals.

In the context of the study of the imperatives of an inclusive economy, as one of the most modern mechanisms for ensuring its macroeconomic stability, the study of the structural and functional environment of the evolution of the concept of smart energy networks, the determination of the impact of the policy of the introduction of smart energy networks on the social and economic development of the country, and the development of mechanisms for coordinating the interests of stakeholders acquires significant importance in the implementation of the road map of stabilization of the economy and its inclusive growth.

Solving current global problems, in particular, environmental (reducing the eco-destructive impact on the environment, preventing climate change and deterioration of the quality of the natural environment, which harms the life and health of people), political (ensuring energy sovereignty and national security) and

economic (reducing the energy intensity of the economy and increasing its competitiveness) should be considered in the context of energy modernization and transformation of the energy system. The development of smart energy networks reduces the country's energy dependence and contributes to ensuring national security, macroeconomic stability, and creates prerequisites for reducing the energy intensity of the national economy and increasing its competitiveness.

In these conditions, one of the main tasks of the state authorities at various levels is the formation of prerequisites for ensuring the macroeconomic stability of the country and its sustainable growth. The implementation of the mentioned measures makes it possible to form the basis for avoiding financial imbalances in the country and crisis phenomena in society.

Scientists and regulators of many countries of the world have worked out a number of mechanisms to increase the level of its inclusive growth. However, in the conditions of a high level of economic losses caused by crisis phenomena in the economy, the problem of finding mechanisms that would contribute to the stabilization of the economy is becoming more and more urgent.

1 A SYSTEMATIC LITERATURE REVIEW OF INCLUSIVE ECONOMY AND MACROECONOMIC STABILITY

1.1 Inclusive economy: directions and trends of modern economic research

Scientific research on the concept of inclusive economic development and the imperatives of macroeconomic stability requires numerous generally accepted and specific methods. Theoretical analysis of the concept's basics is usually carried out using conceptual-categorical, decompositional and terminological analysis. However, in the absence of a unified approach and interdisciplinarity of the topic for a deeper justification of the research problem. It is advisable to conduct a bibliometric analysis. It allows you to measure the impact of publications, scientists, or institutions on the scientific community [1, 2]. Bibliometric analysis is based on data usually formed using generally accepted international scientific databases. Bibliometric analysis is an advanced tool for identifying existing "gaps" in the research topic, identifying areas of research that are most relevant and in line with current trends [3]. Today's most common for economic and social analysis is the Web of Science (WoS) from Clarivate Analytics and Scopus from Elsevier [1], which were used in work as the main.

To further analyze the growing trend of interest in the diagnosed issues, it is advisable to determine the frequency of queries in search engines using the tool Google Trends. This general application displays the frequency of search popularity of a particular term on the main Google search engine relative to the total volume of search queries in different world regions and other languages.

In general, the study is proposed to be carried out in several stages:

1) Analysis of scientific and public interest in the concept of "inclusive economy" (based on the analysis of publications in the scientometric database Scopus and using Google Trends, respectively);

2) Research of scientific and public interest in the concept of "macroeconomic stability" (based on the analysis of publications in the scientometric database Scopus and using Google Trends, respectively);

3) Comparative analysis of the essence of scientific publications within the concepts of "inclusive economy" and "macroeconomic stability" (based on the analysis of publications in the scientometric database Web of Science).

Rapid and sustainable poverty reduction requires inclusive growth to contribute to and benefit from economic growth. Rapid growth is undoubtedly needed to reduce poverty significantly. Still, for this growth to be sustainable in the long run, it must be broad across sectors and include a significant part of the country's workforce. This definition of inclusive growth suggests a direct relationship between macro-and micro-determinants of growth [4, 5].

The European Strategy for Economic Development "Europe 2020" defines inclusive growth as helping to increase employment, achieving social and territorial cohesion [5, 6].

The 2014 OECD Report "All on Board: Putting Inclusive Growth in Practice" defines "inclusive growth" as "a new approach to understanding economic growth that aims to improve living standards and more evenly distribute the benefits of increased well-being among social groups" [5]. However, a large number

Therefore, to determine the key determinants of inclusive economy and the main trends of research in this area at the first stage, we analyzed the scientific interest in the concept of

"inclusive economy" according to the sequence shown in Figure 1.1.

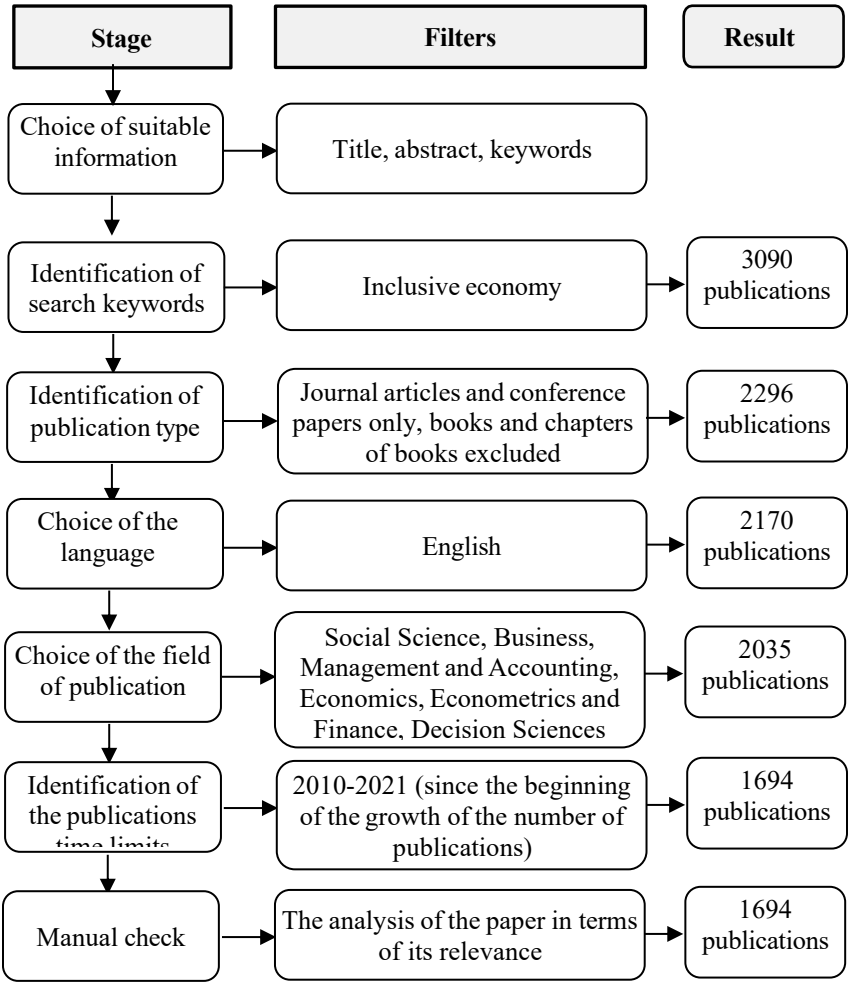


Figure 1.1. Stages of bibliometric analysis

To ensure the complexity and integrity of the study, the search field "title, abstract, keywords" was used. As the

research topic is quite popular and multidisciplinary, restrictions have been placed on selecting relevant materials for bibliometric analysis. Thus, only articles and conference proceedings written in English were selected for further consideration. In addition, restrictions have been introduced on the scope of research (focusing on publications that contain an economic component) and the timing of publication. The inspection also showed that all publications correspond to the research problem. Thus, considering all the limitations, 1694 publications were selected for further consideration.

Figure 1.2 presents a quantitative analysis of scientific publications in the Scopus database on the selected search query for the period 2010 - December 2021. The first publication on inclusive economic development dates back to 1983 [7], but until 2008 the number of publications did not exceed 30 per year.

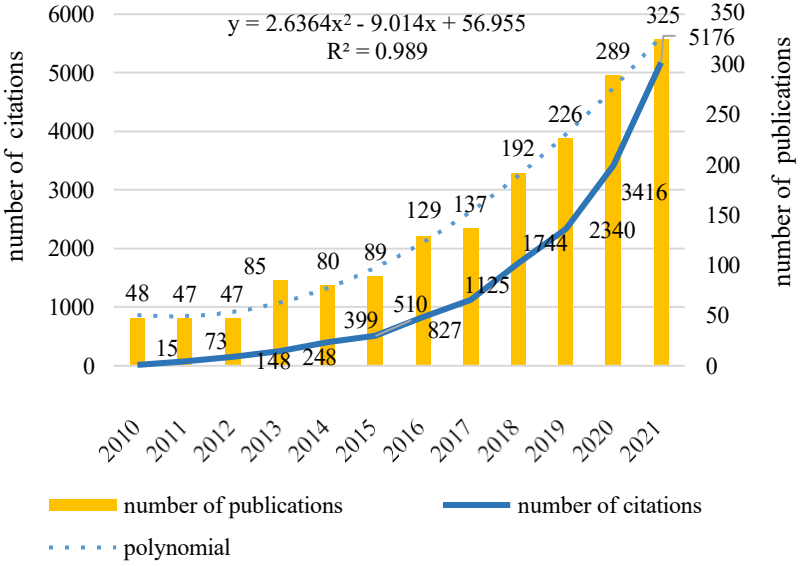


Figure 1.2. The dynamic of scientific publications on the inclusive economy, indexed by the database Scopus for 2010-2021

Since 2010, a period of active interest and intensification of publishing activity in the inclusive economy or related topics has begun. Since then, there has been a steady trend towards increasing the number of publications (as evidenced by the trend line) with a peak in 2021 – 325 publications. Figure 1.1 also shows that in the last five years (2017 to 2021), about 70% of all research materials have been published.

The highest citation rate – 5176 – was reached in 2021. The most significant number of citations per publication was in 2020 and 2021 (12 citations per 1 publication). In 2016, an article was published, which took 1st place among the most cited.

The analysis of the number of publications and citations partially correlates with the development trends of an inclusive economy. This allows us to analyze the evolutionary development of research on inclusive economic growth. The basis for determining the scientific interest is the number of published scientific papers on this topic. The public interest in the subject is determined by Google Trends, which allows you to track the number of queries related to the inclusive economy in the Google search engine. The frequency of questions in search engines was determined using the Google Trends tool. This tool has restrictions on the data collection period and starts in 2004. The period from 2016 to 2021 was chosen for the study due to the fact that in 2016 the approach to data collection was significantly improved.

You can get acquainted with the dynamics of the search frequency of the term “inclusive economy” in Figure 1.3.

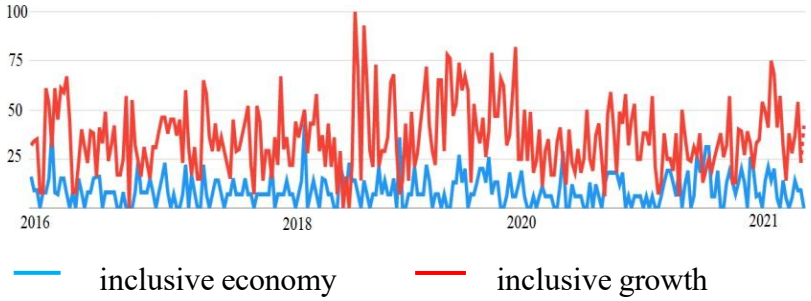


Figure 1.3. The dynamics of the frequency of queries "inclusive economy" and "inclusive growth" in search engines for the period 2005-2019 around the world (built using the tool Google Trends)

Figure 1.3 shows that the "inclusive growth" request frequency is higher than the corresponding "inclusive economy" indicator. The most popular request was in 2019, which may be due to the deepening economic crisis due to the Covid-19 pandemic. Accordingly, there is a growing need to understand ways out of the situation, one of which is the inclusive development of the economy, taking into account social, environmental, energy, and other components.

The Google Trends tool lets you compare search terms and see a map of the world showing shades of popularity. The color intensity corresponds to the percentage of searches for a more popular term in it. The popularity of a search term is related to the total number of Google searches over a period of time in a given region.

Analysis of the popularity of the search query "inclusive economy" by region (Figure 1.4) shows that the top five questions in the number of queries include Canada, the United States, Britain, South Africa, the Philippines.

Figure1.4. The popularity of the search query “inclusive economy” by region (built with Google Trends)

A comparison of the frequency of “inclusive economy” requests in certain regions compared to the frequency of “inclusive growth” requests (Table 1.1) confirms the general trend of more significant popularity of the latter definition.

Table 1.1. Comparison of the frequency of “inclusive economy” and “inclusive growth” requests in the leading regions

Country	Inclusive economy	Inclusive growth
Canada	47%	53%
United States	43%	57%
United Kingdom	37%	63%
South Africa	36%	64%
Philippines	12%	88%

At the same time, a study of the popularity of the search query "inclusive growth" by region (Figure 1.5) shows that the leaders in frequency for this keyword are entirely different. Zambia, Nigeria, Singapore, Ghana, and Azerbaijan are in the top five requests.

Figure 1.5. The popularity of the search query "inclusive economy" by region (built with the tool Google Trends)

A comparison of subject areas in the study of inclusive economy is shown in Figure 1.6. The results indicate the prevalence of social sciences. It can be explained by the origin of inclusiveness, which was first used in this field. The share of publications on management (business, management, and accounting) and economic (economics, econometrics, and finance) research is relatively high. There is also a tendency to increase their number. The share of publications on energy and ecology remains insignificant but confirms the interdisciplinary nature of the research topic.

The most published publications in the "inclusive economy" in the Scopus database are given in Table 1.2. All articles have been cited more than 100 times. It indicates that the world scientific community highly values these publications. There is a scientific discussion, which emphasizes the relevance of the research topic.

At the same time, almost all articles (except 9) were published in high-ranking journals with high SNIP and were included in quartiles Q1 and Q2.

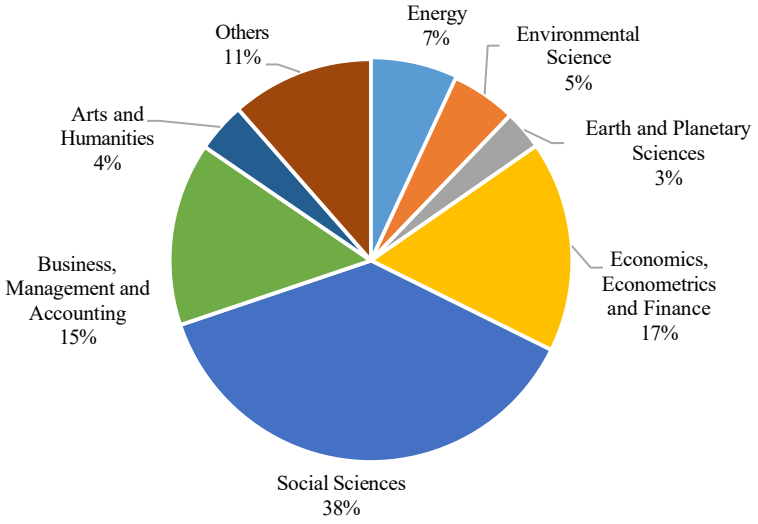


Figure 1.6. Publications in the field of an inclusive economy, selected by research areas (based on the Scopus database)

The ten most cited publications are in the following areas: environmental aspects (paragraphs 2, 5, 6), social aspect (paragraph 3), a combination of social and ecological aspects (paragraph 10), use of innovation as a factor in economic development (paragraphs 4, 9), features of smart use policy,

Table 1.2. Top 10 most cited studies in the field of the inclusive economy from 2010 to 2021 (based on the Scopus database)

№	Total citations	Article title	Author	Number of universities/ institutions	Number of countries	Journal/Year of publication
1	406	Sharing economy: A review and agenda for future research [8]	Cheng, M.	1	1 (Australia)	International Journal of Hospitality Management, 2016
2	295	Green, circular, bio economy: A comparative analysis of sustainability avenues [9]	D'Amato, D., Droste, N., Allen, B., Kettunen M., Lähtinen K., Korhonen J., Leskinen P., Matthies, B.D., Toppinen, A.	4	4 (Finland, Germany, United Kingdom)	Journal of Cleaner Production, 2017
3	223	Classifying work in the new economy [10]	Cappelli, P., Keller, J.R.	1	1 (USA)	Academy of Management Review, 2013

№	Total citations	Article title	Author	Number of universities/ institutions	Number of countries	Journal/Year of publication
4	221	Open service innovation and the firm's search for external knowledge [11]	Mina, A., Bascavusoglu-Moreau, E., Hughes, A.	1	1 (United Kingdom)	Research Policy, 2014
5	150	Towards sustainable groundwater use: Setting long-term goals, backcasting, and managing adaptively [12]	Gleeson, T., Alley, W.M., Allen, D.M., (...), Taniguchi, M., Vandersteen, J.	4	2 (Canada, USA)	Ground Water, 2012
6	132	Role of financial development, economic growth & foreign direct investment in driving climate change: A case of emerging ASEAN [13]	Nasir, M.A., Duc Huynh, T.L., Xuan Tram, H.T.	3	3 (United Kingdom, Viet Nam, Germany)	Journal of Environmental Management, 2019

№	Total citations	Article title	Author	Number of universities/ institutions	Number of countries	Journal/Year of publication
7	126	What is smart rural development? [14]	Naldi, L., Nilsson, P., Westlund, H., Wixe, S.	4	1 (Sweden)	Journal of Rural Studies, 2014
8	124	Perception of competitiveness in the context of sustainable development: Facets of "sustainable competitiveness" [15]	Balkyte, A., Tvaronavičiene, M.	2	1 (Lithuania)	Journal of Business Economics and Management, 2010
9	123	Social innovation, an answer to contemporary societal challenges? Locating the concept in theory and practice [16]	Grimm, R., Fox, C., Baines, S., Albertson, K.	3	1 (United Kingdom)	Innovation: The European Journal of Social Science Research, 2013

№	Total citations	Article title	Author	Number of universities/ institutions	Number of countries	Journal/Year of publication
10	119	An ecology for cities: A transformational nexus of design and ecology to advance climate change resilience and urban sustainability [17]	Childers, D.L., Cadenasso, M.L., Morgan Grove, J., (...), McGrath, B., Pickett, S.T.A.	4	1 (USA)	Sustainability, 2015

sharing economy and sustainable competitiveness (paragraphs 1, 7, 8).

The most cited (406 citations) is the publication "Sharing economy: A review and agenda for future research" by M. Cheng [8]. The author reveals the directions of research of the economy of common use: its essence, business models and their impact, and sustainability development.

In second place is the publication "Green, circular, bio-economy: A comparative analysis of sustainability avenues" by D'Amato, D., Droste, N., Allen, B. et al. [9] (295 citations). In this publication, the authors analyze the concepts of circular economy, green economy, and bio economy in a combination aimed at reconciling economic, environmental, and social goals.

The third place is occupied by the publication "Classifying work in the new economy" [10], cited 223 times. Authors – Cappelli, P., Keller, J.R. from the University of Pennsylvania. The article describes an inclusive classification system that clearly distinguishes between work and its alternatives.

One of the leading indicators of effectiveness in scientific circles is the number of citations, which can take individual indexes and are used for ranking. Thus, the list of authors who have the highest citation rates from the inclusive in the Scopus database is listed in Table 1.3.

Thus, Managi S., Rogerson C. M., Rivza B. have the most significant publications on the research topic. They also have high h-index values. It confirms the high scientific level and relevance of their research.

Table 1.3. Top authors by the number of publications in the field of the inclusive economy during 2010-2021 (based on the Scopus database)

Author	Number of published materials	Author's h-index in the Scopus database
Managi, S.	8	40
Rogerson, C.M.	7	39
Rivza, B.	5	7
Chen, B.	4	21
Chen, G.	4	61
Gutberlet, J.	4	19
Kruzmetra, M.	4	3
Anderson, W.	3	10
Asongu, S.A.	3	42
Balkyte, A.	3	4
Christiaensen, L.	3	22
Jeyacheya, J.	3	5
Krysovatyy, A.	3	3
Kurniawan, R.	3	7
Liu, W.	3	29
Sharma, D.	3	6
Tengeh, R.K.	3	10
Tian, G.	3	5
Todorov, V.	3	10
Voyer, M.	3	15
Zvarych, I.	3	
Zvarych, R.	3	3

The leading organizations funding Scopus's inclusive economics research are the European Commission (more than 6%), the National Natural Science Foundation of China (about 6%), the Horizon 2020 Framework Program (4.4%), and the

Economic and Social Research Council. (4.22%), Social Sciences and Humanities Research Council of Canada (2.75%). It shows the importance of inclusive economic development for the European Union, China, Canada, Australia, Britain, etc.

Given the ramifications and debatability of the topic of an inclusive economy, clusters were formed to determine the current areas of further investigation, using VOSviewer, a reliable and effective tool to visualize the relationship between the main keywords in research.

The previous analysis included 8086 keywords (frequency of occurrence more than five times). After checking their relevance, 508 words were selected (excluding repetitive and irrelevant words, such as "university", "Malaysia", etc.). The obtained results allowed us to identify 8 clusters (Figure 1.7), which unite the critical concepts of thematic proximity. This map shows the frequency of terms (the size of the circle), the tightness of the links between them (the closer, the closer), and the different combinations of words both within clusters and between them.

The largest clusters were red and green (87 keywords, respectively). The first (red) cluster was formed around the concept of political economy (the concept establishes 97 connections, the strength of connections – 438, links – 219). This cluster includes the concepts: "employment" (occurrences (occ.) – 49, total link strength – 291, links – 176), "urban economy" (occ. – 48, total link strength – 298, links – 164) , "Globalization" (occurrences (occ.) – 32, total link strength – 183, links – 111), "urbanization" (occ. – 35, total link strength – 245, links – 136), "social inclusion" (occurrences) (occ.) – 36, total link strength – 199, links – 129), "governance" (occurrences (occ.) – 31, total link strength – 143, links – 98), "inclusion" (occurrences (occ.) – 27, total link strength – 80, links – 59). In general, the publications grouped into this cluster contain the results of research on socio–economic

relations, their interaction, taking into account the limited resources and the diversity of goals and ideologies of social and economic institutions of society. Without the analysis and formation of models for implementing such relations, the development of an inclusive economy is impossible.

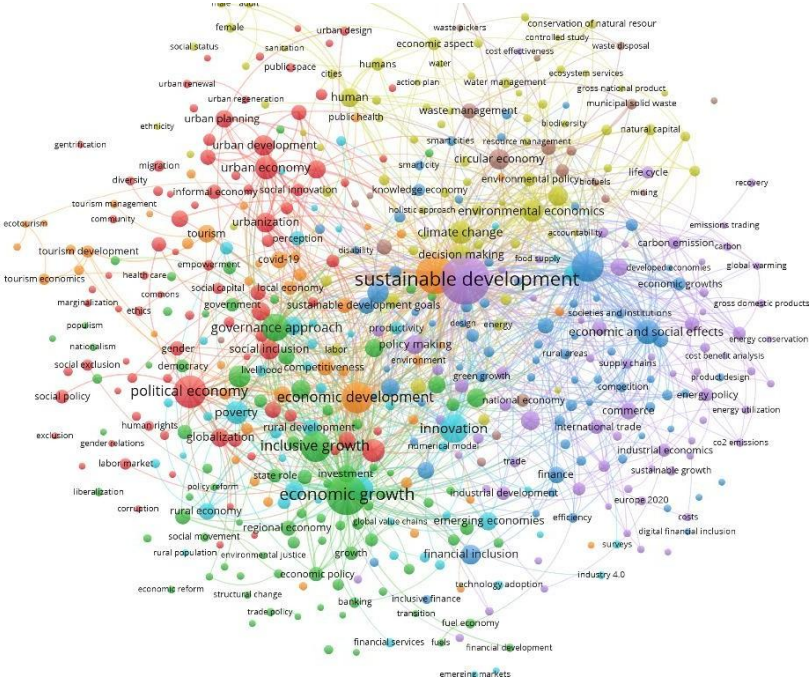


Figure 1.7. Visualization map of cross-sectoral research on inclusive economy (on Scopus database for 2010-2021)

The second (green) cluster is tied to the concept of "economic growth" (occ. – 147, total link strength – 838, links – 291) and covers keywords: "inclusive growth" (occ. – 84, total link strength – 357, links – 194), "governance approach" (occ. – 67, total link strength – 469, links – 244), "inequality" (occ. – 46, total link strength – 231, links – 140), "stakeholder" (occ. – 31, total link strength – 191, links – 131), "GDP"(occ.–

28, total link strength – 187, links – 111). This cluster characterizes the components and indicators of economic development, including in the direction of ensuring inclusiveness, taking into account the policies of governments at the state and regional levels and the interests of other stakeholders.

At the heart of the third (dark blue) cluster is the concept of "economics" (occ. – 95, total link strength – 694, links – 287). The cluster has an educational focus in the field of green economy, finance, investment, regional economy and methods of assessing economic and social effects. The following main keywords belong to this cluster: "economic and social effects" (occ. – 53, total link strength – 424, links – 209), "education" (occ. – 42, total link strength – 215, links – 149), "Green economy" (occ. – 32, total link strength – 189, links – 132), "regional planning" (occ. – 23, total link strength – 164, links – 101), "investments (occ. – 22, total link strength – 142, links – 95), "finance" (occ. – 27, total link strength – 160, links – 110), "finance inclusion" (occ. – 36, total link strength – 85, links – 36).

The fourth (yellow) cluster contains publications that present research results on environmental problems and ways to solve them. It is based on the concept of "environmental economics" (occ. – 45, total link strength – 407, links – 195). Among the 72 items within the cluster, the most powerful are: "climate change" (occ. – 49, total link strength – 333, links – 193), "environmental protection" (occ. – 37, total link strength – 353, links – 181), "human" (occ. – 33, total link strength – 189, links – 157), "decision making" (occ. – 38, total link strength – 266, links – 180).

The fifth (purple) cluster covers 74 keywords such as "commerce" (occ. – 27, total link strength – 204, links – 127); "economic analysis" (occ. – 29, total link strength – 226, links – 142); "policymaking" (occ. – 34, total link strength – 243,

links – 156); “international trade” (occ. – 19, total link strength – 123, links – 95); “developing countries” (occ. – 33, total link strength – 239, links – 146); “energy efficiency” (occ. – 15, total link strength – 126, links – 88). It is formed around “sustainable development” (occ. – 224, total link strength – 1394, links – 392). Within this cluster are united works, the authors of which considered various aspects of sustainable development, which are focused on the inclusive economy.

The last large cluster (blue) is dedicated to innovation and technological development, their impact on achieving the goals of an inclusive economy. The cluster is based on the concept of “innovation” (occ. – 78, total link strength – 419, links – 213) and covers keywords “poverty” (occ. – 49, total link strength – 279, links – 151), “developing world” (Occ. – 52, total link strength – 352, links – 191),“ poverty alleviation (occ. – 32, total link strength – 220, links – 140), “inclusive development” (occ. – 32, total link strength – 166, links – 109), “emerging economies” (occ. – 31, total link strength – 160, links – 113), “rural economy” (occ. – 27, total link strength – 163, links – 90).

Orange and brown clusters are the smallest. Thus, the orange is formed around the concepts of “sustainability” and “economic development” (the change in critical industries related to sustainable development and inclusive economy under the influence of the Covid-19 pandemic is studied. Accordingly, the brown cluster is based on the recovery and rational consumption of resources.

Bibliometric analysis shows that until 2017, the research of scientists mainly focused on the factors of economic growth through the formation of the relationship between the market and the state, the individual and society.

In 2017–2018, the vector of economic analysis changed: research activities were aimed at studying economic development with a focus on achieving the goals of sustainable

development, which is one of the elements of an inclusive economy. In 2018-2019, the emphasis on research was shifted to studying the global economic model of economic development through the prism of environmental protection (Figure 1.8).

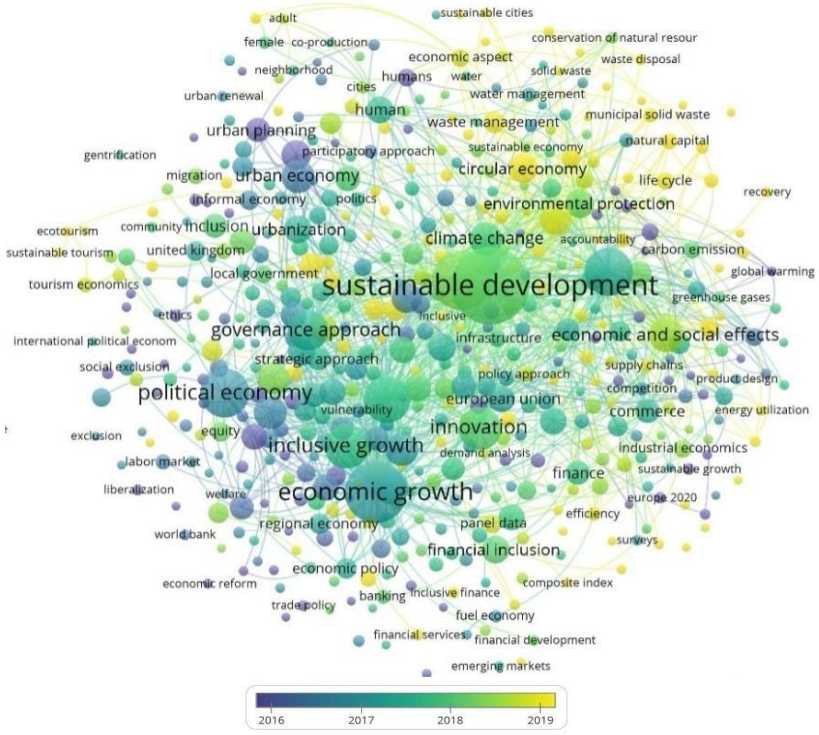


Figure 1.8. Visualization map of changing trends in economic research on the development of inclusive economy, published in 2010-2021 on the Scopus database

Particular attention should be paid to studying the geographical aspect of research in the concept of an inclusive economy. VosViewer helps analyze the relationship between

scientists and researchers of the inclusive economy from different countries. Thus, Figure 1.9 presents a visualization map co-authored by scientists (criterion - the country specified in the affiliation).

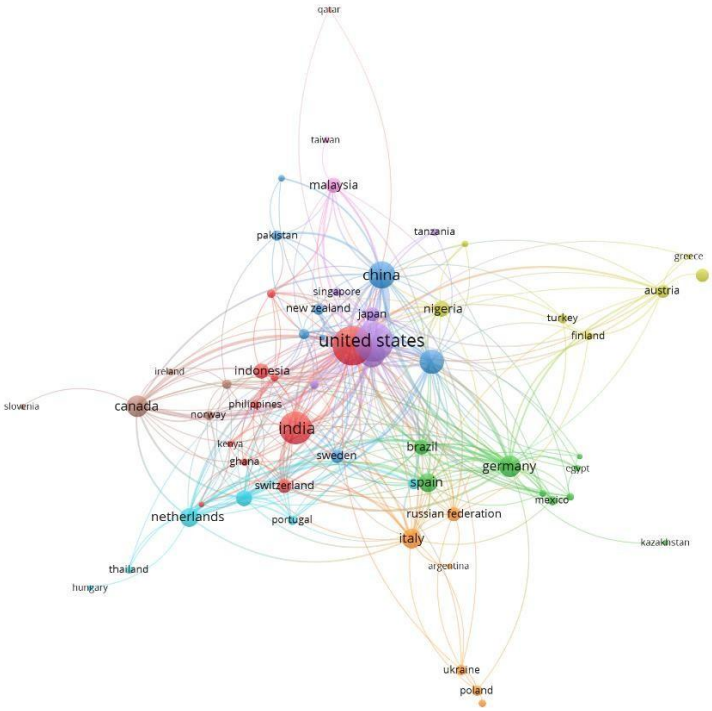


Figure 1.9. Visualization map co-authored by scientists, whose joint publications on the inclusive economy, published in 2010-2021 on the Scopus database

According to the results, ten countries have leading positions. These are United Kingdom (243 publications), USA (243 publications), India (169 publications), China (115 publications), Australia (1089 publications), South Africa (96 publications), Canada (73 publications), Germany (72

publications), Italy (64 publications), the Netherlands (59 publications).

Thus, applying the combination of VOSViewer v.1.6.10 and Google Trends for analysis allowed to generalize the theoretical aspects of the transition to an inclusive economy in more comprehensive formalized parameters (evolutionary, substantive, geographical). This study provides a basis for further empirical research in this area. It also points to the field's prospects, which are associated with many unresolved scientific problems that hinder the development of an inclusive economy at the regional and global levels.

1.2. Directions and trends of modern economic research of macroeconomic stability

The concept of macroeconomic stability has undergone significant changes in recent decades. Within the framework of the proposed structural adjustment program, macroeconomic stability was defined in a very narrow sense, focusing primarily on low inflation, price stability, low fiscal and current account deficits. However, scholars have criticized these aspects for not considering other important variables (mainly real variables, including unemployment), and for some variables, a small range of threshold changes has been considered [18, 19, 20].

Based on this issue, determining the essence of research in this area is relevant.

To determine the key scientific imperatives of macroeconomic stability in this direction, at the first stage, we analyzed the scientific interest in the concept of “macroeconomic stability” by the sequence shown in Figure 1.10.

Only articles and conference proceedings written in English were selected for further consideration. In addition, restrictions

have been introduced on the scope of research (focusing on publications that contain an economic component) and the timing of publication.

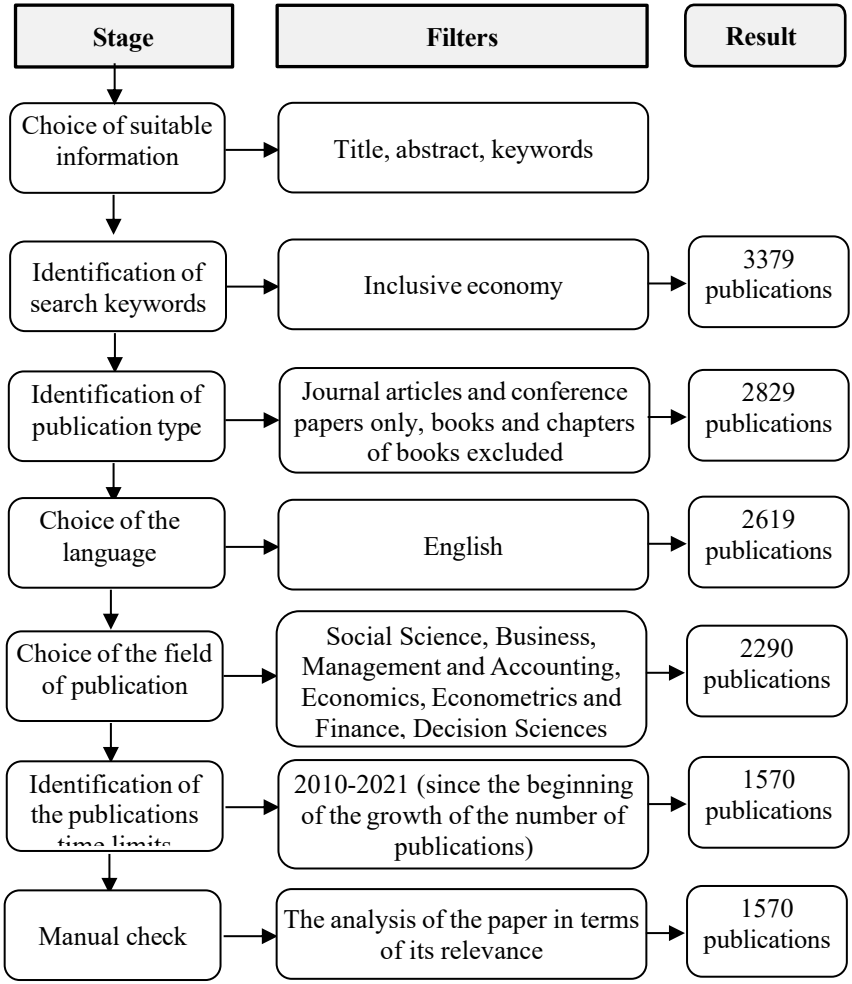


Figure 1.10. Stages of bibliometric analysis

In general, publishing activity in journals reviewed by the Scopus database began in 1970, but until 2000 the number of such publications did not exceed 30 per year. Since 2010, more than 70 units per year have been published.

Figure 1.11 presents a quantitative analysis of scientific publications in the Scopus database for the selected search query from 2010 - December 2021. There is a clear trend towards increasing the volume of publications and increasing the number of citations.

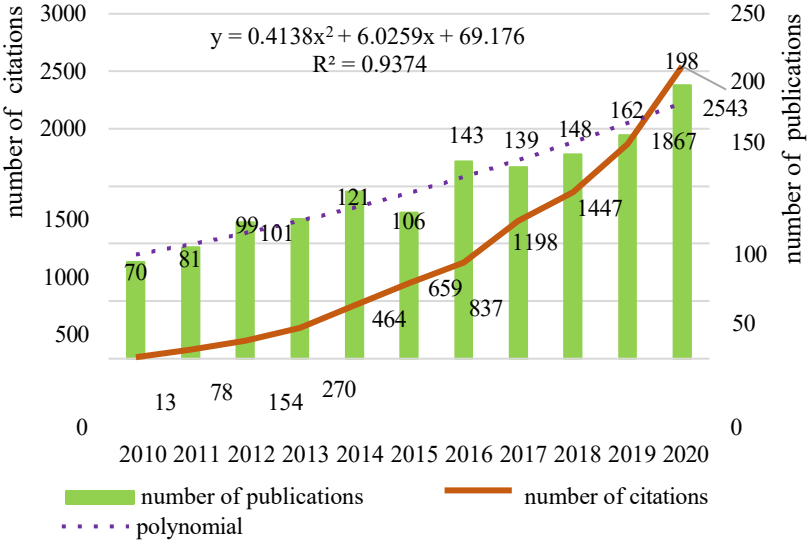


Figure 1.11. The dynamic of scientific publications on macroeconomic stability, indexed by the database Scopus for 2010-2021

For example, in the last five years (from 2017 to 2021), about 55% of all research materials have been published.

The highest citation rate - 2543 - was reached in 2021, despite the analysis being conducted in early December. The most significant number of citations per publication was in 2020 and

2021 (13 citations per 1 publication). In 2014, an article was published that took the first three places among the most cited.

Given the considerable interest in the concept of macroeconomic stability, we will analyze the social analysis of the search query “macroeconomic stability” and “economic stability” using the online resource Google Trends.

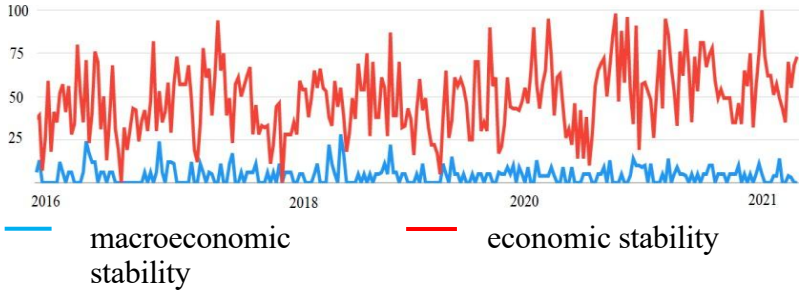


Figure 1.12. The dynamics of the frequency of queries “macroeconomic stability” and “economic stability” in search engines for the period 2005-2019 around the world (built using Google Trends)

Figure 1.12 shows that the frequency of the macroeconomic stability query is much lower than the corresponding economic stability indicator. It can be explained by the fact that users of the global network who made these requests better understand the essence of the latter concept. At the same time, “macroeconomic stability” is more difficult to understand.

With the help of Google Trends, a map of the world was built according to the intensity of search queries of both concepts (Figure 1.13). The color intensity corresponds to the percentage of searches for a more popular term in it.

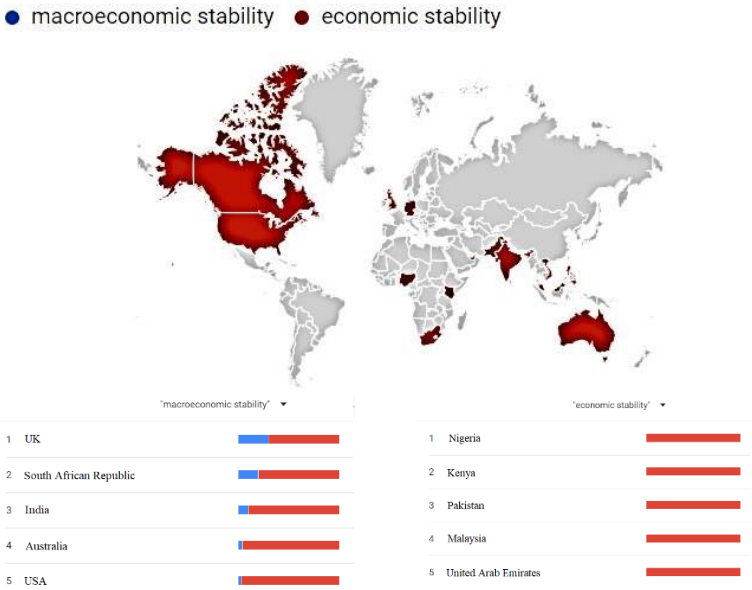


Figure 1.13. Macroeconomic stability and economic stability search popularity by region (built with Google Trends)

An analysis of the popularity of the search query "macroeconomic stability" by region shows that the five leaders in the number of queries include the United Kingdom, South Africa, India, the United States, and Australia. Comparing the frequency of macroeconomic stability (blue) in certain regions to the frequency of economic stability (red) confirms the general trend of more significant popularity of the latter definition. At the same time, a study of the favor of the search query "economic stability" by region (Figure 2.4) shows that the leaders in frequency for this keyword are entirely different. For example, Nigeria, Kenya, Pakistan, Malaysia, and the United Arab Emirates are in the top five in terms of requests.

A comparison of subject areas in the study of macroeconomic stability is shown in Figure 1.14. The results indicate the prevalence of economic research (economics, econometrics, and finance). On the sample, quite a high share of publications on management (business, management, and accounting) and social research (social sciences). There is also a tendency to increase their number.

The most-cited publications in the "macroeconomic stability" in the Scopus database are given in Table 1.4. All articles have been cited more than 100 times. It indicates that the world scientific community highly values these publications. There is a scientific discussion, which emphasizes the relevance of the research topic.

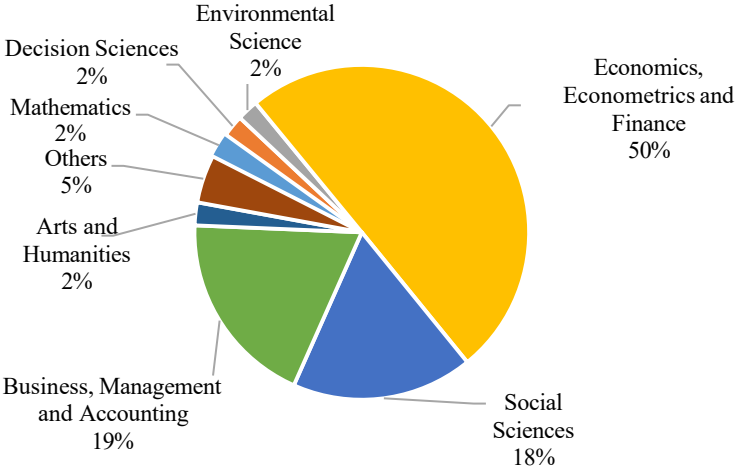


Figure 1.14. Publications in the field of macroeconomic stability, selected by research areas (based on the Scopus database)

This list of the most cited publications can be divided into the following areas: the impact of banks, concentration, regulation, and national institutions on the level of macroeconomic stability, risk analysis of financial stability (paragraphs 3, 4, 7, 10); study of the relationship between the reduction of the workforce and the progress of information technology (paragraph 1); features of monetary policy as one of the imperatives of macroeconomic stability (paragraphs 2, 5); the role of economic activity of enterprises in the formation of macroeconomic dynamics (paragraph 9); analysis of the dynamics of structural fluctuations of macroeconomic indicators in terms of the edge of the world (paragraph 6). In this case, paragraph 8 should be excluded from the analysis because this publication does not meet the previously formed request.

The most cited (529 citations) is the publication "The global decline of labor share" by Karabarbounis L. and Neiman B. [21]. The authors describe that the decline in the relative price of investment goods, often due to advances in information technology and the computer age, has led firms to move from labor to capital. Emphasize the consequences of this phenomenon for macroeconomic dynamics.

The second place is taken by the publication "Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking?" [22], which is cited 358 times. The authors describe the impact of monetary policy on credit risk acceptance through a comprehensive credit register of loan applications and contracts.

Table 1.4. Top 10 most cited studies in the field of macroeconomic stability from 2010 to 2021 (based on the Scopus database)

№	Total citations	Article title	Author	Number of universities/ institutions	Number of countries	Journal/Year of publication
1	529	The global decline of the labor share [21]	Karabarbounis, L, Neiman, B.	1	1 (USA)	Quarterly Journal of Economics, 2014
2	358	Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking? [22]	Jiménez, G., Ongena, S., Peydró, J.-L., Saurina, J.	4	3 (Spain, Switzerland, United Kingdom)	Econometrica, 2014
3	239	Bank competition and financial stability in Asia Pacific [23]	Fu, X., Lin, Y., Molyneux, P.	2	2 (Macao, United Kingdom)	Journal of Banking and Finance, 2014

№	Total citations	Article title	Author	Number of universities/ institutions	Number of countries	Journal/Year of publication
4	217	How does competition affect bank risk-taking? [11]	Jiménez, G., Lopez, J.A., Saurina, J.	2	2 (Spain, USA)	Journal of Financial Stability, 2013
5	198	Macroeconomic effects of federal reserve forward guidance [12]	Campbell, J.R., Evans, C.L., Fisher, J.D.M., Justiniano, A.	1	1 (USA)	Brookings Papers on Economic Activity, 2012
6	168	What makes growth sustained? [13]	Berg, A., Ostry, J.D., Zettelmeyer, J.	3	2 (United Kingdom, USA)	Journal of Development Economics, 2012
7	163	The great mortgaging: Housing finance, crises and business cycles [14]	Jordà, O., Schularick, M., Taylor, A.M.	4	3 (USA,Germany, Switzerland)	Economic Policy, 2016

№	Total citations	Article title	Author	Number of universities/ institutions	Number of countries	Journal/Year of publication
8	125	The temporal stability of factors affecting driver-injury severities in single-vehicle crashes: Some empirical evidence [15]	Behnood, A., Mannering, F.L.	2	1 (USA)	Analytic Methods in Accident Research, 2015
9	123	When truces collapse: A longitudinal study of price-adjustment routines [16]	Zbaracki, M.J., Bergen, M.	2	2 (Cananda, USA)	Organization Science, 2010
10	114	Bank funding structures and risk: Evidence from the global financial crisis [17]	Vazquez, F., Federico, P.	2	1 (USA)	Journal of Banking and Finance, 2015

In the third-cited publication Bank competition and financial stability in Asia Pacific [23], the authors examine the impact of banking competition, concentration, regulation, and national institutions on the fragility of individual banks, as measured by the probability of bankruptcy the bank's Z-score. A study of 14 countries in the Asia-Pacific region.

The next step in the bibliometric analysis is to analyze the number of citations, which can take individual indexes and are used for ranking. Thus, the list of authors with the highest number of publications and the highest citation rates from the macroeconomic stability in the Scopus database are listed in Table 1.5.

Table 1.5. Top authors by the number of publications in the field of macroeconomic stability during 2010-2021 (based on the Scopus database)

Author	Affiliation	Number of published materials	Author's h-index in the Scopus database
Chen S.H.	Taiwan	8	6
Guo J.T.	United States	8	14
Lyulyov O.	Ukraine	8	15
Aizenman J.	n.d.	7	37
Flaschel P.	Germany	7	15
Kandil M.	USA	7	16
Proaño C.R.	Australia	7	11
Nasir M.A.	United Kingdom	6	17
Odhiambo N.M.	South Africa	6	27

Thus, the most significant number of publications on the topic of the study have Chen S.H., Guo J.T., Lyulyov O., who represent Taiwan, the United States, Ukraine, respectively. High values of the h-index confirm their high scientific level and relevance of research according to the Scopus database.

To determine the current areas of further investigation, clusters were formed using VOSviewer, a reliable and effective tool to visualize the relationship between the main keywords in research.

After checking the keywords for relevance, 508 words were selected. The obtained results allowed us to identify 8 clusters (Figure 1.15), which unite the critical concepts of thematic proximity.

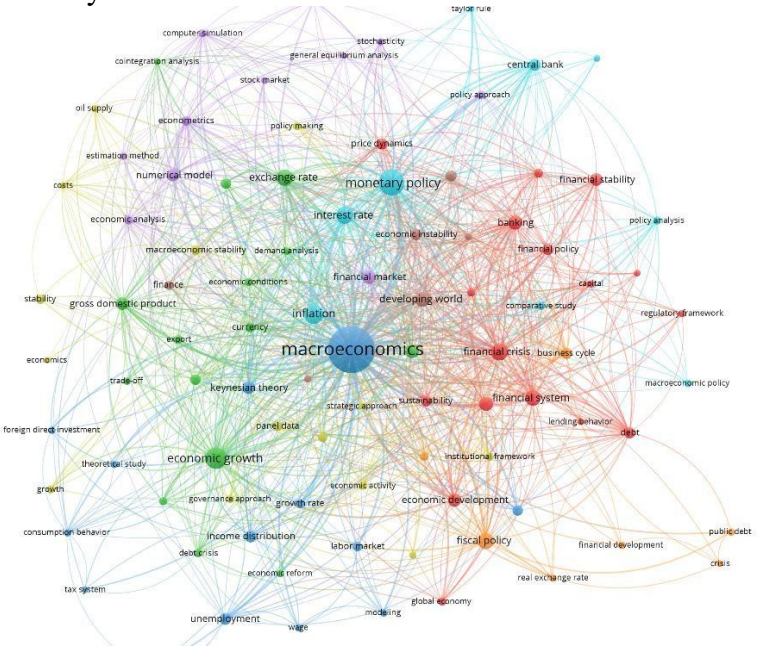


Figure 1.15. Visualization map of cross-sectoral research on macroeconomic stability (on Scopus database for 2010-2021)

This map shows the frequency of terms (the size of the circle), the tightness of the links between them (the closer, the closer) and the different combinations of terms both within clusters and between them.

The biggest (red) cluster is formed around the concept of a financial crisis (the concept establishes 32 connections, the strength of connections – 197, links – 62). The subject of publications of this cluster is related to the financial determinants of macroeconomic dynamics. This cluster includes the concepts: "banking" (occurrences (occ.) – 22, total link strength – 127, links – 53), "financial system" (occ. – 27, total link strength – 142, links – 60), "Economic development" (occurrences (occ.) – 20, total link strength – 113, links – 53), "economic policy" (occ. – 21, total link strength – 112, links – 52).

At the heart of the second (green) cluster is the concept of "economic growth" (occ. – 50, total link strength – 234, links – 73). The following main keywords belong to this cluster: "exchange rate" (occ. – 53, total link strength – 424, links – 209), "gross domestic product" (occ. – 18, total link strength – 120, links – 22), "Investment" (occ. – 19, total link strength – 96, links – 43). The cluster describes indicators of macroeconomic stability.

The third (dark blue) cluster is tied to the concept of "macroeconomics" (occ. – 225, total link strength – 1009, links – 92) and covers keywords: "employment" (occ. – 12, total link strength – 61, links – 35), "unemployment" (occ. – 15, total link strength – 66, links – 33), "income distribution" (occ. – 15, total link strength – 78, links – 49), "growth rate" occ. – 9, total link strength – 56, links – 33). This cluster characterizes the components and mechanisms of policy implementation to stimulate economic activity and the formation of responsible consumption behavior.

The fourth (yellow) cluster contains publications that present the research results on institutional tools for regulating macroeconomic indicators and the state's economic policy as a whole. Within the cluster, the most powerful are: “governance approach”, “panel data”, “growth”, “institutional framework”.

The fifth (purple) cluster covers keywords such as “economic analysis” (occ. – 9, total link strength – 51, links – 32), “numerical model” (occ. – 17, total link strength – 101, links – 48), “Econometrics” (occ. – 10, total link strength – 63, links – 40), “estimation method” (occ. – 6, total link strength – 37, links – 24). Within this cluster are combined works; the authors considered the methodology of forecasting and data analysis of changes in macroeconomic indicators under the influence of relevant factors.

Blue, orange, and brown clusters are the smallest. Thus, the blue cluster is formed around the concept of “monetary policy” and “inflation” (macroeconomic policy issues are studied, aimed at managing aggregate demand through money market conditions to achieve a combination of ultimate goals). The orange cluster is formed around the concept of “fiscal policy” (analyzes the features of fiscal policies and the tax system's importance to maintain sustainable macroeconomic indicators). Accordingly, the brown cluster aims to study the main global economic problems.

Bibliometric analysis (Figure 1.16) shows that until 2015, scientists' research mainly focused on the analysis of economic and mathematical methods and models of forecasting and analysis of changes in macroeconomic indicators. In 2015–2016, the vector of economic analysis changed: scientific activity was aimed at studying the components and mechanisms of policy implementation to stimulate the economic activity of the population and the formation of responsible consumption behavior. In 2017, the emphasis on research was shifted to the study of the financial component of

economic development through the prism of achieving sustainable development goals.

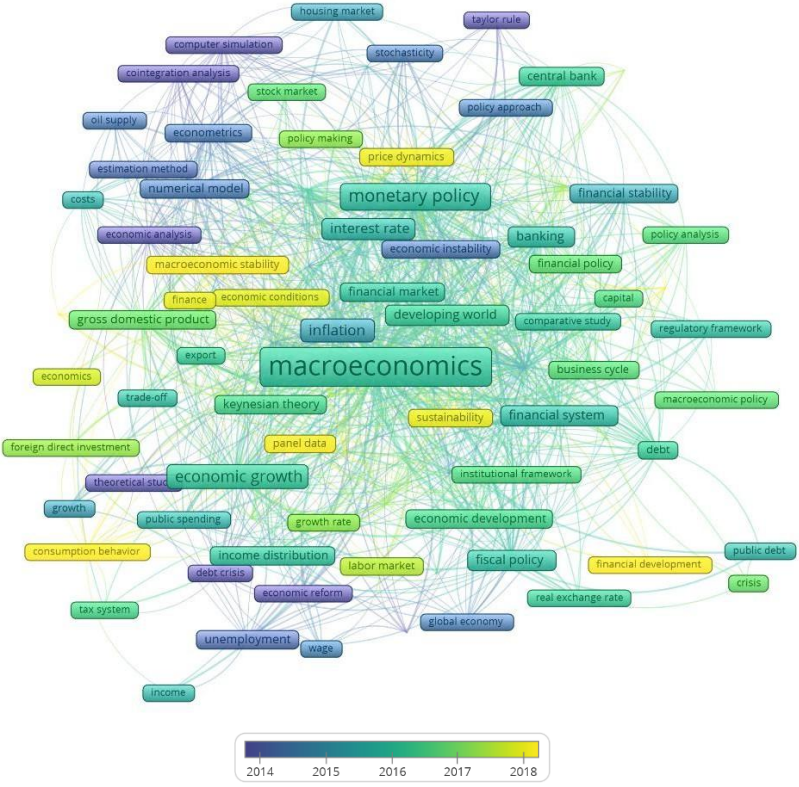


Figure 1.16. Visualization map of changing trends in economic research on the development of macroeconomic stability, published in 2010-2021 on the Scopus database

Particular attention should be paid to the study of the geographical aspect of research in the concept of inclusive economy. In Figure 1.17 presents a list of countries whose representatives have published the most scientific papers on the analyzed topics in the high-ranking Scopus database.

According to the results, nine countries are in the lead. These are USA (300 publications), United Kingdom (134 publications), Germany (116 publications), France (79 publications), China (77 publications), India (77 publications), Italy (75 publications), Malaysia (52 publications), Ukraine (50 publications).

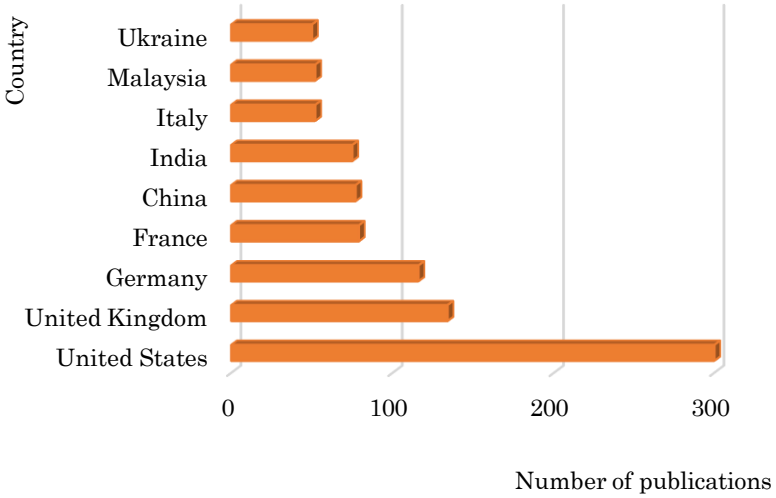


Figure 1.17. Number of documents by country, published in 2010-2021 on the Scopus database

Thus, based on the analysis, the main imperatives of macroeconomic stability can be called economic growth, employment, stability of the national currency, stable price levels, foreign economic balance. All of these components are

increasingly dependent on policies aimed at achieving sustainable development goals. Which, again, makes the need for an inclusive economy.

1.3. Comparative analysis of the essence of scientific publications within the concepts of "inclusive economy" and "macroeconomic stability"

For comparative analysis, Web of Science data were used to analyze and cite existing publications on macroeconomic stability, social development indicators, or inclusive economy. This choice was due to the widespread use of this database in modern research.

Keyword literature was selected and identified. In particular, the search was carried out on request: macroeconomics stability OR social development indicators OR inclusive economy; the selection was carried out only in the titles of publications. It allowed obtaining the most relevant publications on the selected topic.

Based on Web of Science data, 245 publications on selected topics were selected. Article titles, authors, journal title, year of publication, number of citations, and keywords were used for further analysis.

The dynamics of publications by years were studied in work; identified key research areas; the organizations that are most engaged in research are identified; identified the authors of which countries are most engaged in these studies.

The dynamics of citations by years of selected publications were analyzed. Based on the number of citations, the most influential publications, journals, and authors, and the country of affiliation of the authors on the selected topic were identified.

Hierarchical cluster analysis was performed on the basis of keywords. Visualization of scientific literature topics was carried out with the help of the VOSviewer program. Based on keywords (more than three repetitions), clusters on selected topics were identified.

Based on the keywords, the evolution of research was analyzed, and the topics of the current study were identified, and the issues of future research were predicted.

Based on Web of Science data, 245 publications were selected. Most of them will be published in the last five years (Figure 1.18).

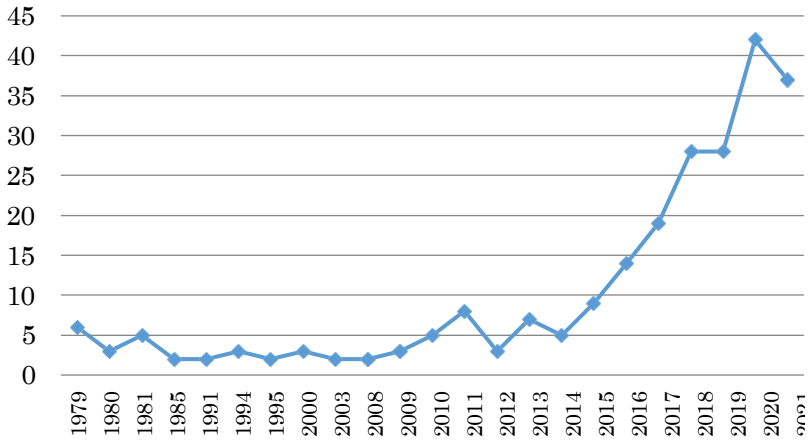


Figure 1.18. Number of publications by year

As can be seen from Figure 1, 62% of the works were published during 2017-2021, which indicates a rapidly growing interest in this topic.

These works cover more than 25 areas of research. The top 10 areas of research are presented in Figure 1.19

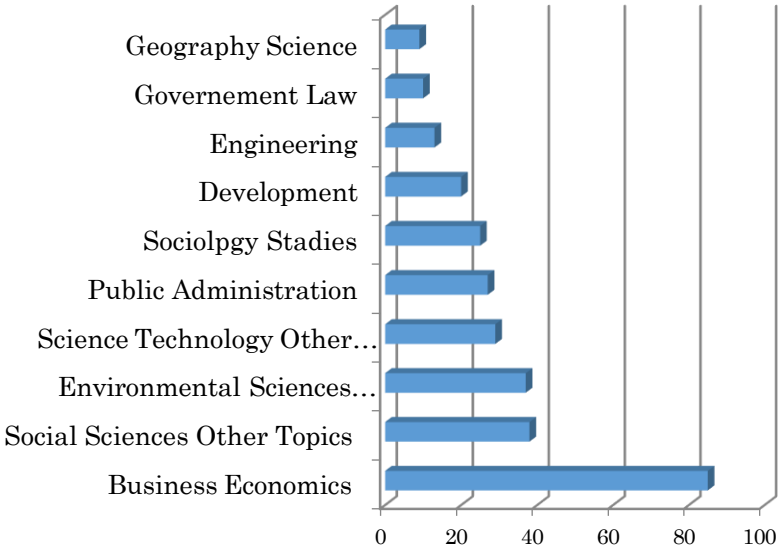


Figure 1.19. Top 10 areas of publications on selected topics

More works related to business economics (34.7%), Social Sciences (15.5%), Environmental Sciences Ecology (15.1%), Science Technology (11.8%), public administration (11.0%).

Authors from more than 100 countries worldwide are engaged in research on selected topics. In Figure 1.20 presents authors from 10 countries who have published eight or more works.

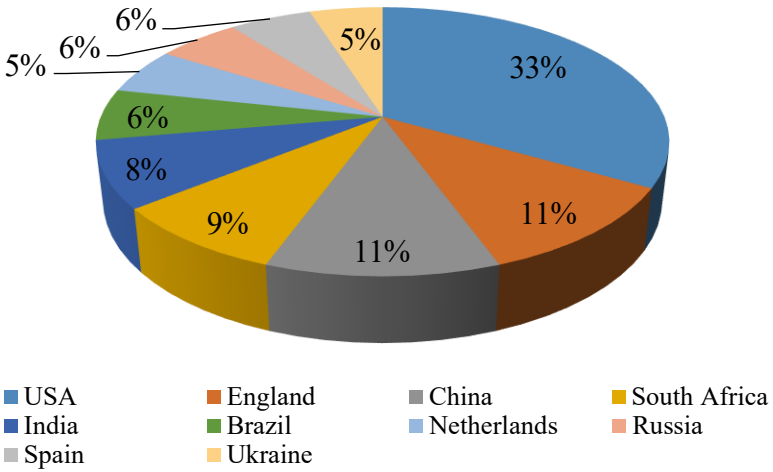


Figure 1.20. Top 11 countries of authors by the number of publications

45% of works have been published by authors from the USA, England, China. Ukraine is also in the Top 10. The sample includes eight studies (5% of all publications) conducted by authors from Ukraine.

Authors from the USA have the most publications and the most citations. If we compare Figure 1.19 and table 2.6, it is seen that in both lists, there are scientists from 7 countries: USA, England, Ukraine, India, China, Spain, South Africa. If in the top 10 by the number of publications, scientists from Ukraine are on the 10th position, then on the number of citations already on the 3rd, which also testifies to the impact of their work.

Table 1.6. Top 10 countries of affiliation of authors by the number of citations

Organization	Number of documents	Number of citations
USA	47	923
England	18	166
Ukraine	8	94
India	9	88
Austria	6	81
France	4	75
China	18	70
Poland	7	70
Spain	9	66
South Africa	13	65

Most journals on selected topics have one or two publications. In Figure 1.20 presents seven journals in which more than three publications on this topic have been published.

More than 30 organizations fund research on selected topics. At the same time, only the National Natural Science Foundation funded eight studies. Another seven organizations supported two studies, others only 1.

More than 200 organizations are researching selected topics, but only 35 have conducted two or more studies. And only seven organizations conducted three studies on this topic (Pekin University, University of Cape Town, University of Melbourne, Erasmus University, Purdue University, University of Leeds, World Bank).

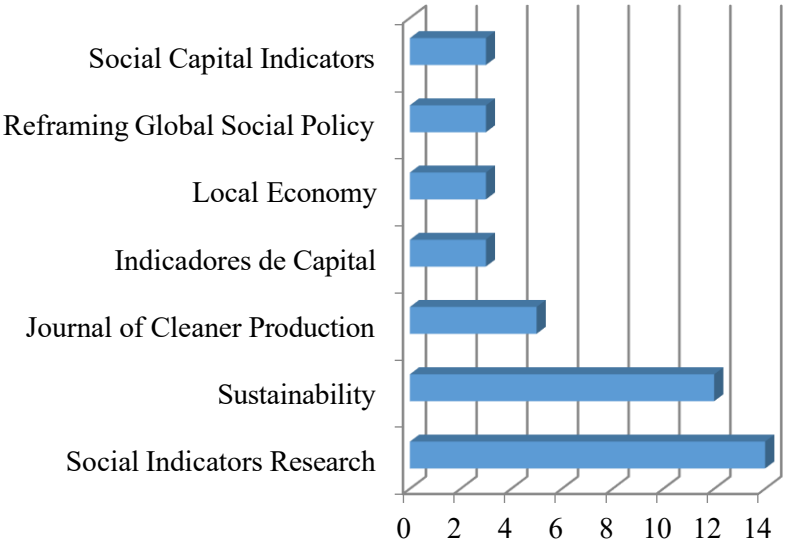


Figure 1.20. Top 7 journals by the number of publications

Table 1.7 presents the top 10 organizations researching selected topics by the number of citations.

Table 1.7. Organizations researching selected topics by number of citations

Organization	Number of documents	Number of citations
Indiana University	2	139
Purdue University	3	83
London AcadSci& Business	2	62
NOAA	2	47
Fugan University	2	40
Pekin University	3	36
Covenant University	2	31
Georgia State	2	27

Organization	Number of documents	Number of citations
University		
University Cape Town	3	26
University Nigeria	2	25

As can be seen from Table 1.7, Pekin University, Cape Town University, Purdue University were included in both lists, which indicates their influence on the chosen topic.

More than 200 authors publish works on selected topics, but only 12 have 2-3 publications. The authors with the most significant number of publications are presented in table 1.8.

Table 1.8. Publications with the most citations

Author	Number of documents	Number of citations
MazottiPabelo, G.	3	0
Kwilinski, A.	2	62
Cabeza-Garcia, L.	2	16
Del Brio, Esther B.	2	16
Johnston, D.F.	2	8
Asongu, S.	2	4
Krysovatyy, A.	2	2
Zvarych, I.	2	2
Zvarych, R.	2	2
Nathkov, T.B.	2	1
Polishchuk, L.I.	2	1
Andorka, R.	2	1

As seen from the table, only one author, MazottiPabelo G. has three publications on selected topics. Others - two works. The works of Kwilinski A., Cabeza-Garcia L., and Del Brio

Esther B. have more than ten citations, indicating these openings' influence.

We will analyze citations by authors. Table 1.9 presents the most cited works by authors.

As can be seen from the table, more than a hundred citations have only two works: groups of authors Adler, N.E., Colditz, G.A., Frazier, A.L., Goodman, E., Huang, E., Kawachi, I. - 386 citations and Mcmullen, J.S. - 136 citations. Table 2 also shows that most authors have published only one paper, but they have many citations.

Table 1.9. Authors with the most citations

Author	Number of documents	Number of citations
Adler, N.E., Colditz, G.A., Frazier, A.L., Goodman, E., Huang, E., Kawachi, I.	1	386
Mcmullen, J.S.	1	136
Evans, A, Evans T.J., Strezov, V.	1	70
Kwilinski, A.	2	62
Anderson, J.G.	1	58
Aubert, F., Callois, J.M.	1	55
Kumar, P.Rancichung, G.D., Singh, S.	1	52
Annen, K	1	52
Reig-Martinez, E.	1	40
Dalevska, N., Khobta, V., Kravchenko, S.	1	38

Comparing the data in Tables 1.8 and 1.9 shows that only Kwilinski, A. is in both tables. It indicates the influence of this author on the chosen topic.

One of the research tasks is the analysis of directions (clusters) of modern research on the chosen subject. Keywords for publications that are repeated at least three times were analyzed (Figure 1.21).

Hierarchical cluster analysis was used to understand the clusters better.

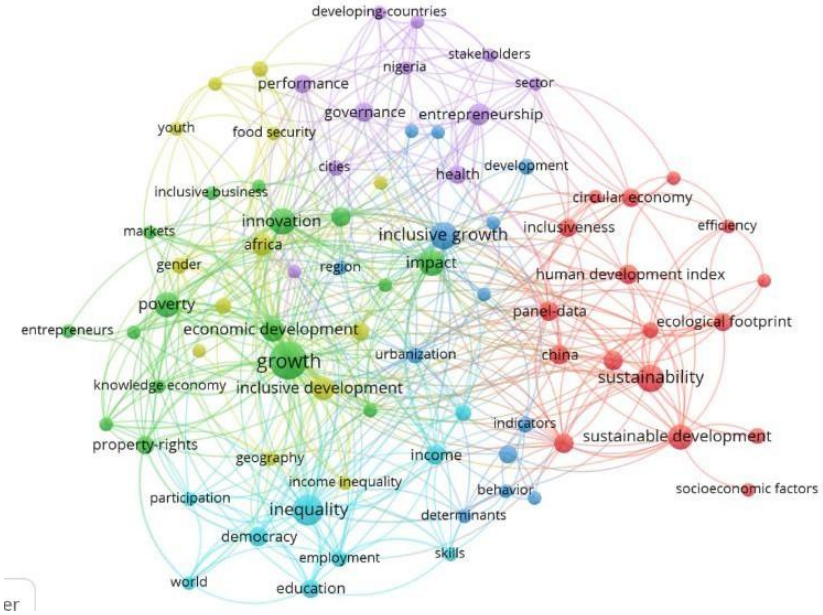


Figure 1.21. Visualization map of cross-sectoral research on macroeconomic stability (on Scopus database for 2010-2021)

As a result of cluster analysis performed using VOSviewer, 6 clusters were identified. Based on Figure 1.21, the following main directions of modern research can be distinguished: growth, inclusive growth, innovation, sustainability, sustainability development, economic development, inequality, inclusive development, and others. The characteristics of the clusters for the most used keywords within each are shown in table 1.10.

The change in research topics during 2015-2020 is shown in Figure 1.22.

Table 1.10. Clusters obtained from the analysis of keyword sharing (developed by the authors)

Claster	Items in cluster	Links	Total link strengs	Occurances
Claster 1. Sustainability (red)	17	20	25	12
Claster 2. Growth (green)	16	41	72	22
Claster 3. Inclusive growth (dark blue)	13	25	32	12
Claster 4. Inclusive development (blue)	13	24	31	8
Claster 5. Enterpreneurship (purpul)	11	15	17	7
v 6. Inequality (blue)	9	28	47	15

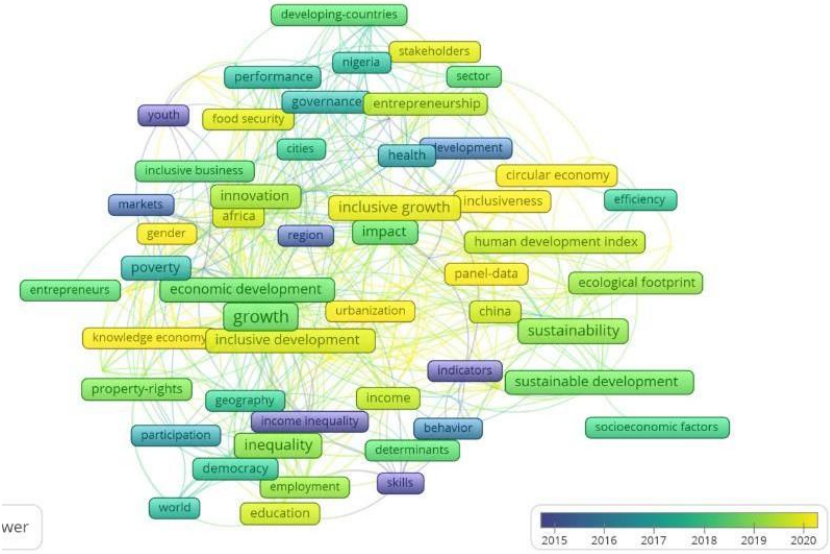


Figure 1.22. Evolution in research on resilience in organizations (developed by the authors)

Most of the articles have been published in the last few years. They reflect the directions of modern research. Based on the publications of 2015-2022, we can identify the following areas of contemporary research: inclusive growth, inclusive development, circular economy, urbanization, knowledge economy.

2 ENERGY AS THE CORE OF INCLUSIVE ECONOMY

2.1. Innovative energy solutions for sustainable development and inclusive economy

Significant energy dependence of the economy and the penetration of energy in all spheres of society make it necessary to reform the energy sector according to modern requirements dictated by changing economic realities. The solution of current world problems, in particular, environmental, political, and economic, should be considered in energy modernization and transformation of the energy system. The shift from a centralized to a distributed energy system is essential to create new economic opportunities, including businesses and households.

Renewable energy and the principles of distributed energy generation most fully solve global energy problems, as they involve replacing fossil resources with renewable and developing clean energy [31].

The modern approach to building a new energy system reduces the eco-destructive impact on the environment, the country's energy dependence and contributes to national security [32, 33]. Innovative energy and information and communication technologies increase energy efficiency and create the preconditions for reducing energy intensity.

However, the effects of introducing a modern energy system are not limited to these. The introduction of innovations in the energy sector positively impacts the economy's energy intensity. Cheap and affordable energy creates ample opportunities to attract more and more people to products and services. It makes the preconditions for developing an inclusive economy, as more and more people become economically

active and take an active part in economic processes, production, distribution, and consumption.

The development of renewable energy and smart technologies improves the energy efficiency of regions and the country as a whole [34]. In addition, it is related to the concept of smart cities [35, 36] and the achievement of sustainable development goals [37].

Modern business is changing rapidly. The days of industrialization are a thing of the past. New requirements and priorities of economic activity come to the fore [38], behavioral patterns of energy consumption are also changing [39, 40].

It is widely believed that the modern economy is energy-centric. Energy has a close relationship with other sectors of the economy, penetrates deeply into all spheres of society. Energy is mainly transforming the economy. It can create new intersectoral and intersectoral ties, underlie sustainable economic and social cooperation, and increase the economic system's productivity. In addition, the innovative development of the economy is fueled by the opportunities created by energy.

The application of innovative energy and information and communication technologies in the energy sector against the background of close integration of the energy system into all society activities forms an integrated energy-centered model of the economy, characterized by significant dependence of indicators of the national economy on energy efficiency. It allows us to identify the energy system as a critical determinant of sustainable economic development [41].

The implementation of international agreements on environmental protection and combating climate change requires significant changes in the energy sector, aimed at its technological renewal based on renewable energy, distributed energy generation, development of smart grids, the formation of an open energy market.

One of the priority areas of energy development is the introduction of intelligent energy networks (smart grids), which contributes to achieving the targets of energy and climate policy. Increasingly, smart grids are seen as an unalterable vector of energy development. The terminology of smart grids is different in research. Some scientists define smart grids as an integrated set of network technologies, devices, and control systems that provide and use digital information, communications, and controls to optimize electricity supply efficiency, reliability, and security [42].

At the same time, smart grids are widely understood in the scientific literature and among energy market participants. The main criterion for classifying energy technologies as intelligent focuses on efficiency and compliance with modern growing requirements [43, 44, 45].

However, there are official deadlines. According to the European Technology Platform, smart grids are "electricity grids that meet the requirements of energy efficiency and economic functioning of the grid through coordinated management through modern two-way communications between power grids, power plants and electricity consumers" [46].

There are clear definitions of a new or modern energy system at the international level. In particular, the values to which it must correspond are defined. Such values are the availability, reliability, and quality of energy supply to consumers; cost-effectiveness, use of all available environmentally friendly resources and technologies, which should be aimed at reducing the negative impact on the environment. It should be noted that these values are equivalent.

The importance of energy for the economy and society is confirmed by the amount of funding for projects under energy policy. Globally, international agencies estimate [47] that by

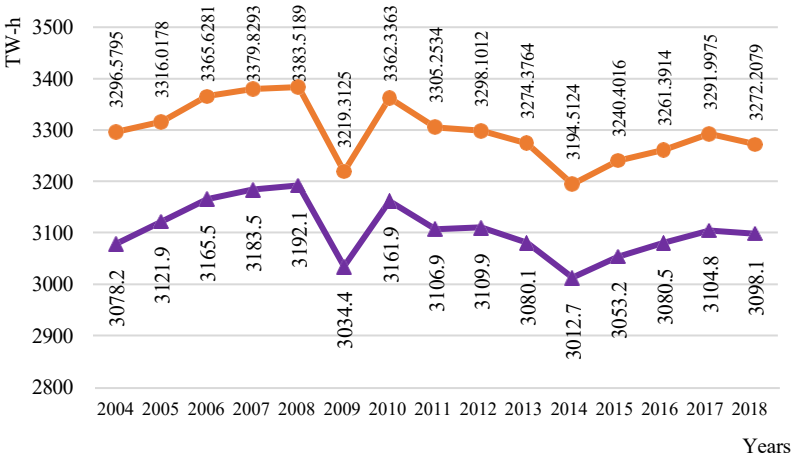
2030, the investment will be about $ 16 trillion US. Of these funds, it is projected that the share of spending on intelligent technologies will be more than 2 trillion dollars [46].

Despite the variety of technologies used in energy to make it more environmentally friendly, a single approach is needed that integrates all technologies. The single energy system of the European Union is an example of such an approach. The formation of a single integrated energy system is a priority of EU policy.

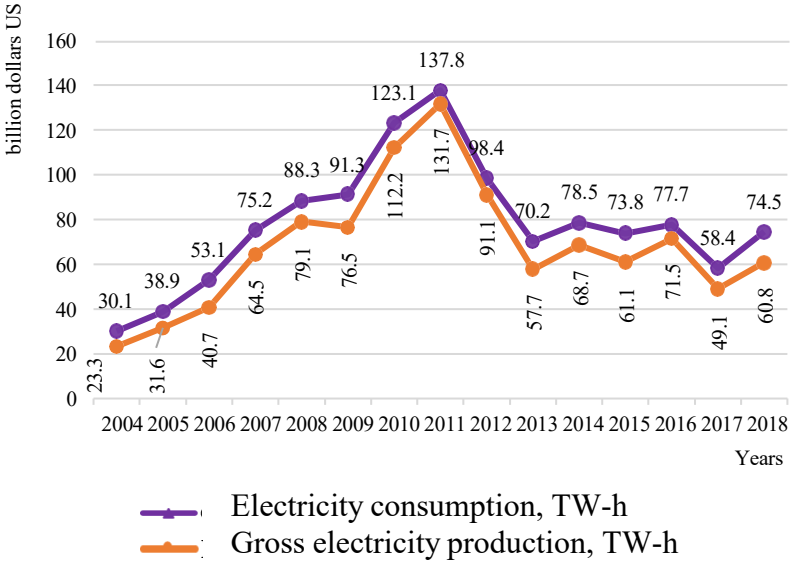
The principle of distributed energy generation and the use of renewable energy is the basis for the transformation of the EU energy system [48]. In Ukraine, there are obstacles to using the EU experience.

At the same time, the need to introduce energy innovations for the systemic restructuring of the energy sector is recognized by the countries of the European Union. In particular, Ukraine, implementing the action program of the Association of Ukraine and the EU, is implementing measures that will help integrate the Ukrainian energy system into the European one. Data on electricity production and consumption are shown in Figure 2.1 a and 2.1.b.

Statistics show that renewable energy generation is overgrowing in the European Union. At the same time, investment in the industry remains stable.In Ukraine, on the other hand, there is no stable growth dynamics of energy generation from renewable energy sources. This indicates the lack of appropriate conditions for the profitability of renewable energy. Therefore, state support is essential. This is a cardinal difference between the energy sector of Ukraine and the energy system of the European Union, where a profitable business model for the development of renewable energy and distributed energy generation has already been formed. The energy production dynamics from renewable sources are shown in Figure 2.2 and 2.3.



a)



b)

Figure 2.1. Some indicators of the functioning of the EU energy sector (formed based on [49-52])

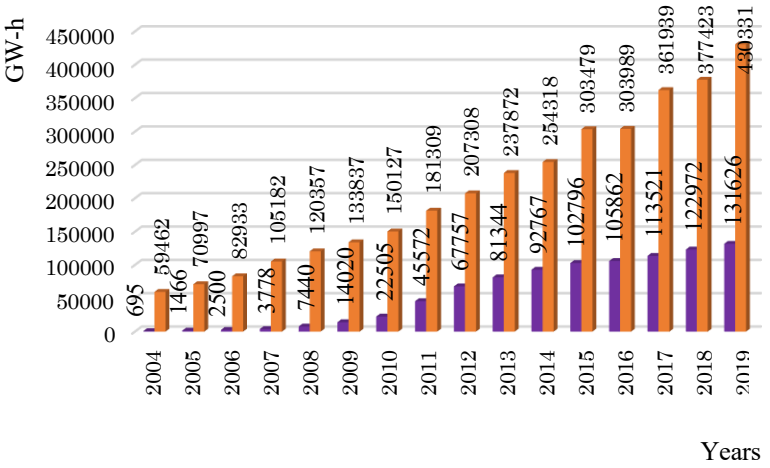


Figure 2.2. Volumes of solar and wind power generation in EU countries (formed based on [49-52])

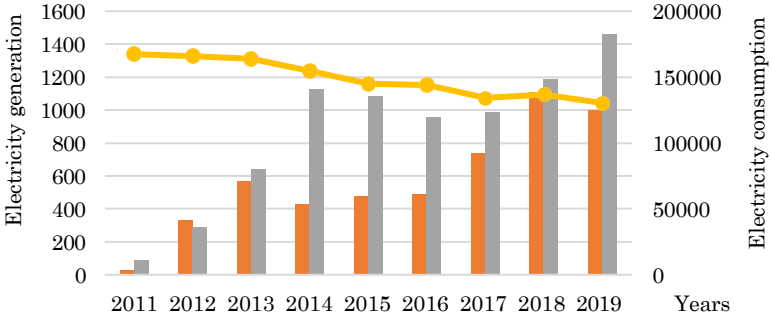


Figure 2.3. Dynamics of energy generation of solar and wind power plants and the total level of electricity consumption in Ukraine (formed based on [49-52]

However, the transition to a new energy system that will promote inclusive economic development is associated with many challenges. In particular, there are significant technical, economic, and political differences.

Innovative technologies are becoming the basis of the energy system. They are a new evolutionary stage in the development of society, in particular, evidence of the progress of the energy sector, as they fully meet modern requirements for the energy system and user demands. The advantage of smart grids is their support for creating an innovative smart environment, building smart cities.

The implementation of intelligent energy technologies has affected the markets of countries that have successful experience in implementing large energy-efficient intellectual grid projects. The consequences of the introduction of smart grids are changes in the technical parameters of the power system, but also the model of the energy market [41].

Innovation in the energy sector can be divided into the following groups [201]:

1) distributed energy generation systems;

2) energy storage systems;

3) electric cars that are connected to the network;

4) micro-networks;

5) intelligent energy metering systems and energy management;

6) reasonable loads (load balancing mechanisms in the network).

Certain areas characterize the trajectory of the energy system.

Distributed power generation systems. Distributed power generation facilities include power plants with an installed capacity of 20 MW or less, connected to the distribution network [54]. However, it is advisable to look more broadly at this concept: “distributed energy generation - the concept of

building an energy generation system that stimulates energy generation on the ground by energy consumers - households, communities, businesses, requiring integration of customer energy management systems and smart metering." Energy generation is carried out for own needs, but it is possible to transfer its surplus to the public network on a "green tariff" basis or through other support mechanisms" [55].

The most widely used technologies of distributed energy generation are photovoltaic systems capable of operating in the mode of permanent connection to the grid [56, 57].

State support for energy producers using photovoltaic technologies can increase the growth of solar energy. It can be traced to the example of Ukraine (Figure 2.3).

Distributed power generation requires technical quality assurance of energy consumption, voltage regulation, and related services [41].

Energy storage systems. The biggest problem that hinders the development of smart grids from a technological point of view is the lack of cost-effective technology for storing excess energy in the system, which will redistribute it according to market needs. Despite the progress in research on this issue and numerous experiments in which energy storage's technical and technological set is rapidly increasing, it is impossible to achieve the desired parameters. Moreover, there is no certainty even about the technology that could lead in this direction and will be widely used by energy systems of individual countries and integrated international energy systems [56].

Electric cars that connect to the network. Electric cars are an important element of an intelligent "ecosystem". The development of electric vehicles has a steady upward trend. The concept of a smart city, which is widely implemented globally, involves the rejection of the use of energy resources derived from fossil fuels in electric vehicles [58]. Accordingly, the policy of economically developed countries in this regard,

aimed at stimulating the production and use (purchase) of electric vehicles and overcoming barriers to the development of electric transport as part of an intelligent grid [56, 59, 60, 61, 62] and a tool for decarbonizing the economy [63]. Electric vehicles can participate in demand response programs and reduce peak load during charging. They can operate in vehicle- to-grid (V2G) mode when a charged electric vehicle provides grid needs for power supply, voltage regulation, and power maintenance.

Micro networks. A smart microgrid can provide access to electricity in remote places where the possibility of connection to the centralized power grid is absent or economically impractical. This type of network is suitable for use not only in remote hard-to-reach locations.

In particular, micro-networks can be successfully used to implement the principle of distributed energy generation in locally limited areas, where it is advisable to use renewable energy sources [64, 65], which also helps reduce peak network load [66, 67] and address specific security issues [68], including national security through improving the energy efficiency of the energy system [69, 70]. However, the development of energy micro-networks is constrained by legal restrictions.

Smart energy metering systems and energy management. The presence of metering systems allows coordinating energy generation, energy consumption, conservation, and exchange of energy resources within the energy system. Only in the presence of meters can realize the potential of distributed energy resources (their producers and consumers) in the retail energy market. The operation of smart grids is impossible. Also, intelligent measurement allows determining the patterns of behavior of energy consumers [71].

Large-scale coverage of consumers, producers, and intermediaries of energy metering devices creates opportunities

for adaptive power control. It saves electricity used by all consumer groups: industrial facilities, households, social infrastructure, etc. [56].

Reasonable loads. One of the tasks to be solved in the future is reducing the grid load. In the second half of the twentieth century, it was predicted that the growth of energy generation would be sufficient to meet the needs of society as a whole. However, the increase in the number of household appliances, the increase in their capacity in combination with the total increase in the capacity of industrial equipment leaves unresolved the issue of reducing the load on the grid. Particularly problematic issues are peak loads on the system, which can be eliminated by using distributed power generation in intelligent grids [56].

Information security in applying energy-smart technologies is one of the critical issues to be addressed. Information and communication systems significantly expand the requirements for the power system and supplement it with previously atypical components [41].

Developing an energy network that can involve the population and enterprises in the management of energy generation, distribution, and transportation requires adopting measures for each of the above measures.

However, given the technical differences between Ukraine and the EU, it is advisable to focus on those innovations and proven technologies that allow you to build the necessary infrastructure that will boost economic development, first in the energy sector and then in other sectors of the economy.

2.2. Regulating the development of the infrastructure of the innovative energy system

The implementation of the transformation of the EU energy system through the introduction of smart grids is based on strategic documents and EU directives that define the main directions of functioning of intelligent grids and mechanisms to stimulate their development. Based on the analysis of the EU regulatory framework and analytical reports on the introduction of new technologies in energy in the scientific literature, determine the following categories of prerequisites for their introduction [my dissertation]:

1) proper regulatory framework for the introduction of smart grids in the energy sector of the economy;

2) lack of technical and technological restrictions on the introduction of innovative energy technologies;

3) economic and organizational preconditions for developing intelligent energy networks (systems to stimulate and support the modernization of the energy sector, the introduction of distributed energy generation, and the development of alternative energy).

The regulatory framework for the modernization of the EU energy sector affects critical areas of the energy system. Essential for the innovative development of energy regulations is the Directive on the Promotion of Energy from Renewable Sources [72], which aims to establish mechanisms to stimulate and transition from energy generation and consumption of energy from fossil and non-renewable to renewable sources; The Energy Efficiency Directive [74], which identifies critical areas for energy efficiency through the introduction of energy- saving technologies and the promotion of energy efficiency, the European Commission's Recommendations on Preparing for Intelligent Accounting Systems [74], aimed at deploying infrastructure for large-scale energy investments.

In addition, to manage energy development following sustainable development and the need to combat climate change in the EU, the Strategic Energy Technology Plan [75] was developed, which provides a system of indicators for measuring the effectiveness of EU energy policy.

Another category of factors that provide the preconditions for developing smart grids is overcoming technical and technological limitations. They determine the power grid configuration, the potential for development, the possibility of integration with a higher-level grid, and scaling from a local project to the regional or state level. The critical factor in the large-scale implementation of innovative energy technologies is the necessary infrastructure. In particular, the deployment of smart grids as one of the essential areas of global energy development and an integral part of integrating technologies in various areas to create an innovative, comfortable, and environmentally friendly environment requires more than pure energy technology solutions.

Although the importance of research aimed at solving technical problems of intelligent grid development [76, 77, 78] is essential. Ensuring the possibility of progress towards the development of intelligent grids largely depends on the development of related industries. In this context, several areas need attention, which relies on the pace of implementation of smart grid technologies and the difference vector of their development. At present, several key issues need to be addressed to accelerate the growth of smart grids as one of the dominant components of the energy system. It suggests that the vector of development and scaling of smart energy technologies may vary significantly in the future. At the current stage of the development of smart grids, the leading work on their implementation is carried out to provide a basis for further implementation of innovative solutions. However, it is impossible to predict what these solutions will be until the

issue of load balancing (and therefore capacity) in the power grid, which uses renewable sources for energy generation [my dissertation]. Since alternative (renewable) energy cannot solve the critical task for a modern energy system, namely to provide consumers with the necessary amount of electricity in the right place and at the right time [79]. This explains the significant role of traditional powerful energy producers in the energy system and restrains the pace of energy innovation based on smart grids.

The development of energy infrastructure is critical for the transition from an outdated energy system that no longer meets modern requirements to an innovative energy network that changes the perception of energy and its role in society.

However, the technical infrastructure is not limited to energy resources. Some other factors are critical to implementing the concept of smart grid development. One of them is the development of information and communication technologies. Information is a crucial issue in many areas. The quality of work with it depends on the functioning of virtually all systems used to meet the needs of society, to ensure its proper functioning under ever-increasing demands and requirements for working with information as to its volume, technology, total digitization of most areas of human activity. The formation of decentralized systems requires significant information and communication capabilities to achieve, on the one hand, the necessary level of control, and on the other hand, the ability to self-regulate. The energy system's future model is undoubtedly considered a decentralized system with a high degree of self-regulation. Therefore, the issue of providing information and communication support and maintenance of energy networks is a vital issue that must be addressed appropriately for the large-scale deployment of smart grids.

In contrast to the previous aspect - infrastructure, which was discussed above, namely: technical and technological energy

infrastructure - information and communication support for implementing the concept of intelligent grids allows you to count on a high level of satisfaction of the vast majority of requirements. The main factor that proves this is the availability of a significant number of information systems - commercial products that serve energy facilities and provide rapid exchange of information, its accumulation and storage, processing, and extensive analytical capabilities. The prospects of the energy market in view of the transformation processes taking place in part now and intensifying in the future contribute to the improvement of information and communication technologies focused on meeting the demands of energy system actors [41].

At the same time, the functioning of information and communication systems is inextricably linked to security issues. Creating reliable information systems is a crucial task for any software developer. After all, non-compliance with security requirements causes vulnerability of objects that use information products and causes severe damage to information systems developers. There are high demands on the information systems that serve the energy sector. It is due to their importance for ensuring the proper functioning of society. In most cases, failures in the power grid cause significant losses. The elimination or compensation of losses that occur in the event of a failure requires substantial financial resources. It sometimes can not be measured, which occurs in the event of death. Thus, the security issue is extremely important in the energy sector. Each aspect of ensuring the security of the energy system, including the power grid, requires a significant amount of work and coordinated activities of specialists in various fields. Today, the safety of power grids is at a controlled level, as evidenced by the low frequency of technical problems that cause significant damage of various kinds. Pilot projects implemented in the world's leading

countries in the field of deployment of intelligent energy networks do not give grounds to speak about the insufficient level of security of information and communication systems that have been applied. It applies both to the aspect of control over the technical parameters of the system, the quality of which is measured in terms of the number of system failures or its individual components, and the security of internal information. Thus, it can be argued that the information and communication systems used in the energy sector meet the requirements set in reforming the energy system.

However, information and communication infrastructure as an element of the energy system needs more consideration. It is not enough to assess the compliance of modern information technologies with the requirements and needs of energy facilities. In practice, the implementation of projects to transform the energy system is guided by public demand under the influence of societal changes. Thus, several decades ago, forecasts for energy development were based on the assumption that world energy consumption would decline, as new devices and technologies will require less energy due to their better performance. Thus, it was assumed that the need for energy generation would gradually decrease. However, as a practice has shown, these predictions were wrong. Even though they were based on the correct assumption of improving the performance of machinery and equipment, energy consumption in the world does not tend to decrease. It is due to the emergence of a much larger number of devices that require energy for their operation than before. The tendency to increase the number of devices and gadgets that serve the needs of society in general and individuals in particular, is growing. Thus, there is currently no reason to predict a short- and medium-term reduction in energy consumption. It means that energy generation must remain high to ensure the proper functioning of society.

The development of new types of equipment, devices, and gadgets indicates the emergence of unique needs that have not been relevant in the past. Digitalization of almost all spheres of human life creates new challenges for energy. Implementing the smart home concept was the first such challenge for the energy sector. We are currently talking about creating smart cities. This global challenge requires changes in the traditional model of energy supply. It means that the information systems used to implement the concept of a smart city must have a high level of interaction with information systems that serve, in fact, the energy system. Thus, a new aspect has emerged. Information and communication systems should be considered not only as an element of ensuring the functioning of the energy system but as a certain element that is a response to public demand due to technological progress in society.

The environmental component is a separate issue of infrastructural support of transformation processes in the energy sector. Under the traditional energy system model, ecological infrastructure was envisaged as the availability of facilities and technologies that reduce the eco-destructive impact on the environment by eliminating excessive emissions of harmful substances into the air or other natural spheres due to the operation of energy-generating facilities using fossils energy resources for energy generation.

Today, much of the world's energy comes from renewable sources. According to the Paris Agreement, by 2050, the signatories must ensure energy generation from renewable sources at 100%. The European Union plans to provide the age of renewable energy sources by 2030 at 32% of the total. The development of intelligent energy networks is one area that contributes to achieving this indicator. They provide the principle of distributed energy generation, without which the rapid growth of the share of energy production from renewable sources is questionable. At this stage of development of

alternative energy [80], a significant number of power generation facilities are medium or low power generation facilities. Therefore, it is economically feasible to increase the number of low-power energy generating facilities in the immediate vicinity of the consumer and use technologies that allow the final consumer to consume energy and produce it by selling the surplus to the grid. The first stage of deployment of intelligent energy networks, which is actually completed in the EU and the US, as mentioned above, is aimed at providing technical capacity for this type of interaction between consumers and energy producers and building a new model of an energy network that has fundamental differences from the traditional dominant during the twentieth century and early XXI century. Thus, the deployment of smart grids implements a new principle of interaction between man and the environment - to prevent the emergence of eco-destructive effects on the environment. It is radically different from the previous approach, which minimizes the damage already done.

The development of technology at the present stage allows the introduction of innovations that significantly increase the efficiency of entire industries, allowing them to be transformed into a state of compliance with ever-increasing requirements [81]. As one of the key areas that ensure the functioning of industrial and non-industrial infrastructure, the energy sector occupies one of the central places in the innovative development system due to its importance and trends in integrated energy-centric economy in the world. The world's energy consumption is growing steadily along with the need for it to create the conditions for the proper functioning of society. At the same time, trends caused by changes in energy system requirements, such as reduction of emissions of harmful substances into the air and solid waste from the operation of energy generating capacity, change in the structure of energy produced in the direction of gradually reducing its share of

fossil (non-renewable) energy resources. Reduction of peak loads on the grid, which leads to its overload and negatively affects the safety and reliability of operation, ensuring the principle of distributed energy generation, the implementation of which is not only related to the technical objectives of creating conditions for connecting additional energy facilities to the grid movement of energy within its (network) boundaries, as well as with the provision of regulatory and legislative framework for regulating this process, the formation of a competitive energy market and the creation of a motivational mechanism to attract consumers of energy resources to n processes of energy-saving and distributed energy generation, introduction of intelligent energy metering systems and integration into the traditional model of the energy system of conceptual projects to create an intelligent living environment - require systematic innovative development of energy, one of the critical areas of which is the deployment of intelligent grids.

Implementing the project (projects) with the above objectives can take place by taking action in such areas.

1. Monitoring. Increasing the awareness of the power grid manager about the mode of its operation by online monitoring of the parameters of substations and creating conditions for the adoption of new volumes of distributed generation from renewable energy sources. It is necessary to perform real-time network operation calculations, as required by the European Network of Transmission System Operators for Electricity (ENTSO-E) [82].

2. Forecasting. Introduction of a system for forecasting generation from renewable energy sources. Two parties should solve this task:

1) participants in the energy network to avoid energy imbalances;

2) system operator for evaluating new projects and operational planning of energy regimes [82].

3. Openness of the general information model (CIM). Creation of an integration platform designed to collect technical data on the power system. The need for this platform is explained by the need to implement the technical ability to reflect the cost of a new connection and quality indicators of electricity in a particular section of the grid (a specific region) [82, 83].

4. Virtual power plants and demand response. This step aims to reduce the effects of stochastic energy generation from renewable energy sources. It envisages the implementation of technology to attract consumers to the secondary and tertiary regulation of the load on the grid, as well as the launch of unifying technology of a virtual power plant to consolidate generation from renewable energy sources with the grid by implementing the principle of shunting power [82].

In general, the development of modern energy networks has a different philosophy depending on the region. For Europe, the vector of development of intelligent technologies in energy is aimed at the optimal functioning of the energy system, optimization of its infrastructure, and the development of communication and information technologies; for the United States, on building a profitable business model and low-carbon and energy efficiency; for Japan - on the green economy; in China, to improve resource allocation, security, and energy efficiency [84].

2.3. The formation of a modern energy system for inclusive development

The transformation of the energy system is characterized by a change in its characteristics, which consists both in the

structure of energy generation and consumption, and in the technologies used to replace traditional ones.

Climate change, which threatens all living things, is a significant reason to eliminate the harmful effects of human activities on the environment. Industry and households are consuming more and more energy every year. Intelligent and innovative technologies cannot stop this trend. On the contrary, they encourage you to consume more and more. Automation replaces processes performed by human labor without using energy-consuming devices or with the help of mechanical devices. Digitalization and informatization are gaining total volume. It means that absolutely any process, even elementary, requires energy.

Demand creates supply. For decades, growing energy demand has provoked governments and private companies to meet demand by increasing carbon production. It had catastrophic consequences for humanity, the realization of which came too late. However, awareness of the need for radical change was the basis of energy policy. This policy aims to replace fossil fuels with renewable energy sources as soon as possible.

Figure 2.4 shows the growth dynamics of the share of renewable energy, in particular energy derived from solar panels and windmills. This figure also shows the effectiveness of existing energy policies, which leads to a reduction in the share of carbon energy.

Technologies, or rather technological limitations, were named among the main reasons that do not allow to abandon fossil fuels. Today, this reason is also often mentioned in scientific and political circles when discussing the development of energy and climate policy. However, progress is not standing. Still, technology is constantly improving, expanding opportunities to replace traditional energy resources with renewable ones.

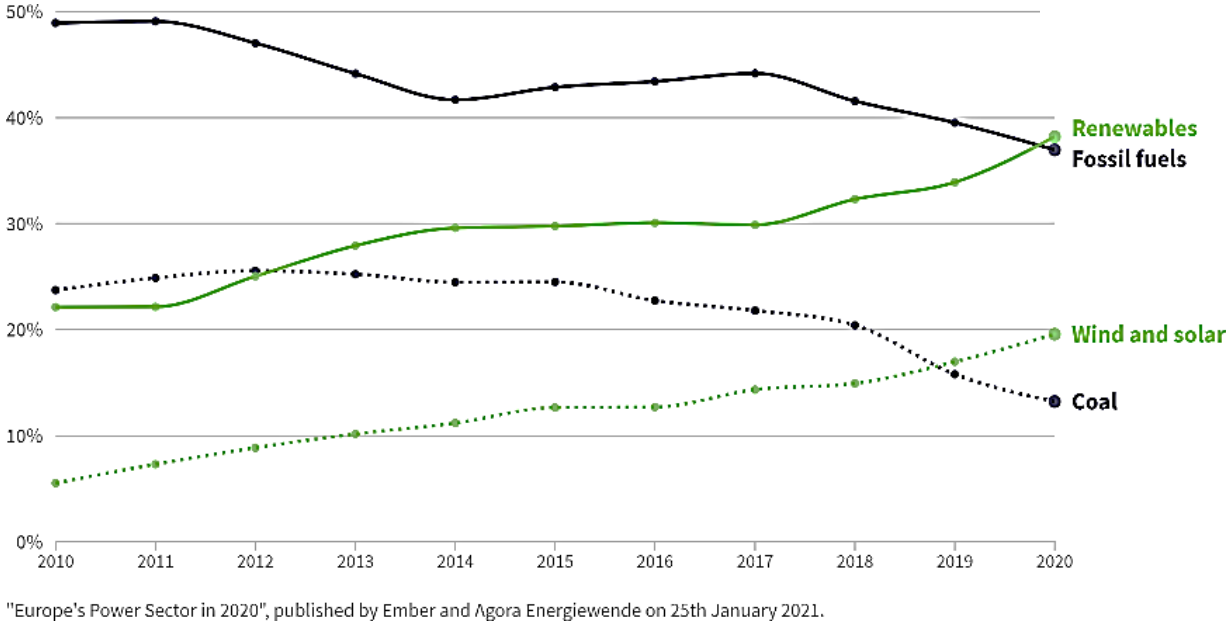


Figure 2.4. Share of renewable electricity production EU 27 [85]

Since not all renewable energy technologies are developing equally successfully, it is challenging to expect breakthrough results in all areas of renewable energy. At the same time, this is not a reason to abandon some of its areas. It is unknown where the technological breakthrough will occur and which technologies will dominate in the future. Therefore, the issue of renewable energy development lies in the search for opportunities and optimal options for applying each of the areas of renewable energy. It is necessary to develop integration schemes that will include various sources of renewable energy in the energy system.

Statistics show that the world community applies this approach, which may not be optimal in economic performance, but is strategically balanced and correct. After all, this approach does not allow in the early stages to reject the direction of renewable energy, which can provide significant results in the future.

In Figure 2.5 it is possible to trace the situation with the use of different types of renewable energy compared to the dynamics of the use of carbon fuel (Figure2.6 and Figure 2.7), the share of which is declining in the long run. The graph shows that positive dynamics is observed in the solar and wind energy sector. At the same time, the production of biofuels and hydropower as areas of renewable energy have found their niche and do not have a clear upward trend. The lack of technological breakthroughs, particularly in biofuels, is perhaps one of the main reasons why the share of renewable energy is not growing as fast as we would like.

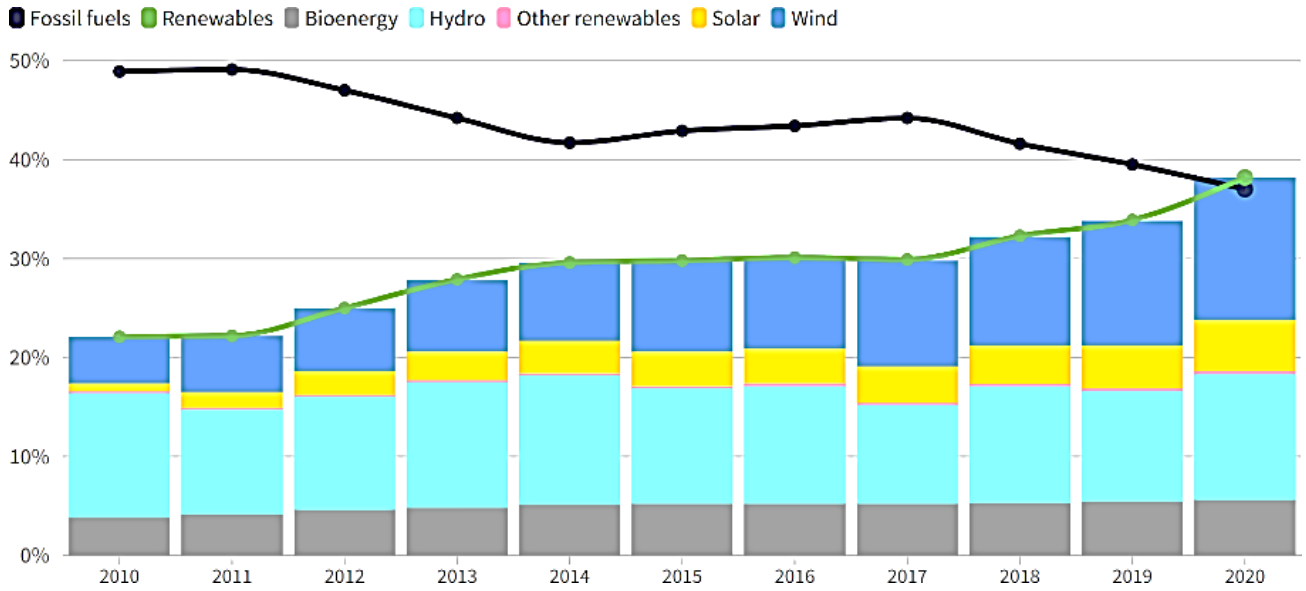


Figure 2.5. Share of electricity production in EU-27 [85]

Data on the share of electricity production from different energy sources raises essential questions about renewable energy and the formation of the future energy system. What should it be like? What energy sources will be most in demand. What should be the system of incentives for energy producers and consumers?

However, first, it is necessary to answer the question: Why should the answer to the questions be given based on data on electricity production, although there are other types of energy? The answer to this question is not obvious to everyone. The argument is serious. It is an electric energy that covers all of humanity's energy needs. It is energy for stationary and mobile devices and transport. It is a universal type of energy. If society has access to cheap, clean energy in sufficient quantities, the energy problem will be solved, and the fight against climate change will be much more successful. This logic allows to make assumptions about the future development of energy and predict changes in industry, the economy, and society as a whole.

Statistics show that the most suitable technologies for renewable energy, which can increase its share and reduce the percentage of carbon energy, are solar and wind energy.

The prospects of this direction of energy development are evidenced by the data on the use of these renewable energy sources in the European Union, which are considered the flagships in implementing renewable energy technologies.

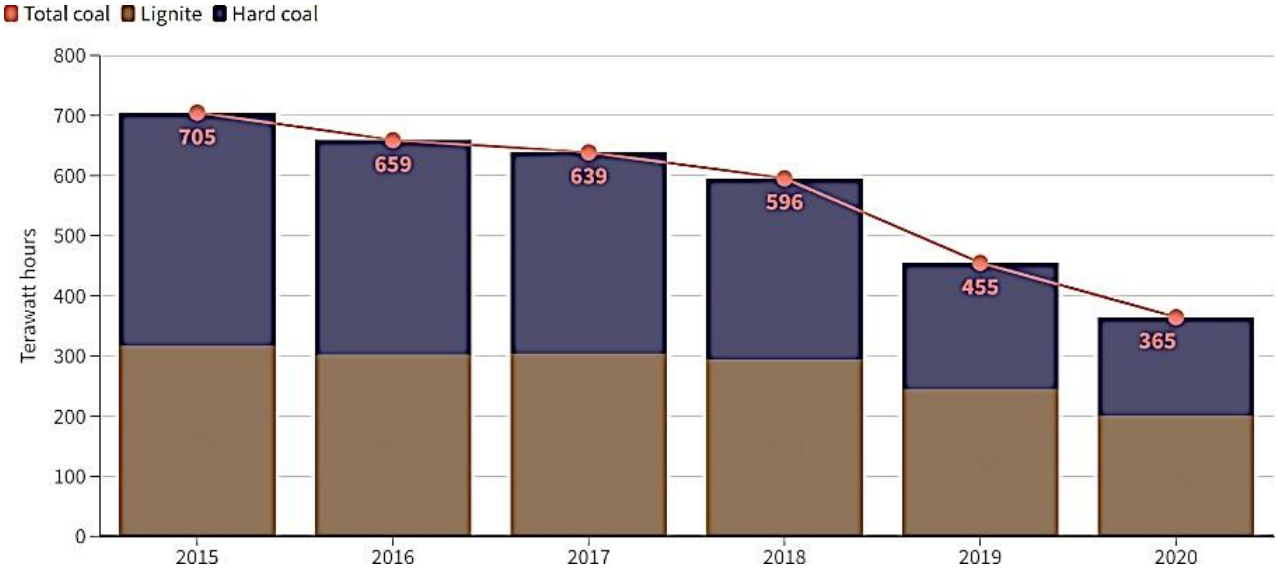


Figure 2.6. EU-27 electricity generation [85]

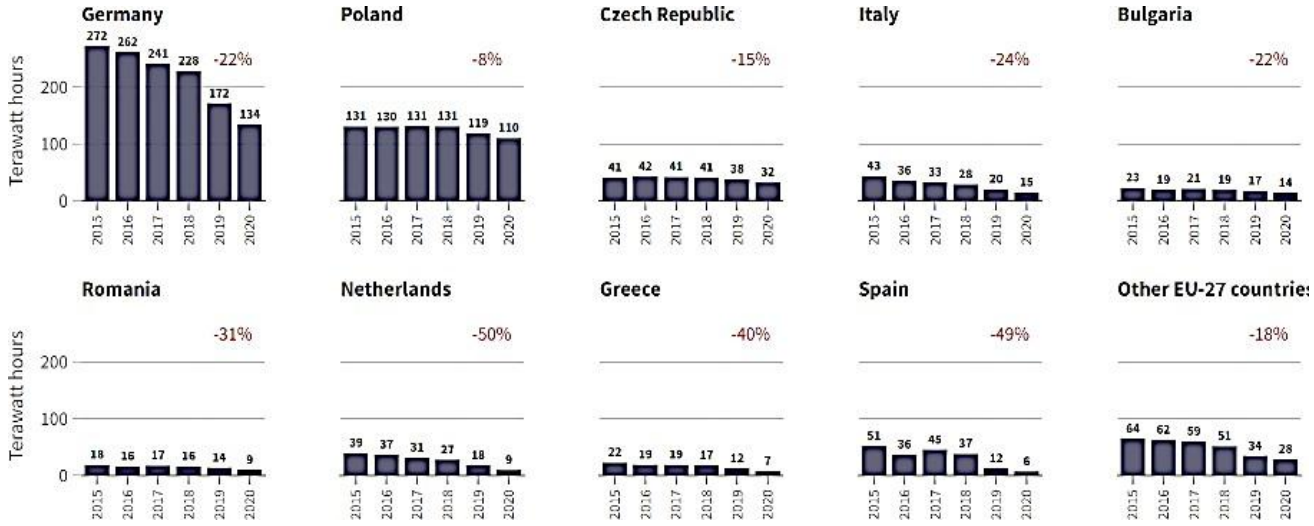


Figure 2.7. Hard coal and lignite generation [85]

The growth rates of solar and wind energy in some countries of the European Union (Figure 2.8) show that we have found schemes that allow extensive use of solar and wind power. Accordingly, integration schemes have been found that have made renewable energy an integral part of the energy system, increasingly transforming it and making it more environmentally friendly.

The progress made in the development of alternative energy, particularly in wind and solar power, over the last decade is shown in Figure 2.9.

The data obtained show that each of the countries of the European Union has made progress in this direction. However, the results of the countries differ significantly. The reasons for this may be different initial conditions of countries, including the existing natural and climatic conditions. However, an important factor is the systematic action of governments to implement initiatives aimed at the development of renewable energy, in particular through the use of mechanisms to stimulate alternative energy producers and consumers.

At the same time from those shown in Figure 2.9 data, it is obvious that the most significant progress in introducing solar and wind power generation technologies was made by the countries that were the first to embark on the path of stimulating and implementing renewable energy. A striking example of such countries is Denmark, Ireland, Greece, and Germany. The progress of these countries is impressive. These countries are the flagships of renewable energy development in Europe.

Figure2.8. Wind and solar generation and percentage change from 2019 to 2020 [85]

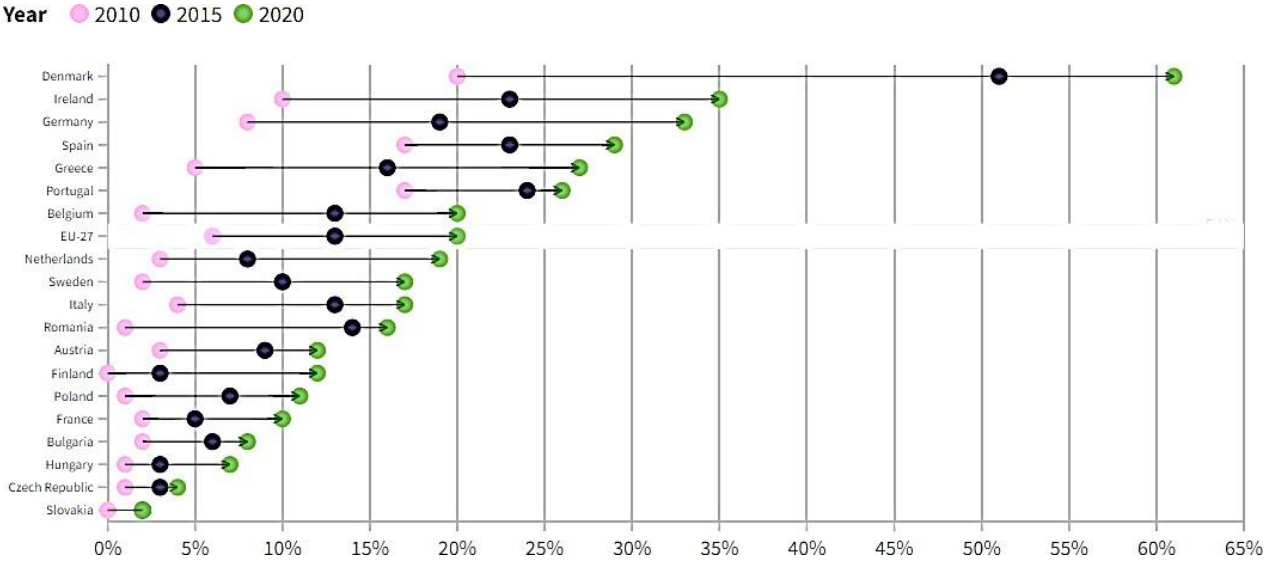


Figure2.9. Wind and solar as a percentage share of electricity production in EU [85]

The experience of these countries in achieving the targets set by national energy policy and international regulations, including European Union directives, as well as target programs.

At the same time, the European Union consists of countries that have different opportunities for the development of renewable energy and the state of socio-economic development. Fluctuations in macroeconomic indicators and market conditions can significantly affect energy policy effectiveness.

In addition, a significant obstacle to accelerating the development of renewable energy is the organizational and economic components. Schemes for scaling up the technology and integrating renewable energy sources into the energy system require significant investments, making them unprofitable.Taking into account the factors described above that affect the development of renewable energy, particularly solar and wind energy, leads to a different understanding of the further development of the industry. In particular, this applies to the pace of development and targets that can actually be achieved by 2030.

In Figure 2.10 provides estimates of the amount of electricity that twenty-seven countries of the European Union will produce.

Among the tools suitable for increasing the production of energy from renewable sources, special attention should be paid to those that stimulate the demand for energy from renewable sources. After all, according to market laws, the demand for such energy will generate supply.

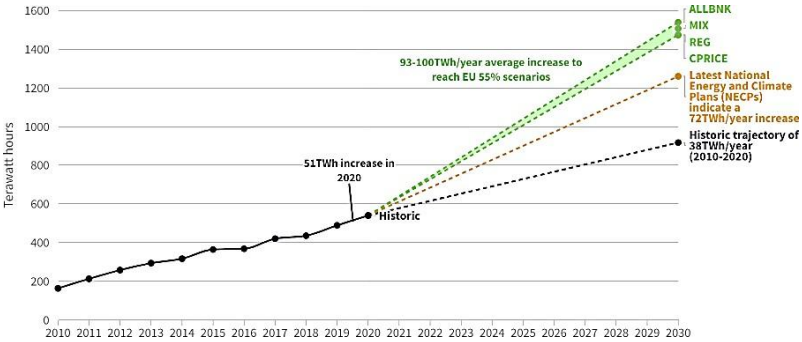


Figure 2.10. EU-27 target generation from wind and solar [85]

Thus, this is the most desirable way to develop renewable energy, as it stimulates the energy market and, in the long run, reduces the burden on governments, which will not have to be the principal investor in the solar and wind energy sector. In addition, stimulating the demand for renewable energy is closely linked to involving citizens in the grid, particularly in electricity generation. Thus, it is possible to attract more and more people to economic activity, increasing its economic activity and creating business opportunities. The dynamics of electricity demand are shown in Figure 2.11.

An alternative to fossil fuels is nuclear energy, which has been considered an effective way to obtain clean energy since the middle of the twentieth century. The decay potential of atoms used in nuclear energy is impressive.

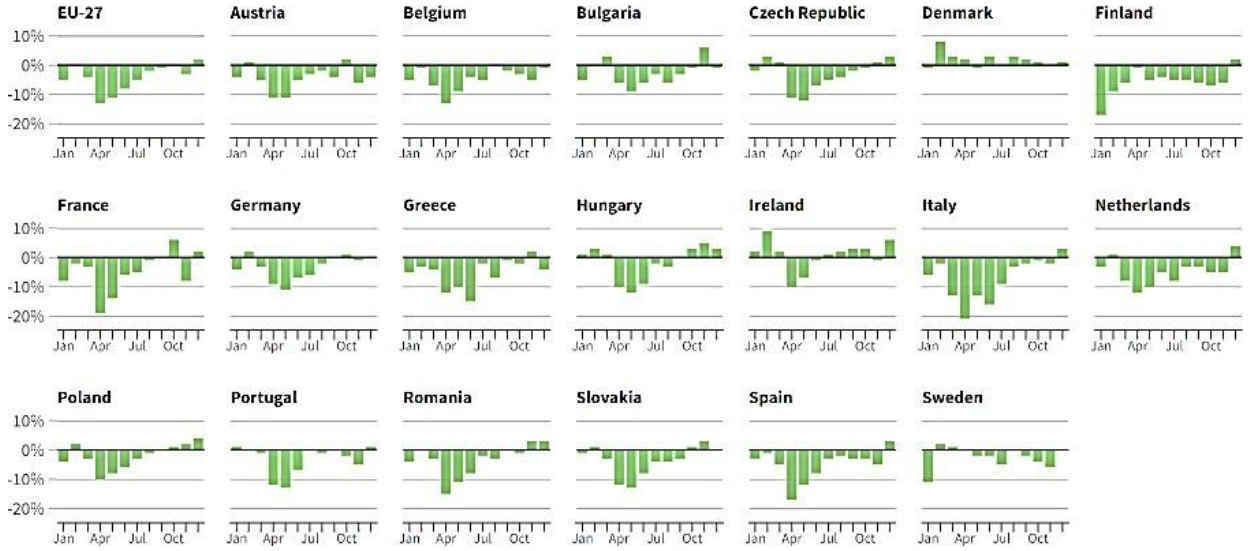


Figure 2.11. Monthly electricity demand change in 2020 versus 2019 in EU countries [85]

The cheapness of nuclear energy is the main argument in its favor and the factor that stimulated its active development in the twentieth century.

However, electricity production at nuclear power plants is associated with significant risks. Emergencies at nuclear power plants can cause enormous damage to the environment and the lives and health of many people.

The most telling example of the dangers of nuclear power is the accident at the Chernobyl nuclear power plant in the former Soviet Union. The explosion at the third power unit became one of the most significant artificial disasters in human history.

Until recently, it was believed that the current level of technological development could prevent the recurrence of such tragedies, but the events at the power plant in Fukushima have proved wrong.

The threatening consequences of accidents at nuclear power plants have excluded them from replacing fossil fuels with environmentally friendly ones in many countries. It is evidenced by data on the dynamics of electricity production at nuclear power plants (Figure 2.12). However, the economic attractiveness of this type of electricity leads to differences of opinion between countries on whether to develop nuclear energy. Unlike France, Germany, and Sweden, most European Union countries do not have policies to reduce electricity production from nuclear power plants.

The main task of renewable energy development is to replace traditional, environmentally, and climate-harmful fuels.

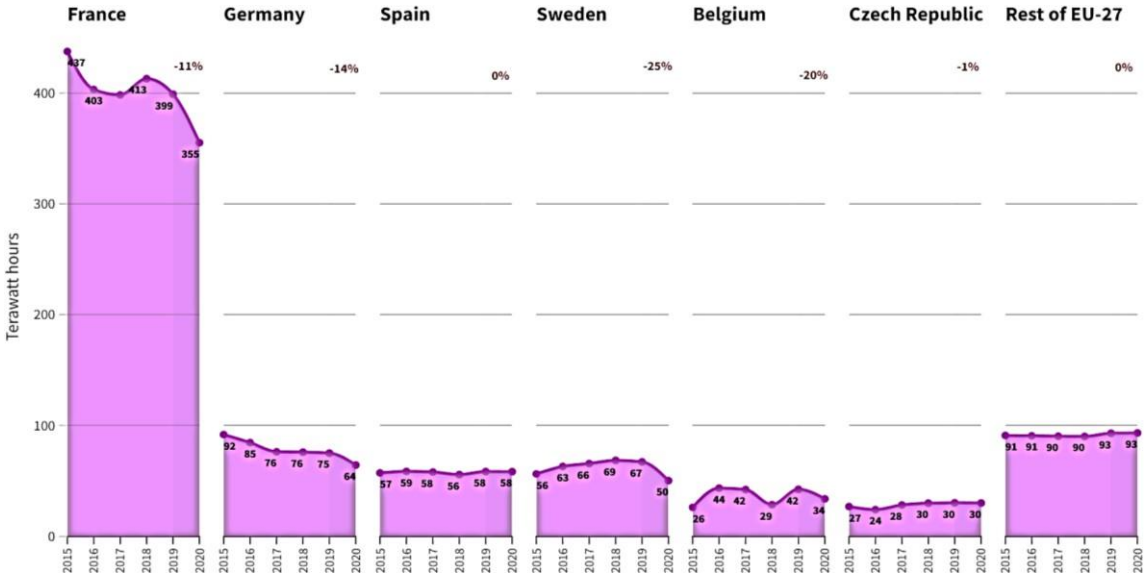


Figure 2.11. Nuclear electricity generation, percentage change from 2019 to 2020 [85]

Economic circumstances do not allow the replacement of traditional fuels with renewable energy. However, significant progress has been made in this direction over the last two decades. The data presented earlier show a positive trend in renewable energy development, especially solar and wind energy. The dynamics of the use of non-renewable energy resources for electricity production, on the contrary, indicates a downward trend.

However, it isn't easy to judge how significant the results achieved in the global dimension are without considering the structure of energy resources. In Figure 2.13 shows data on the use of different fuels for electricity production by the European Union. The data show significant differences in the fuel and energy balance of EU member states.

The availability of fossil fuel raw materials or the ability to obtain these resources at cost-effective prices hinder the motivation of individual governments to implement energy reforms aimed at developing renewable energy and reducing the use of fossil fuels. Prominent examples of countries in no hurry to give up fossil fuels are Poland, the Czech Republic, and Bulgaria (Figure 2.13-2.14).

At the same time, there are examples in the European Union of countries pursuing more responsible energy policies. Such countries include Greece, Germany, and Denmark.

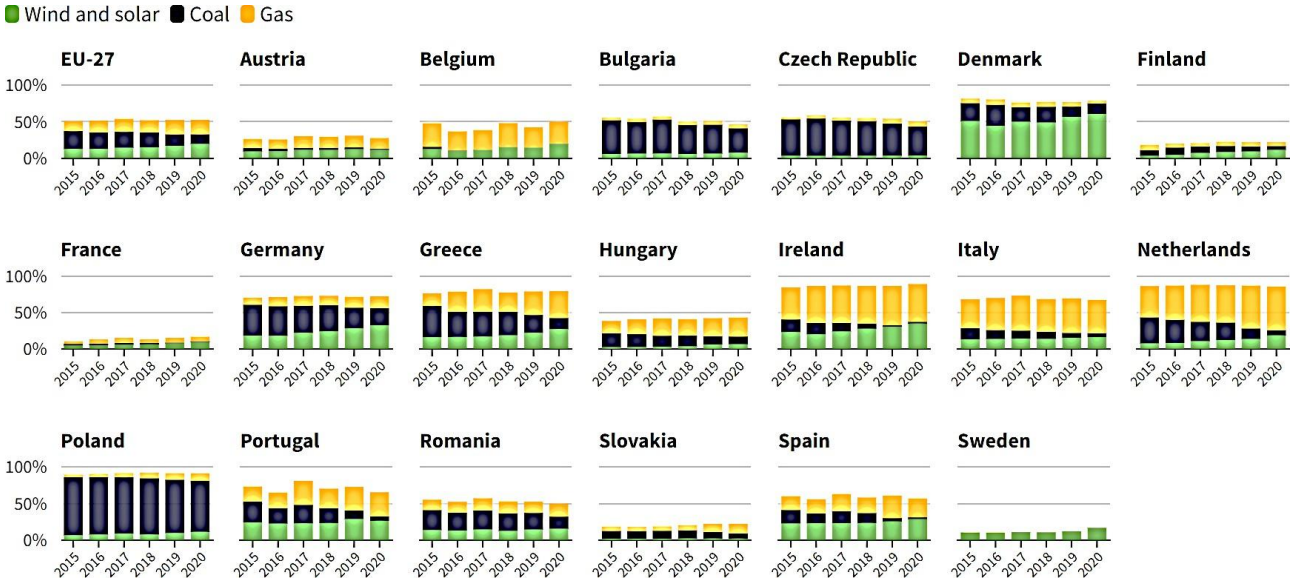


Figure 2.13. Percentage of total electricity generation in EU [85]

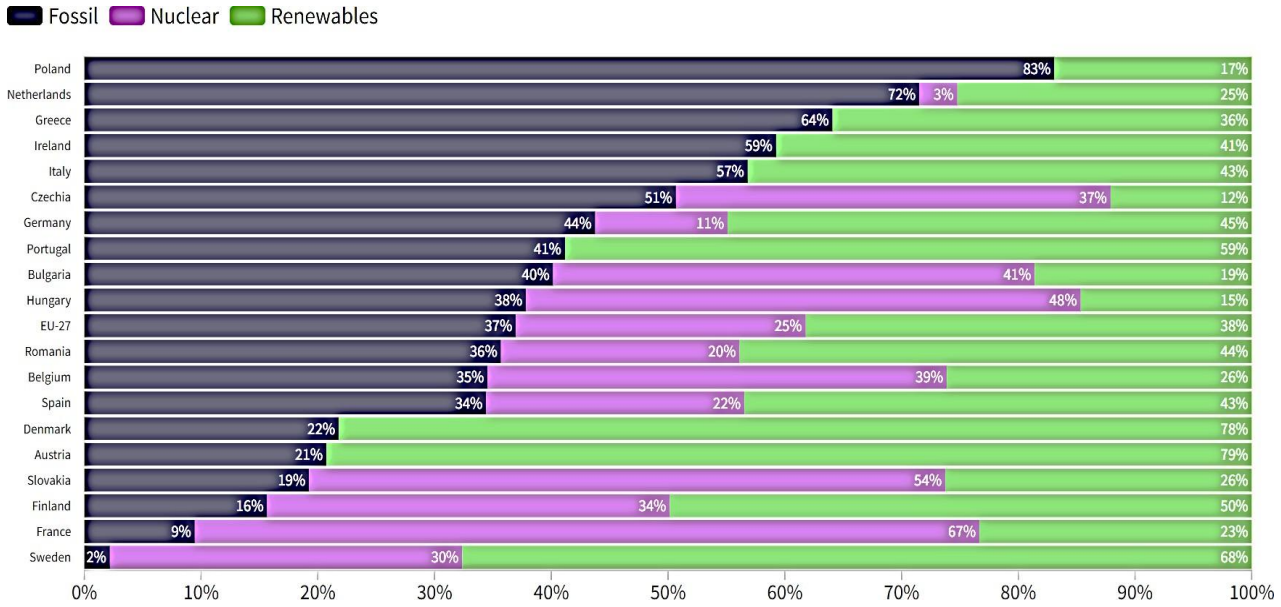


Figure 2.14. Share of electricity generation by energy resources [85]

The existing imbalance in the structure of fuels used in the European Union, which affects the achieved indicators of renewable energy development in some countries, leads to difficulties implementing a standard energy policy and limits its results

However, despite the ambiguous situation with achieving energy policy goals over the past five years, the European Union has significantly reduced carbon emissions (Table 2.1).

Table 2.1. Carbon intensity in EU in 2015-2020 (gCO2/kWh) [85]

Area	2015	2016	2017	2018	2019	2020
Austria	110	98	107	102	99	83
Belgium	227	172	177	207	184	192
Bulgaria	486	462	497	425	424	352
Croatia	212	210	195	135	172	164
Cyprus	670	679	661	664	660	653
Czech Republic	495	505	453	445	423	386
Denmark	192	231	176	189	122	116
Estonia	944	924	928	900	783	669
EU-27	317	305	303	287	252	226
EU27+1	324	305	300	285	251	226
Finland	103	109	99	111	89	67
France	54	60	69	54	54	55
Germany	460	456	424	406	343	301
Greece	739	622	658	662	603	522
Hungary	271	261	264	251	226	218
Ireland	437	429	399	353	313	293
Italy	283	262	263	248	229	212
Latvia	141	117	65	138	147	92
Lithuania	206	154	92	65	68	146
Luxembourg	141	78	72	69	69	69

Area	2015	2016	2017	2018	2019	2020
Malta	654	653	435	356	356	356
Netherlands	514	491	459	441	382	318
Poland	803	794	784	789	752	724
Portugal	364	296	353	310	251	201
Romania	349	309	315	291	271	208
Slovakia	125	116	119	137	104	90
Slovenia	256	254	254	248	242	219
Spain	318	266	305	276	228	190
Sweden	11	12	13	13	12	13
United Kingdom	380	294	264	250	228	209

Currently, the most efficient economies in terms of CO_2 emissions are countries that have significantly modernized the energy system and for a long time pursued a consistent innovation policy, maintaining high levels of public investment and implementing mechanisms to encourage business to invest in the latest environmentally friendly technologies.

2.4. The role and place of green energy for inclusive economic development

According to the European Green Agreement, the development of smart grids is the basis for the decarbonization of the economy and the catalyst for changes in socio-economic development. This approach is consistent with forming a model of an energy-centric economy, characterized by deep energy penetration in all areas and, consequently, the ability to influence economic and social development indicators by increasing efficiency and innovation of the energy sector as a driver of socio-economic development and synergy catalyst -

sectoral interaction during the implementation of energy efficiency measures and innovation.

To determine the energy in forming an energy-centered economy model, which creates opportunities for active involvement of as many people as possible in dynamic economic processes, it is vital to establish the strength and direction of changes in energy on indicators of social and economic development. To this end, it is advisable to apply a two-stage scientific and methodological approach:

The first stage is to test the hypothesis of a statistically significant difference in the levels of efficient energy consumption before and after implementing energy reforms based on the use of environmentally friendly and environmentally friendly technologies.

In the second stage, with the help of regression analysis, it is planned to determine the element-by-element impact of energy transformation efficiency indicators on the social and economic development of the country.

It is advisable to use a wide time range to obtain reliable results. The study period is in the range of 2006-2019. This time is sufficient to assess the energy developments and the consequences that have led to them, including economic and social ones. On this basis, it is possible to establish a link between the studied indicators before implementing the current energy policy and after its implementation.

Stata 14.0 / SE software was used to perform the following calculations [41].

To carry out the first stage of the study, the Shapiro-Wilk test was used to test the nature of the data distribution. The choice in favor of using the Shapiro-Wilk test was made because it gives the best results when working with small samples.

Shapiro-Wilk W-test is based on regression of ordinal statistics. The calculation of the W-criterion of Shapiro-Wilk is carried out according to the formula:

$$W = \frac{1}{s^2}\left[\sum_{i=1}^{m} a_{n-i+1}(x_{n-i+1} - x_i)\right]^2, \quad (2.1)$$

where n – sample size; $s^2 = \sum_{j=1}^{n}(x_j - \bar{x}_i)^2 = s_x^2(n-1)$; $\bar{x} = \sum_{j=1}^{n} x_j$; m – he whole part $\frac{n}{2}$; coefficients a_{n-i+1} (i = 1, 2, ..., k; n =3, 4, ..., 14) – constants [86].

Two hypotheses were formed:

- empirical distribution does not differ from normal;
- empirical distribution differs from normal.

As a result of the calculation of criterion W, the hypothesis of normal sample distribution was confirmed (test statistics (W) = 0.92857; deviation from normality (V) - 1.322) (Figure 1.11).

To test the equality of the variances of the samples, the Levene test was used, which has an advantage over other tests, including the Bartlett test, because it is less sensitive to deviations from normal [87].

The Levene test is performed according to the formulas:

H_0: $\sigma_1^2 = \sigma_2^2 = \ldots = \sigma_k^2\sigma$

H_a: $\sigma_i^2 \neq \sigma_j^2$ for at least one couple *(i, j)* (2.2)

Test Statistic: Given the variable Y with a sample of size N divided into k subgroups, where Ni is the sample size of the *i-th* subgroup, the Levene statistical test is defined as:

$$W = \frac{(N-k)}{(k-1)} \frac{\sum_{i=1}^{k} N_i (\overline{Z}_{i.} - \overline{Z}_{..})^2}{\sum_{i=1}^{k} \sum_{j=1}^{N_i} N_i (\overline{Z}_{ij} - \overline{Z}_{i.})^2} \quad (2.3)$$

Z_{ij} can take one of three values:

1. $Z_{ij} = |Y_{ij} - \overline{Y}_i|$

$\overline{Y}_i$ – this is the average value of the *i-th* subgroup.

2. $Z_{ij} = |Y_{ij} - \tilde{Y}_i|$

$\tilde{Y}_i$ – the median of the *i-th* subgroup.

3. $Z_{ij} = |Y_{ij} - \overline{Y}'_i|$

$\overline{Y}'_i$ *is* a 10% truncated average of the *i-th* subgroup.

$\overline{Z}_i$ is the group average Z_{ij};

$\overline{Z}_{..}$ is the overall average Z_{ij}.

The application of the Levene test to check the equality of variances of the samples showed the following results (Figure 1.11): statistics of the test on the average (W0) - 0.94 (0.35); median test statistics (W50) - 0.93 (0.35); test statistics for 10% truncation of the average (W10) - 0.94 (0.35).

A parametric test was used because the data have a normal distribution [88].

The method of calculating the two-sample t-test for independent samples is as follows [88]:

a) if the sample sizes differ slightly:

$$t = \frac{|M_1 - M_2|}{\sqrt{\frac{\sigma_1^2}{N_1} + \frac{\sigma_2^2}{N_2}}}, \quad (2.4)$$

b) when the sample sizes differ significantly:

$$t = \frac{|M_1 - M_2|}{\sqrt{\frac{(N_1-1)\sigma_1^2+(N_2-1)\sigma_2^2}{N_1+N_2-2}\left(\frac{1}{N_1}+\frac{1}{N_2}\right)}}, \quad (2.5)$$

where M_1, M_2 – arithmetic mean;

σ_1 , σ_2 – standard deviation;

N_1, N_2– sample sizes.

The number of degrees of freedom is calculated as:

$$df = N_1 + N_2 - 2. \quad (2.6)$$

The results of calculations on this test showed a statistically significant difference between the levels of efficient energy consumption before and after the implementation of energy reform policy in Ukraine (Table 2.2).

Regression analysis was used to identify the relationship between the studied indicators, which allows establishing the form of dependence between variables. Regression analysis allows the value (or magnitude) of one attribute (variable X) to determine the expected values of another attribute (variable Y) if there is a correlation between them. To obtain accurate analysis results, it is necessary to establish relationships between the variables under study, which allows identifying the quantitative relationship between the dependent variable and one or more independent variables [89].

Regression analysis of time data was used to determine the impact of energy transformations on the indicators of social and economic development of the country.

Table 2.2. Results of the Shapiro-Wilk test, Levene test, and calculation of the two-sample Student's t-test [41]

Shapiro-Wilk W test for normal data						
Variable	Obs	W	V	z	Prob>z	
Ec1	14	0.92857	1.322	0.550	0.29130	
Levene test						
diff	Mean		Std. Dev.		Freq.	
Summary of Ec1						
0	0.20485714		0.00990671		7	
1	0.15812381		0.01569772		7	
Total	0.18149048		0.02733184		14	
W0 = 0.94009372 df(1, 12) Pr> F = 0.3513911 W50 = 0.93451083df(1, 12) Pr> F = 0.35277303 W10 = 0.94009372df(1, 12) Pr> F = 0.3513911						
Two-sample t test with equal variances						
Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf.	Interval]
0	7	0.2048571	0.0037444	0.0099067	0.195695	0.214019
1	7	0.1581238	0.0059332	0.0156977	0.1436058	0.172641
combined	14	0.1814905	0.0073047	0.0273318	0.1657095	0.197271
diff		0.0467333	0.0070159	0.031447	0.062019	

The regression model has the form:

$$CE = \alpha_0 + \beta_i PE_i + \varepsilon, \quad (2.7)$$

where α_0 – equation constant;

β_i – search parameters;

CE – indicators of socio-economic development of the country;

PE – indicators of the direct impact of energy reform policy;

ε – error.

Endogenous variables (regressions) in the model were:

– volumes of gross fixed capital in the country, K (USD);

– number of the employed population in the country, L (persons);

– GDP of the country, GDP (USD);

– volume of net foreign direct investment, FDI (USD);

– human development index, HDI (according to UN analytical reports);

– expenditures on research and development, R&D (% of GDP);

– level of openness of the economy, trade (%, the amount of exports and imports of goods and services to GDP);

– level of urbanization, U (%, share of urban population in its total number).

Exogenous model variables are:

– electricity consumption, ES (kWh / t of net raw material supply);

– energy intensity of GDP, En (tons of oil equivalent/ thousand US dollars).

The choice of indicators for regression analysis is justified by numerous studies of the relationship between the development of the energy sector and social and economic indicators of the country's functioning.

The indicators included in the calculation were chosen in such a way as to show the current impact of innovative energy policy on those areas of activity that need maximum attention in today's world. These indicators show the relationship between energy and the achievement of economic and social goals in line with EU priorities. These areas are reflected in numerous EU directives and strategic plans.

The regression analysis results for different determinants of socio-economic development are shown in Table 2.3-2.12.

Table 2.3. Results of regression analysis: regression - the number of employed population; regressor - energy intensity of GDP [41]

2006-2012 En **. regress L En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 0.01	
Model	0.00011561	1	0.000115615		Prob > F = 0.5459	
Residual	0.00137940	5	0.00027588		R-squared = 0.077	
Total	0.01495023	6	0.00024917		Root MSE = 0.016	
L	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	-0.10981	0.1696	0.65	0.546	-0.32625	0.54588
_cons	9.371343	0.8626	10.8	0.000	7.15385	11.5888

Table2.4. Results of regression analysis: regression - human development index; regressor - energy intensity of GDP [41]

2006-2012 En **. regress HDI En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 0.01	
Model	1.2850e-06	1	1.2850e-06		Prob > F = 0.9231	
Residual	0.000623081	5	0.00012461		R-squared = 0.002	
Total	0.000624366	6	0.00010406		Root MSE = 0.011	
HDI	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	0.0115773	0.1140	0.10	0.923	-0.28149	0.30465
_cons	-0.376566	0.5797	-0.65	0.545	-1.86691	1.11378

Table 2.5. Results of regression analysis: regression - the amount of expenditure on research and development; regressor - energy intensity of GDP [41]

2006-2012 En **. regress RD En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 1.94	
Model	0.01237571	1	0.01237571		Prob > F = 0.2221	
Residual	0.031850243	5	0.00637004		R-squared = 0.279	
Total	0.044225953	6	0.00737091		Root MSE = 0.079	
RD	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	-1.13617	0.81513	-1.39	0.222	-3.23155	0.95920
_cons	5.59174	4.14514	1.35	0.235	5.06370	16.2471

Table 2.6 Results of regression analysis: regression - the level of urbanization; regressor - energy intensity of GDP [41]

2006-2012 En **. regress U En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 0.26	
Model	5.5063e-06	1	5.5063e-06		Prob > F = 0.6340	
Residual	0.00010729	5	000021458		R-squared = 0.0488	
Total	0.00011279	6	0.000018799		Root MSE = 0.00463	
U	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	0.02396	0.04731	0.51	0.634	-0.0976492	0.14558
_cons	4.10393	0.24058	17.06	0.000	3.485499	4.72237

Table 2.7. Results of regression analysis: regression - the volume of gross fixed capital in the country; regressor - energy intensity of GDP

2013-2019 En **. regress K En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 0.05	
Model	0.0073360	1	0.00733604		Prob > F = 0.8239	
Residual	0.6669644	5	0.133392886		R-squared = 0.0109	
Total	0.6743004	6	0.112383412		Root MSE = 0.36523	
K	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	0.4307	1.83671	0.23	0.824	-4.290694	5.15215
_cons	21.566	9.12557	2.36	0.064	1.891066	45.02499

Table 2.8 Results of regression analysis: regression - the number of employed people in the country; regressor - energy intensity of GDP [41]

2013-2019 En **. regress L En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 13.80	
Model	0.0325576	1	0.0325576		Prob > F = 0.0138	
Residual	0.0117971	5	0.0023594		R-squared = 0.7340	
Total	0.0443548	6	0.0073924		Root MSE = 0.0485	
L	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	-0.9074	0.24427	3.71	0.014	0.279475	1.53533
_cons	5.2402	1.21366	4.32	0.008	2.12080	8.36044

Table 2.9. Results of regression analysis: regression - GDP; regressor - energy intensity of GDP [41]

2013-2019 En **. regress GDP En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 0.46	
Model	0.033311	1	033311961		Prob > F = 0.5266	
Residual	0.360092	5	0.07201849		R-squared = 0.0847	
Total	0.393404	6	0.06556740		Root MSE = 0.2683	
GDP	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	0.9178	1.34957	0.68	0.527	-2.551338	4.38705
_cons	20.989	6.70526	3.13	0.026	3.753215	38.2260

Table 2.10. Results of regression analysis: regression - human development index; regressor - energy intensity of GDP

2013-2019 En **. regress HDI En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 7.87	
Model	0.000056	1	0.00005689		Prob > F = 0.0377	
Residual	0.000036	5	7.2259e-06		R-squared = 0.611	
Total	0.000093	6	0.00001550		Root MSE = 0.0026	
HDI	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	-0.037	0.01351	-2.81	0.038	-0.072681	-0.0031
_cons	-0.105	0.0671	-1.57	0.177	-0.278016	0.06728

Table. 2.11 Results of regression analysis: regression - the amount of expenditure on research and development; regressor - energy intensity of GDP

2013-2019 En **. regress RD En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 44.42	
Model	0.369211	1	0.3692116		Prob > F = 0.0011	
Residual	0.041563	5	0.00831265		R-squared = 0.8988	
Total	0.410774	6	0.06846247		Root MSE = 0.09117	
RD	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	-3.055	0.45850	6.66	0.001	1.877088	4.23434
_cons	-15.82	2.2780	-6.95	0.001	-21.68086	-9.96902

Table 2.12. Results of regression analysis: regression - the level of urbanization; regressor - energy intensity of GDP

2013-2019 En **. regress U En**						
Source	**SS**	**df**	**MS**		**Number of obs = 7**	
					F(1, 5) = 49.58	
Model	0.000051	1	0.00005128		Prob > F = 0.0009	
Residual	5.1722e-06	5	1.0344e-06		R-squared = 0.908	
Total	0.000056	6	9.4098e-06		Root MSE = 0.0010	
U	**Coef**	**Std. Err.**	**t**	**P>|t|**	**[95% Conf. Interval]**	
En	-0.036	0.00511	-7.04	0.001	-0.049162	-0.0022
_cons	4.4153	0.02541	173.7	0.000	4.350027	4.4806

Modernization measures in the energy sector are aimed at improving energy efficiency. The most expected consequence of increasing energy efficiency on a national scale is reducing the energy intensity of the gross domestic product. At the same time, it should be noted that scientists' expectations in the past to reduce energy consumption due to the increased energy efficiency of appliances have not come true. Despite improving devices' technical, technological, and operational characteristics, energy consumption rises over a long period of observations. The increase in energy efficiency, which could lead to a reduction in total energy consumption, is offset by an increase in the number of industrial and household equipment, which, in turn, should lead to increased levels of information and automation. It should create the preconditions for improving the quality of life. Accordingly, this should be reflected in social development indicators

The result of the study on the impact of energy efficiency policy on the country's socio-economic development level is shown on Table 2.13.

Table 2.13. The impact of energy efficiency policy on socio-economic development of the country [41]

Variable		Regressor coefficient		Significance of the regressor		R^2		Communication power		Adequacy of the mode		Direction of influence	
Regressor: Ec		(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
	L	0.22	0.71	0.09	0.03	0.47	0.66	Moderate	High	Adequate	Adequate	Positive	Positive
	HDI	-0.21	0.03	0.00	0.03	0.92	0.67	High	High	Adequate	Adequate	Negative	Positive
	R&D	1.28	2.56	0.06	0.00	0.52	0.92	Moderate	High	Adequate	Adequate	Positive	Positive
	U	26.7	0.03	0.00	0.00	0.79	0.95	High	High	Adequate	Adequate	Positive	Positive
Regressor: Eh	L	-0.11	-0.91	0.55	0.01	0.07	0.73	Low	High	Inadequate	Adequate	Negative	Negative
	GDP	3.48	0.92	0.07	0.53	0.49	0.08	Moderate	Low	Adequate	Inadequate	Positive	Positive
	FDI	5.27	-4.08	0.07	0.493	0.49	0.09	Moderate	Low	Adequate	Inadequate	Positive	Negative
	HDI	0.01	-0.04	0.92	0.03	0.01	0.61	Low	High	Inadequate	Adequate	Positive	Negative
	R&D	-1.13	-3.05	0.22	0.00	0.27	0.89	Low	High	Inadequate	Adequate	Negative	Negative
	Trade	1.19	0.72	0.07	0.84	0.51	0.08	Moderate	Low	Adequate	Inadequate	Positive	Positive
	U	0.02	-0.03	0.63	0.00	0.05	0.91	Low	High	Inadequate	Adequate	Positive	Negative

Accordingly, it can be argued that energy efficiency policy, which includes legislation and incentives for all actors involved in the economy to create, maintain and develop innovative technologies in the energy sector, has a positive effect on improving key indicators of the economy. And last but not least, it improves social development indicators. This allows us to conclude that the energy sector is a driver for the development of an inclusive economy.

The calculations made in [41] allowed to empirically confirm the hypothesis about the impact of energy reform based on innovative and environmentally friendly technologies on indicators of social and economic development of the country.

CONCLUSION

The modern mainstream of social development, which is accompanied by the deterioration of economic development indicators, the aggravation of environmental problems in the country, the deterioration of the quality and conditions of society's life, is an increase in the level of involvement of the population in the country's financial environment. The low level of financial inclusion of the population, as well as ineffective state economic, social and environmental policies serve as the basis for the low efficiency of the implementation of state programs and measures and only deepen destructive processes in all spheres of interaction between the state, business and society. This is accompanied by a decrease in the level of economic security of the country, and as a result - threats to its macroeconomic stability and the quality of life of the population.

Scientists have developed effective mechanisms for inclusive development of the country as a component of stabilizing its economic indicators. However, the challenges caused by the consequences of the protracted military, political and economic crisis in Ukraine lead to the transformation of models of reforming the mechanisms of attracting the country's population to its financial environment. The need for the development and subsequent implementation of a roadmap for economic policy reform in Ukraine, which would be based on empirically confirmed and statistically substantiated results of economic and mathematical modeling and forecasting of the consequences of the interaction of economic, social and environmental determinants, is becoming increasingly urgent.

The study of the sensitivity of the level of macroeconomic stability of the country and its inclusive development through the use of a wide range of economic and mathematical tools for the implementation of individual measures within the

framework of coordination of the needs and interests of the state, business and society will contribute to increasing the effectiveness of the implementation of the proposed measures. The formation of such a road map will allow to increase the level of involvement of the population in the financial environment and turn reforms in the field of inclusive development into an effective tool for increasing the level of macroeconomic stability of the country.

The implementation of the state policy of ensuring macroeconomic stability should take place through the implementation of complex measures aimed at harmonizing the social, economic and environmental goals and needs of the state, business, and society. This will make it possible to diversify the toolkit of state policy implementation depending on the object of influence and the specifics of its functioning.

The authors, on the basis of bibliometric and trend analysis, conducted a study of the economic content of the concepts of inclusive economy and macroeconomic stability. With the help of the VOSViewer toolkit, the methodological basis of the theory of macroeconomic stability and inclusive economy was improved by highlighting content-contextual and evolutionary-spatial regularities of their interaction, dominant directions, periods and critical bifurcation peaks of changes in public and scientific attention to the studied phenomena, clustering of world countries and research networks , interference of dynamic geographic and temporal patterns with regulatory changes in this area.

The developed theoretical and methodological principles for identifying the relationship between macroeconomic stability and the inclusive economy formed the basis for identifying the theoretical and conceptual regularities of this relationship (contextual, geographical and temporal dimensions) and substantiating the empirical features of its existence.

Based on the analysis, it was concluded that the concept of macroeconomic stability has undergone significant changes in recent decades.

The main imperatives of macroeconomic stability include: economic growth, employment, stability of the national currency, stable price levels, foreign economic balance. All of these components are increasingly dependent on policies aimed at achieving sustainable development goals. Which, again, makes the need for an inclusive economy.

The analysis of modern problems of ensuring the macroeconomic stability of Ukraine testified to significant energy dependence of the economy and the penetration of energy in all spheres of society. Thus, reforming the energy sector according to modern requirements dictated by changing economic realities acts as a driving force for stabilizing the economy.

REFERENCES

1. Makarenko, I. O & Vorontsova, A. S. & Yelnikova, Yu. V. & Lasukova, A. S. (2021). Bibliometric analysis of research on responsible investment. *Problems of Theory and Methodology of Accounting, Control and Analysis*, 1, 70-76. doi: 10.26642/pbo-2021-1(48)-70-76.
2. Bulavinova, N., Burdenko, I., Lehenchuk, S., Tsaruk, I., & Ostapchuk, T. (2021). Trends in research of responsible investment in the context of sustainable development: bibliometric analysis. *Agricultural and Resource Economics: International Scientific E-Journal*, 7(3), 179–99.
3. Vakulenko, I., Saher, L., Lyulyov, O., Pimonenko, T. (2021). A systematic literature review of smart grids. *Paper presented at the E3S Web of Conferences, 250*, 08006. doi: 10.1051/e3sconf/202125008006.
4. Ianchovichina, E., Lundstrom, S. (2009). Inclusive Growth Analytics: Framework and Application. *Policy Research working paper; no. WPS 4851. World Bank*. Retrieved from https://openknowledge.worldbank.org/handle/10986/4047 License: CC BY 3.0 IGO."
5. Tkalich, T. (2018). Inclusive economy as a model of world economic growth. *Scientific bulletin of V. Sukhomlynsky. Economic Sciences*, 1, 93-98.
6. Communication from the commission Europe 2020 EUA strategy for smart, sustainable and inclusive growth, 2010, 37 p.
7. Marenin O., Pisciotta A. W., Juliani T. J. (1983). Economic conditions and social control: An empirical assessment of the relationship between unemployment and incarceration in the U.S.A., 1958 to 1978. *Criminal Justice Review*, 8(1), 43–53.

8. Cheng, M. (2016). Sharing economy: A review and agenda for future research. *International Journal of Hospitality Management*, 57, 60–70.
9. D'Amato, D., Droste, N., Allen, B., Kettunen, M., Lähtinen, K., Korhonen, J., Toppinen, A. (2017). Green, circular, bio economy: A comparative analysis of sustainability avenues. *Journal of Cleaner Production*, 168, 716–734.
10. Cappelli, P., & Keller, J. R. (2013). Classifying work in the new economy. *Academy of Management Review*, 38(4), 575-596. doi:10.5465/amr.2011.0302
11. Mina, A., Bascavusoglu-Moreau, E., & Hughes, A. (2014). Open service innovation and the firm's search for external knowledge. *Research Policy*, 43(5), 853–866.
12. Gleeson, T., Alley, W. M., Allen, D. M., Sophocleous, M. A., Zhou, Y., Taniguchi, M., &Vandersteen, J. (2012). Towards sustainable groundwater use: Setting long-term goals, backcasting, and managing adaptively. *Ground Water*, 50(1), 19–26.
13. Nasir, M. A., Duc Huynh, T. L., & Xuan Tram, H. T. (2019). Role of financial development, economic growth & foreign direct investment in driving climate change: A case of emerging ASEAN. *Journal of Environmental Management*, 242, 131–141.
14. Naldi, L., Nilsson, P., Westlund, H., & Wixe, S. (2015). What is smart rural development? *Journal of Rural Studies*, 40, 90–101.
15. Balkyte, A., & Tvaronavičiene, M. (2010). Perception of competitiveness in the context of sustainable development: Facets of "sustainable competitiveness". [Konkurencingumo Suvokimas Darnaus Vystymosi Kontekste: "Darnaus Konkurencingumo" aspektai] *Journal of Business Economics and Management*, 11(2), 341-365.

16. Grimm, R., Fox, C., Baines, S., & Albertson, K. (2013). Social innovation, an answer to contemporary societal challenges? locating the concept in theory and practice. *Innovation: The European Journal of Social Science Research*, 26(4), 436–455. doi:10.1080/13511610.2013.848163
17. Childers, D. L., Cadenasso, M. L., Morgan Grove, J., Marshall, V., McGrath, B., & Pickett, S. T. A. (2015). An ecology for cities: A transformational nexus of design and ecology to advance climate change resilience and urban sustainability. *Sustainability (Switzerland)*, 7(4), 3774–3791.
18. Davoodi, H.R., Montiel, P., Ter-Martirosyan A. (2021). Macroeconomic Stability and Inclusive Growth. Retrieved from https://www.imf.org/en/Publications/WP/Issues/2021/03/19/Macroeconomic-Stability-and-Inclusive-Growth-50259.
19. Lyulyov, O. V. (2016). Macroeconomic stability determinants: international approaches analysis and dynamics of indicators in Ukraine. *Bulletin of Sumy State University. Economics series*, 3, 4–7.
20. Zolkover, A., Bozhenko, V. (2020). Appoaches to macroeconomic stability assessment. *Bulletin of Sumy State University. Economics series*, 3, 303-308. doi: 10.21272/1817-9215.2020.3-34.
21. Karabarbounis, L., & Neiman, B. (2014). The global decline of the labor share. *Quarterly Journal of Economics,* 129(1), 61–103.
22. Jiménez, G., Ongena, S., Peydró, J., &Saurina, J. (2014). Hazardous times for monetary policy: What do twenty-three million bank loans say about the effects of monetary policy on credit risk-taking? *Econometrica*, 82(2), 463– 505.

23. Fu, X., Lin, Y., & Molyneux, P. (2014). Bank competition and financial stability in Asia Pacific. *Journal of Banking and Finance*, 38(1), 64–77.
24. Jiménez, G., Lopez, J. A., & Saurina, J. (2013). How does competition affect bank risk-taking? *Journal of Financial Stability*, 9(2), 185–195.
25. Campbell, J. R., Evans, C. L., Fisher, J. D. M., & Justiniano, A. (2012). Macroeconomic effects of federal reserve forward guidance. *Brookings Papers on Economic Activity*, 1, 1–54.
26. Berg, A., Ostry, J. D., & Zettelmeyer, J. (2012). What makes growth sustained? *Journal of Development Economics*, 98(2), 149–166.
27. Jordà, O., Schularick, M., & Taylor, A. M. (2016). The great mortgaging: Housing finance, crises and business cycles. *Economic Policy*, 31(85), 107–152.
28. Behnood, A., & Mannering, F. L. (2015). The temporal stability of factors affecting driver-injury severities in single-vehicle crashes: Some empirical evidence. *Analytic Methods in Accident Research*, 8, 7–32.
29. Zbaracki, M. J., & Bergen, M. (2010). When truces collapse: A longitudinal study of price-adjustment routines. *Organization Science*, 21(5), 955–972.
30. Vazquez, F., & Federico, P. (2015). Bank funding structures and risk: Evidence from the global financial crisis. *Journal of Banking and Finance*, 61, 1–14.
31. Vasylieva, T. A. (2019). Preconditions of the transition to the clean energy concept. *European energy collaboration: modern smart specialization strategies*: monograph / edited by Vasilyeva T. A., Kolosok S. I. Szczecin: Centre of Sociological Research, 172 p.
32. Gubarieva, I. O. (2015). Strategic guidelines formation for economic security of national economy. *Actual Problems in Economics*, 168, 122.

33. Hubarieva, I., Yaroshenko, I. (2018). Ensuring financial and economic security of the timber industry complex of Ukraine. *Uzhorod National University Herald. International Economic Relations and World Economy*, 19 (1), 109–113.
34. Hubarieva, I. O., Salashenko, T. I. (2020). Strategic Aspects of Enhancing Energy Efficiency in Regions of a Country. *The Problems of Economy*, 2, 190–197.
35. Pereira, G. V., Luna-Reyes, L. F., Gil-Garcia, J. R. (2020). Governance innovations, digital transformation and the generation of public value in smart city initiatives. *ACM International Conference Proceeding Series*, 602–608.
36. Pereira G. V., Wimmer M., Ronzhyn A. (2020). Research needs for disruptive technologies in smart cities. ACM *International Conference Proceeding Series,* 620–627.
37. Sotnyk, I. M., Sotnyk, M. I. (2015). Increasing the energy efficiency of budgetary objects as a component of sustainable development of the region. *Sustainable human development of local communities: scientific works of universities-partners of the EU/UNDP Project "Community-Oriented Local Development"*; in general ed. MA. Lepsky Zaporizhzhia: Zaporizhia National University, 2015. P. 323–329.
38. Pelenc, J., Wallenborn, G., Milanesi, J., Sébastien, L., Vastenaekels, J., etc. (2019). Alternative and resistance movements: The two faces of sustainability transformations? *Ecological Economics*, 59, 373–378.
39. Wallenborn, G., Wilhite, H. (2014). Rethinking embodied knowledge and household consumption. *Energy Research and Social Science*, 1, 56–64.
40. Wallenborn, G., Orsini, M., Vanhaverbeke, J. (2011). Household appropriation of electricity monitors. *International Journal of Consumer Studies*, 35(2), 146–152.

41. Vakulenko, I. A. (2020). Organizational and economic principles of smart grid implementation in the energy sector of Ukraine. PhD thesis, 252 p.
42. Abdel-A, E., D'Andrade, B. W. (2017). Transmission Grid Smart Technologies. Smart, Secure, Green and Reliable, 37–55. Retrieved from www.sciencedirect.com/science/article/pii/B9780128053218000021
43. Moon, J., Park, J. (2014). Smart production scheduling with time-dependent and machine-dependent electricity cost by considering distributed energy resources and energy storage. *International Journal of Production Research*, 52(13), 3922–3939.
44. Tuballa, M. L., Abundo, M. L. (2016). A review of the development of Smart Grid technologies. *Renewable and Sustainable Energy Reviews*, 59, 710–725.
45. Wang, Y., Huang, Y., Wang, Y., Zeng, M., Li, F., etc. (2018). Energy management of smart micro-grid with response loads and distributed generation considering demand response. *Journal of Cleaner Production*, 197, 1069–1083.
46. Assessment of the state and implementation of the concept of "intelligent" power grids development in world practice. Retrieved from https://ua.energy/wp-content/uploads/2018/01/3.-Smart-Grid.pdf
47. Official website of International Energy Agency. Retrieved from https://www.iea.org/areas-of-work/global-engagement
48. Hossain, M. S., Madlool, N. A., Rahim, N. A., Selvaraj, J., etc. (2016). Role of smart grid in renewable energy: An overview. *Renewable and Sustainable Energy Reviews*, 60, 1168–1184.
49. Official website of European Commission (2021). Retrieved fromhttps://ec.europa.eu.

50. Official website of Eurostat (2021). Retrieved from https://ec.europa.eu/eurostat/home?
51. International Energy Agency: official website. Retrieved fromhttps://www.iea.org/areas-of-work/global-engagement.
52. Official website of World Bank (2021). Retrieved from https://www.worldbank.org.
53. Official website of State Statistics Service of Ukraine. Retrieved from http://www.ukrstat.gov.ua.
54. On the electricity market: Law of Ukraine № 2019-VIII of 13.04.2017. Retrieved from https://zakon.rada.gov.ua/laws/term/38583.
55. Distributed energy production: benefits and opportunities for every Ukrainian. Retrieved from https://ecoaction.org.ua/rozpodilene-vyrobnyctvo-energii.html.
56. Vakulenko, I., Kolosok, S. (2019). Typology of "smart" environmentally friendly energy solutions adapted to the peculiarities of domestic energy networks. *Bulletin of Sumy State University. Series: Economics*, 2, 21–25.
57. Six innovations of the distribution network of the future. Retrieved from: https://vsenergy.com.ua/categories-page/shist-innovacij-rozpodilchoi-merezhi-majbutnogo/.
58. Keller, V., Lyseng, B., Wade, C., Scholtysik, S., Fowler, M., Donald, J., Rowe, A. (2019). Electricity system and emission impact of direct and indirect electrification of heavy-duty transportation. *Energy*, 172, 740–751.
59. Keller, V., English, J., Fernandez, J., Wade, C., Fowler, M., Scholtysik, S., etc. (2019). Electrification of road transportation with utility controlled charging: A case study for British Columbia with a 93% renewable electricity target. *Applied Energy*, 253, 1.
60. Kester, J., Noel, L., Zarazua de Rubens, G., Sovacool, B. K. (2018). Policy mechanisms to accelerate

electric vehicle adoption: A qualitative review from the nordic region. *Renewable and Sustainable Energy Reviews*, 94, 719–731.
61. Noel, L., Zarazua de Rubens, G., Kester, J., Sovacool, B. K. (2019). Navigating expert skepticism and consumer distrust: Rethinking the barriers to vehicle-to- grid (V2G) in the Nordic region. *Transport Policy*, 76, 67– 77.
62. Sovacool, B. K., Kester, J., Noel, L., De Rubens, G. Z. (2019). Income, political affiliation, urbanism and geography in stated preferences for electric vehicles (EVs) and vehicle-to-grid (V2G) technologies in northern Europe. *Journal of Transport Geography*, 78, 214–229.
63. Sovacool, B. K., Noel, L., Kester, J., Zarazua de Rubens, G. (2018). Reviewing Nordic transport challenges and climate policy priorities: Expert perceptions of decarbonisation in Denmark, Finland, Iceland, Norway, Sweden. *Energy*, 165, 532–542.
64. Dobriansky, L., Ghatikar, G., Ton, D. (2018). Smart microgrids: Re-visioning smart grid and smart city development in India. *Compendium of Technical Papers*, 273-288.
65. Gopakumar, P., Reddy, M. J. B., Mohanta, D. K. (2013). Renewable energy utilization using low power microgrid system. *International Conference on Power, Energy and Control*, ICPEC, 751–755.
66. Abid, S., Alghamdi, T. A., Haseeb, A., Wadud, Z., Ahmed, A., Javaid, N. (2019). An economical energy management strategy for viable microgrid modes. *Electronics*, 8(12), 1442.
67. Ton, D., Reilly, J. (2017). Microgrid controller initiatives. *IEEE Power and Energy Magazine*, 15(4), 24–31.
68. Schneider, K. P., Radhakrishnan, N., Tang, Y., Tuffner, F. K., Liu, C., Xie, J., Ton, D. (2019). Improving

primary frequency response to support networked microgrid operations. *IEEE Transactions on Power Systems*, 34(1), 659–667.
69. Sukhodolya, O. (2005). *Energy efficiency of the economy in the context of national security: research methodology and implementation mechanisms*: monograph, 400 p.
70. Sukhodolya, O. (2005). Model of energy consumption analysis and determination of the energy efficiency level of the national economy. *Economy of Ukraine*, 5, 31–37.
71. Olmos, L., Ruester, S., Liong, S., Glachant, J. (2011). Energy efficiency actions related to the rollout of smart meters for small consumers, application to the austrian system. *Energy*, 36(7), 4396–4409.
72. Directive for the Promotion of the Use of Energy from Renewable Sources, RES. Retrieved from https://eur-lex.europa.eu/eli/dir/2009/28/oj.
73. Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency. Retrieved from https://eur-lex.europa.eu/eli/dir/2012/27/oj.
74. 2012/148/EU Commission Recommendation of 9 March 2012 on preparations for the roll-out of smart metering systems. Retrieved from https://eur-lex.europa.eu/eli/reco/2012/148/oj.
75. Strategic Energy Technology Plan. Retrieved fromhttps://ec.europa.eu/energy/en/topics/technology-and-innovation/strategic-energy-technology-plan.
76. Elguezabal, P., Arregi, B., Armijo, A., Schuetz, P., Gwerder, D., Scoccia, R. (2019). Optimization module for filtering and ranking alternative energy replacement systems, in an online ICT design tool for building retrofits. *Journal of Physics: Conference Serie*, 1, 1343.
77. Gopakumar, P., Reddy, M. J. B., Mohanta, D. K. (2015). Adaptive fault identification and classification methodology for smart power grids using synchronous

phasor angle measurements. *IET Generation, Transmission and Distribution*, 9(2), 133–145.
78. Reddy, M. J. B., Rajesh, D. V., Gopakumar, P., Mohanta, D. K. (2014). Smart fault location for smart grid operation using RTUs and computational intelligence techniques. *IEEE Systems Journal*, 8(4), 1260–1271.
79. English, J., Niet, T., Lyseng, B., Keller, V., Palmer- Wilson, K., Robertson, B. (2020). Flexibility requirements and electricity system planning: Assessing inter-regional coordination with large penetrations of variable renewable supplies. *Renewable Energy*, 145, 2770–2782.
80. Sotnyk, I. (2019). Development of renewable energy in Ukraine and the world: a comparative analysis. *Energy efficiency and renewable energy in Ukraine: management problems*: a monograph / edited by Sotnyk I.M., 28–53.
81. Kubatko, O. (2016). Ecological innovations as a source of fluctuations of national economy energy efficient development. *Marketing and management of innovation*, 4, 365–376.
82. Smart grids. Retrieved fromhttps://ua.energy/majbutnye-ukrenergo/smart-grid/
83. Common Information Model. Retrieved from https://www.entsoe.eu/digital/common-information-model/#developing-cim-standards.
84. Research on the Evaluation Model of a Smart Grid Development Level Based on Differentiation of Development Demand. Retrieved fromhttps://www.mdpi.com/2071-1050/10/11/4047/pdf.
85. Jones, D. (2021). EU Power Sector in 2020. Retrieved from https://ember-climate.org/project/eu-power-sector- 2020/
86. Shapiro, S. S., Wilk, M. B. An Analysis of Variance Test for Normality (Complete Samples). Retrieved from https://www.jstor.org/stable/2333709?seq=1

87. Levene Test for Equality of Variances. Retrieved from https://www.itl.nist.gov/div898/handbook/eda/section3/eda35a.htm
88. Student's criterion. Retrieved fromhttp://fpo.bsmu.edu.ua/static/t-kryteriy-styudenta
89. Rudenko, V. M. (2012). Mathematical statistics. Tutorial, 304.
90. Abdolmajid, A., Aziz, A., Aziz, S. (2014). The estimation of Iran‘s macroeconomics instability index. *Management Science Letters*, 4, 871–882.
91. Abdul-Khaliq, S., Soufan, T., & Shihab, R. A. (2014). The relationship between unemployment and economic growth rate in Arab Country. *Journal of Economics and Sustainable Development*, 2222-1700.
92. Acemoglu, D., Johnson, S., Robinson, J., Thaicharoen, Y. (2003). Institutional causes, macroeconomic symptoms: volatility, crises and growth. *Journal of monetary economics, 50(1), 49-123.*
93. Alesina, A., Ozler, S., Roubini, N., Swagel, P. (1996). Political in stability and economic growth. *Journal of Economic Growth,* 1 (2),189–211.
94. Ali, A., Rehman, H. U. (2015). Macroeconomic Instabilityand Its Impact on Gross Domestic Product: An Empirical Analysis of Pakistan. *Pakistan Economic and Social Review*, 53(2), 285-316.
95. Almfraji, M. A. and Almsafir, M. K. (2014). Foreign direct investment and economic growth literature review from 1994 to 2012. *Procedia-Social and Behavioral Sciences*, 129, 206-213.
96. Fatas, A. (2009). Macroeconomic imbalances and the current recession. Retrieved from http://fatasmihov.blogspot.com/2009/03/macroeconomic-imbalances-and-current.html.
97. Antwi, S., Mills, E.F., Zhao, X. (2013). Impact of

Macroeconomic factors on economic growth in Ghana: A co integration analysis, *International journal of academic research in accounting, finance and management sciences*, 3(1), 35-45.

98. Arefyeva, O.V., Horodyanska, D.M. (2008). Economic stability of the enterprise: essence, components and its providing methods‖. *Urgent economy problems*, 8(86), 83-90.
99. Barro, R. J. (1991). Economic growth in a cross section of countries. *The quarterly journal of economics*, 106(2), 407-443.
100. Barro, Robert J. (1989), A Cross-Country Study of Growth, Saving, and Government, NBER Working Paper, No 2855.9.
101. Beerli, A., & Martín, J. D. (2004). Factors influencing destination image. *Annals of Tourism Research*, 31(3), 657–681.
102. Bhowmik, D. (2018). Financial Crises and Nexus Between Economic Growth and Foreign Direct Investment. *Financial Markets, Institutions and Risks*, 2(1), 58-74
103. Bleaney, M. F. (1996). Macroeconomic stability, investment and growth in developing countries. *Journal of development economics*, 48(2), 461-477.
104. Bloom, D. E., Canning, D., & Sevilla, J. (2001). Economic growth and the demographic transition. National Bureau of Economic Research, No. w8685. Retrieved from http://www.nber.org/papers/w8685
105. Campos, N. F., Nugent, J. B. (2000).Who is afraid of political instability. *Journal of Development Economics*, 67, 157–172.
106. Cárdenas, M., & Urrutia, M. (1995). Macroeconomic Instability and Social Progress. In Reform, Recovery, and Growth: Latin America and the Middle East (pp.79-

114).University of Chicago Press.
107. Castells-Quintana, D., & Royuela, V. (2012). Unemployment and long-run economic growth: The role of income inequality and urbanisation. Investigaciones Regionales, (24), 153-173
108. Cingano, F. (2014). Trends in income inequality and its impact on economic growth. OECD Social, Employment and Migration Working Papers, №163. Retrieved from http://www.oecd-ilibrary.org/social-issues-migration-health/trends-in-income-inequality-and-its-impact-on-economic-growth_5jxrjncwxv6j-en
109. Corruption perceptions index. (2017). Transparency International. Retrieved from https://www.transparency.org/research/cpi/overview
110. Dealing with macroeconomic imbalances (2017). European Commission. Retrieved from https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/macroeconomic-imbalance-procedure/dealing-macroeconomic-imbalances_en
111. Denison, E. (2011). Trends in American economic growth. Brookings Institution Press.
112. Dieckmann, O. (1996). Cultural determinants of economic growth: Theory and evidence. *Journal of Cultural Economics, 20*(4), 297-320.
113. Essl, S., & Stiglbauer, A. (2011). Prevention and correction of Macroeconomic imbalances: the excessive imbalances Procedure. *Monetary Policy & the Economy* 4, 99-113.
114. European Commission. (2015). Adding employment indicators to the scoreboard of the Macroeconomic Imbalance Procedure to better capture employment and social development, Brussels, 4 September 2015.

Retrieved from http://ec.europa.eu/economy_finance/economic_governance/documents/employment_indicators_mip_en.pdf
115. European Parliament. (2011). Regulation (EU) No 1174/2011 of the European Parliament and of the Council of 16 November 2011: On enforcement measures to correct excessive macroeconomic imbalances in the euro area. Official Journal of the European Union. 23 November 2011. Retrieved from http://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex:32011R1174
116. European Parliament. (2011). Regulation (EU) No 1176/2011 of the European Parliament and of the Council of 16 November 2011: On the prevention and correction of macroeconomic imbalances. Official Journal of the European Union. 23 November 2011. Retrieved from :http://eur-lex.europa.eu/legal-content/en/TXT/?uri=celex%3A32011R1176
117. Eurostat. (2017). The indicators in the Macroeconomic Imbalance Procedure. Retrieved from http://ec.europa.eu/eurostat/web/macroeconomic-imbalances-procedure/indicators
118. Feltenstein, A., & Iwata, S. (2005). Decentralization and macroeconomic performance in China: regional autonomy has its costs. *Journal of Development Economics,76*(2), 481-501.
119. Fischer, S. (1993). The role of macroeconomic factors in growth. *Journal of monetary economics, 32*(3), 485-512.
120. GII. (2017). Global innovation index. Cornell University, INSEAD, and the World Intellectual Property Organization. Retrieved from https://www.globalinnovationindex.org/analysis-indicator
121. Tobias, A., Boyarchenko, N., Giannone, D. (2019).

Vulnerable Growth. *American Economic Review*, 109(4), 1263-1289.
122. Aghion, P., Abhijit B., Piketty, T. (1999). Dualism and Macroeconomic Volatility. *The Quarterly Journal of Economics*, 114(4), 1359- 1397.
123. Aizenman, J., Yothin J., Gemma, E., Shu, T. (2018), Flexibility of Adjustment to Shocks: Economic Growth and Volatility of Middle-Income Countries. Emerging Markets Finance and Trade, 54(5), 1112-1131.
124. Baldacci, E., De Mello, L., Inchauste, G. (2002). Financial crises, poverty and income distribution. IMF Working Paper 02/4. International Monetary Fund, Washington.
125. Banerjee, A. V., Esther D. (2003). Inequality and Growth: What Can the Data Say? *Journal of Economic Growth*, 8(3), 267-299.
126. Barlevy, G., Tsiddon, D. (2006). Earnings inequality and the business cycle. *European Economic Review*, 50, 55-89.
127. Christian, B., Born, B., Luetticke, R. (2020). Shocks, Frictions, and Inequality in U.S. Business Cycles. Retrieved from https://voxeu.org/article/shocks-frictionsand-inequality-us-business-cycles
128. Andrew, B., Ostry, J. (2017). Inequality and Unsustainable Growth: Two sides of the same coin? IMF Economic Review, 65(4), 792-815.
129. Andrew, B., Ostry, J., Tsangarides, C., Yakhshilikov, Y. (2018). Redistribution, Inequality, and Growth: New Evidence. *Journal of Economic Growth*, 23,259-305.
130. Bordo, M. D., Meissner, C. M. (2012). Does inequality lead to a financial crisis? *Journal of International Money and Finance*, 31(8), 2147-2161.
131. Richard, B., Garcia-Penalosa, C. (2005). Income Inequality and Macroeconomic Volatility: An Empirical

Investigation. *Review of Development Economics*, 9(3), 380-398.
132. Ahamed, M. M., Mallick, S. K. (2019). Is financial inclusion good for bank stability? International evidence. *Journal of Economic Behavior and Organization*, 157, 403-427.
133. Bruhn, M., Love, I. (2014). The real impact of improved access to finance: Evidence from Mexico. *The Journal of Finance*, 69(3), 1347-1376.
134. Camara, N., Tuesta, D. (2014). Measuring financial inclusion: A muldimensional index. Working Paper, Nº 14/26, 40 p.
135. Cihak, M., Mare, D. S., Melecky, M. (2016). The nexus of financial inclusion and financial stability: A study of trade-offs and synergies. Policy Research Working Paper 7722.
136. Creel, J., Hubert, P., Labondance, F. (2015). Financial stability and economic performance. *Economic Modelling*, 48, 25-40.
137. En, F., Demirguc-Kunt, A., Klapper, L., Peria, M. S. (2012). The Foundations of Financial Inclusion: Understanding Ownership and Use of Formal Accounts. Policy Research Working Paper; No. 6290. World Bank, Washington, DC. http://localhost:14773//entities/publication/b34c09d6-239b-5b12-9aa0-49cd2b84aa14
138. Kim, D. W. & Yu, J. S., Hassan, M. K. (2018). Financial inclusion and economic growth in OIC countries. *Research in International Business and Finance*, 43(C), 1-14. https://doi.org/10.1016/j.ribaf.2017.07.178
139. Kim, J. H. (2016). A Study on the Effect of Financial Inclusion on the Relationship Between Income Inequality and Economic Growth. *Emerging Markets Finance and Trade*, 52(2), 498-512.

https://doi.org/10.1080/1540496X.2016.1110467
140. Lopez, T, Winkler, A. (2018). The challenge of rural financial inclusion–evidence from microfinance. *Applied Economics*, 50(14), 1555-1577.

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Authors

©Ph.D. Liudmyla Saher
Sumy State University, Ukraine

Prof. Dr. Tetiana Vasylieva
Sumy State University, Ukraine

Dr. Inna Tiutiunyk
Sumy State University, Ukraine

Reviewers

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