

# The Current State of Industrial Production in the European Union and New Recovery Solutions

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## Abstract

Industrial activity is of great importance in the economic development of all countries, but in the last decades the results of this branch of the economies of many countries have faced various problems due to the systemic crises that economies in transition, but also the economies of developed countries, are going through. In this article, we propose to review some aspects of the situation regarding industrial production in EU countries, with a stronger focus on industrial production in Romania. It is more necessary to study these topics considering the crisis of the Covid-19 Pandemic, the geopolitical crisis in the region that has stopped multiple logistic processes related to the industry. In other words, it is important to connect the industrial strategies and policies of the European Union countries for the development of Industry 4.0/5.0, to digitize production systems, digital technological processes and robotization, efficient management of the production and distribution chain. We propose to outline the main objectives that must be taken into account for the development of new industrial policies focused on new directions of development for the Romanian economy.

## Keywords

Industrial production, industrial policy, industry 4.0, decarbonization of the economy, digitalization

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## Introduction

In this article he aimed to make a statistical analysis of the evolution of industrial production in the countries of the European Union and especially in Romania in the current conditions of multiple crises that Europe is facing today. We propose to do the bibliographic study of the specialized literature in the field, through which we can identify the experience of researchers from different countries who have studied the respective problem regarding the situation of industrial production, of industrial policy both in the EU member countries and in other states, such as be the experience of China for example. These studies will allow us to identify policies and strategies that will help us know how we can develop industrial policies both in Romania and in other EU member countries. We want to mention the authors (Criscuolo, Lalanne and Díaz, 2022), who studied the problem of quantifying industrial strategies and measuring industrial policy expenses. Authors (Coyle and Muhtar, 2021), studied UK industrial policy, oriented towards learning from the past, Author (Zurstrassen, 2022). EU industrial policy in the steel industry, author (Timmers, 2022), the digital industrial policy for Europe. Not least, it is of interest The OECD report on industrial policy was based on a new industrial policy framework analysis developed by (Criscuolo et al., 2022), the paper reviews the study bibliography on the effectiveness of industrial policy, the tools applied He argues that well-designed economic incentives for companies and good framework conditions that shape

the business environment are effective. In this article, we proposed an analysis of the evolution of industrial production in the European Union, a review of the scientific literature in the industrial field and the new industrial development priorities and development by promoting viable and functional industrial policies.

### 1. Analysis of the evolution of industrial production in the European Union

Although recently we are facing multiple crises both in Europe and globally, in 2021, the value of production sold in the EU amounted to 5,209 billion Euros, an increase of almost 14% compared to 4,581 billion Euros in year 2020, in current prices. In the period 2011-2014, the value generated by the production of EU member countries was stable. Between 2014 and 2018, there was a steady annual increase from the previous year. In 2019, production growth was consolidated, with a value of production sold in the EU reaching 4,945 billion euros. In the countries of the European Union, decreases were recorded in the production of clothing. In 2021, EU countries produced more than EUR 3.5 billion of articles, which constituted EUR 27.8 billion. This product decreased by 5% in 2021, compared to 23% since the pandemic break in 2019. Italians produced more than 50% of the value sold at the level of EU countries (around EUR 14 billion). In second place is Spain, Portugal in third place, which constituted 5.5 billion Euros. Germany, Romania and Bulgaria were in the top 6 producers in the EU, 85% of the total production in the EU. Industrial production in Romania, in May 2022, registered a decrease of 0.1% compared to the previous month, as a result of the decreases recorded by the manufacturing industry (-2.3%), the extractive industry (-1.7%). but with an increase of 1.1% compared to May of the previous year (2021) (INSSE, 2022). In the first five months of 2022, industrial production was down by 2.4% compared to the corresponding period of 2021, as a result of the decreases in the three industrial sectors: the production and supply of electricity and thermal energy, gas, hot water and air conditioning (-5.8%), extractive industry (-4.3%), manufacturing industry (-1.2%). The production and supply of electricity and thermal energy, gas, hot water and air conditioning increased by 4.3% compared to April.

**Table no. 1. Evolution of the annual growth of industrial production in the member countries of the European Union (%)**

	2018	2019	2020	2021	2022
EU - 27 from 2020	106.4	106.2	98.5	107.5	110.8
Euro area - 20 (from 2023	105.3	104.6	96.6	105.2	107.6
Euro area - 19 (2015- 2022)	105.3	104.6	96.6	105.2	107.5
Belgium	108.7	114.0	109.7	128.1	127.2
Bulgaria	107.0	107.6	100.9	111.1	125.3
Czechia	113.6	113.2	105.1	112.0	114.8
Denmark	108.7	111.6	105.0	113.7	130.8
Germany,until 1990	104.7	101.3	91.6	95.9	95.4
Estonia	112.5	120.5	117.1	132.1	129.1
Ireland	97.3	104.1	119.2	153.0	181.9
Greece	108.8	108.0	105.7	116.6	119.5
Spain	105.4	106.0	95.6	102.8	105.9
France	103.5	104.1	92.8	98.2	98.1
Croatia	105.9	106.5	102.9	109.4	111.2
Italy	106.5	105.3	93.3	104.7	105.1
Cyprus	127.2	132.9	123.2	131.1	132.8
Latvia	116.1	117.0	115.0	122.4	123.4
Lithuania	116.3	119.7	117.4	141.2	154.4
Luxembourg	102.2	99.0	88.3	95.7	94.5
Hungary	110.1	116.3	100.1	118.8	125.6
Malta	102.4	103.5	103.2	103.0	106.0

Netherlands	103.3	102.4	98.4	103.3	105.9
Austria	113.5	113.4	106.8	118.9	127.8
Poland	116.6	121.6	119.0	136.7	151.8
Portugal	106.2	103.9	96.3	99.6	99.6
Romania	118.1	114.3	103.7	110.6	108.7
Slovenia	120.7	124.5	117.9	130.0	132.0
Slovakia	111.7	112.5	103.4	114.1	109.9
Finland	111.2	113.0	109.4	114.0	118.4
Sweden	109.3	111.9	106.4	113.0	115.8

*Source: Eurostat, 2022*

According to the information of the National Institute of Statistics in Romania, industrial production in Romania decreased by 6.1% compared to last year, in January 2023, after a decrease of 6.3% in the previous month. It was the third consecutive period of contraction due to declines in manufacturing output (-4.6% from -3.6% in December) and electricity, gas, steam and air conditioning production (-13.8% from -16.6%). Meanwhile, mining and quarrying output rebounded (0.8% vs. -1.1). On a monthly basis, industrial production rose 2.0 percent in January, the first monthly increase in five months, rebounding from a 1.6 percent decline in December.

**Table no. 2. Evolution of monthly industrial production growth in 2022-2023**

**(in % of monthly data, 2022-2023)**

	2022-04	2022-05	2022-06	2022-07	2022-08	2022-09	2022-10	2022-11	2022-12	2023-01
EU - 27, from 2020	109	110.7	112.6	109.8	111.8	112.3	110.2	111.6	110.9	111.2
Euro area - 20 countries, (from 2023)	105	107.6	109.7	106.2	108.7	109.1	107.1	108.6	107.2	107.9
Euro area - 19 countries, from 2015-2022	105	107.6	109.7	106.1	108.7	109.1	107.1	108.6	107.2	107.9
Romania	111	110.6	108	108.5	108.5	108.6	108.1	104.2	107	102.4

*Source: Eurostat, 2022*

The beginning of 2022 was very difficult and worrying at the global level, due to the consequences of the pandemic, but especially the geopolitical and military context in region, which caused imbalances, being also felt on the main commodity markets, stock exchanges and financial markets, consumption and services. We see the results in the significant increase in the prices of consumer goods, the revision of economic growth forecasts, in the shaping of the basis for the increase in monetary policy interest rates. Supply chains were affected for industry and commerce.

## 2. Review of the scientific literature

Complementarities between economic incentives and interventions such as skills policies, framework conditions, competition and trade policies are highlighted (Androniceanu et al., 2017). The authors reflected the opportunities for the adoption of robotic applications, through the perspective of the marketing mix, by describing the current state of the integration of industrial robots in Romanian enterprises and on the labor market, in contrast to other economies of the European Union. The respective research highlights the impact of industrial robots within enterprises, taking into account the standard of living of the population, perceived by GDP per capita. Exploratory research was carried out based on secondary data on the evolution of the robotics sector in Romania, in relation to the dynamics of the global robotics market and the European Union. The authors performed a principal components analysis, which revealed the main factors that contributed to the dynamics of the enterprise statistics at the national level. That analysis reflected the fact that greater integration of industrial robots contributed to lower employment rates in the six EU countries considered, while having positive correlations with GDP per capita and productivity appearance of work. We can highlight that the impact of industrial robots contributes to the increase in remuneration, suggesting the potential adverse effects that automation can have on incomes.

Extensive studies on CE in the construction industry have focused on resource use and waste management. Research on CE in the construction industry clearly concludes that research focuses on the impact of CE in the areas of supply chain integration, building design, policy, energy efficiency, land use, off-site production, cost reduction and cost management, cost and risk whole life. , health and safety are limited. The focus of the empirical analysis was directed to sectors related to the so-called New Industrial Revolution (Industry 4.0) (Ďurcova, 2022). However, agriculture will always be among the most important sectors in every national economy. It is a sector that has undergone many structural changes in the last two decades. The purpose of the authors is - the detailed analysis of different indicators of this sector, especially its current position, its economic links with other internal/or external industries (from abroad) or the effects generated on employment, and the added value. The analysis is based on the input-output methodology. The results confirm the global weakening of internal links, especially on the demand side, the strengthening of import flows. From the supply side, the importance of agriculture as a supplier to other sectors is declining. The agricultural sector has lost its power and job creation potential. Regarding the indicators of added value and the value of the gross product, the authors' results confirm the important role of agriculture in the Slovak economy (Pangratie et al, 2022). In order to have results in industrial production in Romania, an important moment belongs to the development of rural areas, and the development of the eight development regions, different in evolution and development. Rural areas are particularly important both throughout Europe and in Romania, being characterized by social, economic and environmental diversity (Burlacu et al., 2022). Some rural areas enjoy good socio-economic results, in some cases better than the neighboring urban areas, with a prosperous population, with well-paid jobs . Other areas face depopulation, demographic aging, high levels of poverty, abandonment of agricultural land, dependence on small-scale agricultural production, limited/or non-existent basic services, major infrastructure problems (Radulescu et al., 2018). Authors (Tutak and Brodny, 2022) present the results of the study that reflects the assessment of the level of digital maturity of businesses in Europe, they analyze the similarities between companies in terms of the technologies implemented in Industry 4.0. It is mentioned that the digital transformation of production and service enterprises has become a common direction of development for all economic sectors (Burlacu et al., 2022). The idea of Industry 4.0 has become synonymous with innovation, it is the basis of business development (Burlacu, 2021). The role and importance of these transformations is recognized by the EU, in promoting and supporting the development of the innovative digital economy (Radulescu et al., 2018; Burlacu, et al., 2022; Hernández, Nieto, and Rodríguez, 2022) it is based on the institutional theory, and on the resource view to analyze the relationship between the governance imperfections in the country of origin, the intensity of exports of companies from economies in transition, including the examination of the moderating role of innovation. The authors' findings allow us to support the authors' conclusions, although companies from transition economies face export difficulties, due to regulatory constraints in the countries of origin, and the innovation strategy represents a viable way to overcome these limits. The study is focused on the systematic review of CE literature published between 1990 and 2019 (Osobajo et al., 2022). The study adopts the five-step procedure as the methodology for the review: formulating research questions, locating and identifying relevant studies, selecting and evaluating studies, synthesizing and reporting results. Authors (Apurbo Sarkar et al., 2022) argue the global trends in sustainable agriculture (SA) have expanded into many practical and academic studies. Many studies and analyzes have focused on various aspects of sustainable agriculture (SA): the effectiveness of pesticide management, the impact on cultivation and improvement, quantification with soil, water and air, agro-ecological activities, ecological aspects, etc. areas of interest (Bran et al., 2020; Radulescu et al., 2020; Burlacu et al., 2022). An in-depth background and data analysis is described that will support academia, science and governments to understand how SA-focused studies create environmental impacts and potential long-term impacts on the world's biodiversity. Authors (Lu, 2017), claims that in Germany, Industry 4.0, the fourth industrial revolution, has attracted a lot of attention in studying the respective problem. It is closely related to Internet of Things (IoT), Cyber Physical System (CPS), Information and Communication Technology (ICT), Enterprise Architecture (EA) and Enterprise Integration (EI). However, Industry 4.0 required a systematic and extensive review of research about it was not available. The authors perform a comprehensive analysis on Industry 4.0, present an overview of the content, scope and findings of Industry 4.0, examining the existing bibliography in all Web of Science databases.

Analysis of the concept of construction models (Grabowska and Saniuk, 2022) it is the essential aspect of the theoretical treatment of business modeling, which is part of strategic management. The interest of researchers in business models, Industry 4.0 is constantly growing. The study contributes to identifying the current state of knowledge about the concept of business models in the era of the fourth industrial revolution by analyzing the evolution of the state of knowledge and trends. Due to the broad agreement that the world community must actively combat climate change and promote green and low-carbon development, the authors (Siy et al., 2023) argue, that in order to address the problem of the relocation of carbon emissions, which is caused by the increase in the cost of industrial production, as a result of policies to reduce

greenhouse gas emissions, the EU intends to implement a Mechanism to adjust the carbon border in its entirety, starting in 2026. The pilot phase will start in 2023. This reflects the emergence of the new international trade system, coordinated by "climate change actions", "carbon peak", "carbon neutrality", which will be broad and broad in character, achieving impact on China's foreign trade industry. The authors of the paper presented policy proposals actively address the problems and effects of the EU "carbon tariff", analyzing the operation process of the EU, through the development of models, and determining the influence of the mechanism on social welfare, carbon emissions and exports.

Authors Dembicka-Niemiec et al., (2023), pursue the main objective of the research, to identify the scope of application of EU funds for the formation of the economy with low carbon emissions, by companies providing energy services in Poland in the period 2014-2020. The presented findings are new and will contribute to a better understanding in the use and management of EU funds. The author's conclusions directed towards: (1) studies of the use of EU funds by Polish energy companies indicate that the funds were an important tool in the transition to a low-carbon economy in the period 2014-2020. (2) EU funds are important in financing investments for the decarbonization of the economy. (3) The level of co-financing of investments made by energy companies was high, often exceeding half of the investment value. (3) The companies that entered the sociological research, surveyed with the support of EU funds, aimed to achieve the objectives of Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency, of bringing to reality the economy with low emissions of carbon. (4) Most of the EU support funds, allocated to infrastructure investments, are insufficient to accelerate the energy transition. (5) The projects implemented by some companies were aligned with the objectives of Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency and aimed at supporting the transition to a low-carbon economy. Therefore, half of the projects involved investments related to renewable energy sources (Angheluta et al., 2019).

Author Detsios, et al. (2023) emphasize that the Paris Agreement's Climate Change Goals are putting aviation under great pressure and environmental inspection. In particular, the aviation industry is committed to achieving a 50% reduction in CO<sub>2</sub> emissions by 2050 compared to 2005 levels. A shift to alternative aviation fuels appears imperative. The International Air Transport Association has identified the production of sustainable liquid fuels as the most promising strategy for reducing environmental impact. A critical summary of current alternative aviation fuels presented, and a comparative analysis of dominant technologies performed, considering techno-economic assessment, environmental assessment and future projections.

Authors Szymańska and Mroczek (2023) are of the opinion: "the aim of this study was to assess the energy consumption of production in selected branches of the Polish food industry and to identify its changes after Poland's accession to the EU". This issue is particularly important in the period of energy transformation and rising energy prices. The novelty of this article is the determination of changes in the energy efficiency of different branches of the food industry. The main data source was the main statistical data and unpublished data from the Central Statistics Office for the period 2004–2020. Descriptive statistics, comparative analysis and strategic group mapping used in data analysis. Indeed, food production is one of the most energy-intensive processing sectors (Rădulescu et al., 2022). Authors Berglund et al. (2022) familiarize us with EU Directive 92/57/EEC, which focuses on ensuring that health and safety aspects are considered at every stage of construction work and have been introduced into the regulations of member countries. In addition, we argue that there is a need to broaden the analysis of the implementation of EU directive 92/57/EEC also include specific national changes to health and safety management and policy. Authors Sechi, et al. (2022) claim that the share of industry in the final global energy consumption was over 30% in 2020, of which hard-to-reduce sectors represented almost 60% of consumption total end in the industry. In Europe, industry accounts for approximately 25% of final energy consumption. In order to reduce the industry's impact on energy consumption and greenhouse gas emissions, Europe has established many policies to support and regulate the sector, including pricing carbon emissions in a cap-and-trade scheme called the European Trading Scheme of emissions (EU ETS). According to the EU ETS, in 2021 the verified emissions of all stationary installations were approximately 1.3 billion tonnes of carbon dioxide equivalent emissions. In 2021, the total allocated allowances amounted to about 1 billion tonnes of carbon dioxide equivalent emissions, half of which freely allocated.

### **3. Methodological approaches for the development of industrial policy in Romania**

In order to be able to build a new industrial policy for Romania, it is welcome to see what are the objectives of the European Union in the field of industrial policy: (1) accelerating the adaptation of industry to structural changes; (2) encouraging the environment favorable to the initiative and development of EU

enterprises, in particular, of small and medium-sized enterprises; (3) encouraging the environment conducive to cooperation between enterprises; and (4) favoring the efficient exploitation of the industrial potential of innovation, research and technological development policies (Article 173 of the TFEU). During several years, the European Commission paid due attention to industrial development. We propose to go through a short x-ray of the actions of the European Commission in terms of industrial development (1) From the Europe 2020 Strategy to the new Industrial Strategy. (2) European Commission Communication from 2012, "A stronger European industry for economic growth and recovery - Update on the Communication on Industrial Policy", to support investment in innovation, focusing on six priority areas with high potential. (3) in 2014 "For a European industrial renaissance", focused on the reversal of industrial decline, of reaching the objective of 20% of GDP for manufacturing activities by 2020. In 2016, that policy was developed with the work "Digitalization of Industry European - The full exploitation of the digital single market", oriented towards the digital transformation, towards issues related to financing, ICT standardization, BIG data and skills. (4) In 2019 the "European Green Pact", aimed at mobilizing industry for a clean and circular economy (which included the ICT, steel, cement, textiles and chemicals sectors). (5) in March 2020, "A New Industrial Strategy for Europe", aimed at helping European industry to lead the dual transition to climate neutrality and digital leadership, and to strengthen the competitiveness and strategic autonomy of Europe. (6) in May 2021, the Industrial Strategy for Europe was updated, focusing on the resilience of the EU single market, EU dependencies in key strategic areas, supporting small and medium-sized enterprises (SMEs), new start-ups, accelerating green transition and prioritizing digital transformations. (7) In September 2020, it adopted the action plan on critical raw materials with the prospective study for critical raw materials for technologies and strategic sectors until 2030 and 2050.

For the development of a viable and functional industrial policy, it is necessary to consider some priority aspects. Considering the real situation, we are facing and the results that confirm the global weakening of internal ties, especially on the demand side, the strengthening of import flows. On the supply side, the importance of agriculture as a supplier to other sectors is declining. The agricultural sector has lost its strength and job creation potential. Rural areas are particularly important both throughout Europe and in Romania, being characterized by social, economic and environmental diversity (Burlacu, Stoica et al., 2022). Some rural areas enjoy good socio-economic outcomes, in some cases better than neighboring urban areas, with a prosperous population and well-paid jobs. Other areas face depopulation, demographic aging, high levels of poverty, abandonment of agricultural land, dependence on small-scale agricultural production, limited/or non-existent basic services, major infrastructure problems (Rădulescu et al., 2018).

Authors Nisula et al. (2022) argue that while the field of work is moving towards digital environments, the antecedents of knowledge workers' digital creativity remain scarce understood well. The study investigated the digital work environment as a sociotechnical environment and contextual amplifier of the digital creativity of knowledge workers. Briggs (2012) examines the apparent flourishing of community-centred digital practices in the subsequent 'post-conflict' decade, galvanized by Northern Ireland and EU policy initiatives armed with the strengthening of the peace process. The article highlights two projects - "digital memory boxes" and "interactive galleon" - developed in 2007-2008. The article continues and critically examines the processes involved in the practical realization and creative and theoretical reconciliation of digital production, engaged by the community in a certain socio-political context of academic-community collaboration. Authors Authors (Tseng et al., 2021) provide contributions to the existing literature, a state-of-the-art bibliometric analysis of sustainable industrial and operational engineering as the field moves towards Industry 4.0, and directions for future studies and practical achievements. Although industrial and operational engineering is promoted towards sustainability, the systematization of knowledge that forms the production and operations of companies, which includes their broad concepts, abundant complementary elements, industrial engineering is still absent. Bibliometric analysis and the fuzzy Delphi method are proposed. It results in a total of 30 indicators - critiqued and grouped into eight study groups, including lean manufacturing in industry 4.0, cyber-physical production system, intelligent and big data-driven communications, safety and security, artificial intelligence for sustainability, circular economy, in a digital environment, business intelligence and virtual reality and environmental sustainability. Machado et al (2020), conducted the systematic review, and to identify how sustainable manufacturing research contributes to the development of the industry 4.0 agenda, for a broader understanding of the links between Industry 4.0 and sustainable manufacturing, by mapping and summarizing existing research efforts, identifying research agendas, gaps and opportunities for research development.

## Conclusions

For the development of an effective industrial policy, it is necessary through sustainable industrial policies to support and promote the involvement of enterprises, in the design and implementation of project activities, aimed at - the creation and use of innovative solutions, in the training of human competence, in various industrialization activities with the reduction of intensity carbon of the economy.

It is necessary to financially support the low-carbon economy modeling projects of the key players in the energy sector.

Organizational support from industry in supporting creativity, innovation, digital transformations applied in industries will contribute to the modernization of industries and facilitate the use of technology in virtual and digital industrial activity.

Especially in rural areas that require sustainable economic development, especially rural areas that face depopulation, demographic aging, high levels of poverty, abandonment of agricultural land, dependence on small-scale agricultural production, limited basic services, problems of infrastructure.

Continuing deep structural reforms and developing new policies to increase economic and industrial competitiveness, ensuring sustainable growth in the medium and long term.

Creating business conditions that allow entrepreneurs and businesses to take initiatives and capitalize on existing ideas and opportunities. Developing models that suggest that the relationship between organizational support and digital creativity is moderated by the sense of virtual community that is facilitated by the ease of use of technology.

In the field of digitalization and robotization apart from IoT, CPS, ICT, big data and cloud computing, there are a variety of industrial information integration methods and techniques that we can use in enterprise architecture and enterprise integration for Industry 4.0, such as be business process management, workflow management, enterprise applications, integration, service-oriented architecture, network computing, enterprise resource planning and supply chain management.

## References

- Androniceanu, A., Burlacu, S., Drăgulănescu, I. V., & Nicolae, E.E., 2017. New trends of businesses digitalization in Romania and the behaviour young consumers. In: *BASIQ International Conference: New Trends in Sustainable Business and Consumption*, Graz, 31, pp. 27-35.
- Angheluta, S.P., Burlacu, S., Diaconu, A., and Curea, C.S., 2019. The Energy from Renewable Sources in the European Union: Achieving the Goals. *European Journal of Sustainable Development*, 8(5), p.57.
- Bartóková, E. and Ďurčová, J., 2022. Agricultural Sector and Its Importance for the Slovak Economy: Structural Analysis. *Ekonomický časopis*, 70(3), pp.237–263. <https://doi.org/10.31577/ekon-cas.2022.03.02>.
- Berglund, L., Johansson, J., Johansson, M., Nygren, M., Samuelson, B. and Stenberg, M., 2022. A post-analysis of the introduction of the EU Directive 92/57/EEC in the Swedish construction industry. *Buildings*, 12(10), p.1765.
- Bran, F., Rădulescu, C.V., Bodislav, D.A., and Burlacu, S., 2020. Environmental risks in the context of globalization. *Economic Convergence in European Union*, pp.350-356.
- Briggs, J., 2012. Investigating situated cultural practices through cross-sectoral digital collaborations: processes, policies, insights. *Digital Creativity*, 23(2), pp.98-112.
- Burlacu, S., 2021. IT Governance in Public Administration, *The 29th NISPACEE Annual Conference "Citizens' Engagement and Empowerment - The Era of Collaborative Innovation in Governance"* Ljubljana, Slovenia New term: October 21-23, 2021.
- Burlacu, S., Diaconu, A., Mocanu, V. and Gombos, S.P., 2022. The Effects of Digital Globalization on Economics and Society. In: R. Pamfilie, V. Dinu, C. Vasiliu, D. Pleșea, L. Tăchiciu eds. 2022. *8th BASIQ International Conference on New Trends in Sustainable Business and Consumption*. Graz, Austria, 25-27 May 2022. Bucharest: ASE, pp.95-100. DOI10.24818/BASIQ/2022/08/011.
- Burlacu, S., Pargaru, I., Iacob, O.C., and Gombos, S.P., 2022. Digital Public Administration and the Perspectives of Sustainable Development in Romania. *European Journal of Sustainable Development*, 11(4), pp.230-230.

- Coyle, D. and Muhtar, A., 2021. *The UK's Industrial Policy: Learning from the Past*. [online] Available at: <[https://www.bennettinstitute.cam.ac.uk/wp-content/uploads/2020/12/Industrial\\_Policy\\_-\\_Learning\\_from\\_the\\_past.pdf](https://www.bennettinstitute.cam.ac.uk/wp-content/uploads/2020/12/Industrial_Policy_-_Learning_from_the_past.pdf)> [Accessed 12 March 2023].
- Criscuolo, C., Gonne, N., Kitazawa, K. and Lalanne, G., 2022. *An industrial policy framework for OECD countries: Old debates, new perspectives*. [OECD Science, Technology and Industry Policy Papers] <https://doi.org/10.1787/0002217c-en>.
- Criscuolo, C., Lalanne, G. and Díaz, L., 2022. *Quantifying industrial strategies (QuIS): Measuring industrial policy expenditures*. [OECD Science, Technology and Industry Working Papers] <https://doi.org/10.1787/4f531faf-en>.
- Dembicka-Niemiec, A., Szafranek-Stefaniuk, E. and Kalinichenko, A., 2023. Structural and Investment Funds of the European Union as an Instrument for Creating a Low-Carbon Economy by Selected Companies of the Energy Sector in Poland. *Energies*, 16(4), p.2031.
- Detsios, N., Theodoraki, S., Maragoudaki, L., Atsonios, K., Grammelis, P. and Orfanoudakis, N.G., 2023. Recent Advances on Alternative Aviation Fuels/Pathways: A Critical Review. *Energies*, 16(4), p.1904.
- Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency and aimed at supporting the transition to a low-carbon economy.
- Eurostat, 2022. *Production in industry - annual data*. [online] Available at: <[https://ec.europa.eu/eurostat/databrowser/view/STS\\_INPR\\_A/default/table?lang=en](https://ec.europa.eu/eurostat/databrowser/view/STS_INPR_A/default/table?lang=en)> [Accessed 12 March 2023].
- Grabowska, S. and Saniuk, S., 2022. Business Models in the Industry 4.0 Environment - Results of Web of Science Bibliometric Analysis. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), p.19. <https://doi.org/10.3390/joitmc8010019>.
- Hernández, V., Nieto, M.J. and Rodríguez, A., 2022. Home country institutions and exports of firms in transition economies: does innovation matter? *Long Range Planning*, 55(1), p.102087.
- Lu, Y., 2017. Industry 4.0: A survey on technologies, applications, and open research issues. *Journal of industrial information integration*, 6, pp.1-10.
- Luo, X. and Yu, S.C., 2022. Relationship between external environment, internal conditions, and digital transformation from the perspective of synergetics. *Discrete Dynamics in Nature and Society*, 2022, pp.1-12.
- Machado, C.G., Winroth, M.P., and Ribeiro da Silva, E.H.D., 2020. Sustainable manufacturing in Industry 4.0: an emerging research agenda. *International Journal of Production Research*, 58(5), pp.1462-1484.
- Nisula, A.M., Heinänen, S., Kianto, A., Toth, I. and Blomqvist, K., 2022. A psychological perspective on the sociotechnical enablers of knowledge worker digital creativity. *Digital Creativity*, pp.1-15.
- Osojajo, O.A., Oke, A., Omotayo, T. and Obi, L.I., 2022. A systematic review of circular economy research in the construction industry. *Smart and Sustainable Built Environment*, 11(1), pp.39-64.
- Pangratic, A., 2022. Analysis of romanian development regions-a first step to support national regional development priorities. *Agricultural Management/Lucrari Stiintifice Seria I, Management Agricol*, 24(3), pp.355-363.
- Rădulescu, C.V., Angheluță, P.S., Burlacu, S., and Kant, A., 2022. Aspects Regarding Renewable Sources in the European Union. *European Journal of Sustainable Development*, 11(3), pp.93-93.
- Radulescu, C.V., Bodislav, D.A., and Burlacu, S., 2018. Demographic Explosion and IT Governance in Public Institutions. *Managerial Challenges of the Contemporary Society. Proceedings*, 11(1), p.18.
- Rădulescu, C.V., Bran, F., Burlacu, S., Dobrea, C.R., and Diaconu, S., 2020. Challenges Regarding Food Resources in the Context of Globalization and Population Growth. In: *Proceedings of the International Conference on Economics and Social Sciences*, pp.1041-1052.
- Rădulescu, C.V., Dobrea, R.C., and Burlacu, S., 2018. The Business Management of Distress Situations. *The 12th International Management Conference "Management Perspectives in the Digital Era"* Novembre 1st-2nd, 2018, Bucharest, Romania, 741-747.
- Sechi, S., Giarola, S. and Leone, P., 2022. Taxonomy for Industrial Cluster Decarbonization: An Analysis for the Italian Hard-to-Abate Industry. *Energies*, 15(22), p.8586.
- Siy, A.L., Wang, A., Zheng, T. and Hu, X., 2023. Research on the Impact of the EU's Carbon Border Adjustment Mechanism: Based on the GTAP Model. *Sustainability*, 15(6), p.4761.
- Szymańska, E.J. and Mroczek, R., 2023. Energy Intensity of Food Industry Production in Poland in the Process of Energy Transformation. *Energies*, 16(4), p.1843.



- Timmers, P., 2022. *Digital industrial policy for Europe*. [pdf] Available at: <<https://cerre.eu/wp-content/uploads/2022/12/Digital-Industrial-Policy-for-Europe.pdf>> [Accessed 12 March 2023].
- Tseng, M.L., Tran, T.P.T., Ha, H.M., Bui, T.D. and Lim, M.K., 2021. Sustainable industrial and operation engineering trends and challenges Toward Industry 4.0: A data driven analysis. *Journal of Industrial and Production Engineering*, 38(8), pp.581-598.
- Tutak, M. and Brodny, J., 2022. Business digital maturity in Europe and its implication for open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), p.27.
- Zurstrassen, D., 2022. *EU industrial policy in the steel industry: historical background and current challenges*. Leuven global governance series. Cheltenham, UK ; Northampton,MA, USA: Edward Elgar Publishing.