Symbiosis of Creativity and Sustainability: Modelling the Dynamic Relationship Between Sustainable Development and Cultural and Creative Industries in the EU Countries, Great Britain and Ukraine

Symbioza kreatywności i zrównoważonego rozwoju: modelowanie dynamicznych relacji pomiędzy zrównoważonym rozwojem a kulturą i przemysłem kreatywnym w krajach UE, Wielkiej Brytanii i Ukrainie

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Abstract
The study explores the complex dynamics of cultural and creative industries and their potential to contribute to the achievement of the Sustainable Development Goals (SDGs). The dual nature of these industries is reviewed, recognizing their potential to have a positive impact on sustainable development while addressing the risks they pose, including environmental threats and the potential for increased social inequality. The main goal of the study was to identify the determinants of asymmetric shocks that influenced the development of cultural and creative industries. To achieve the goal, we used an integrated modeling approach based on panel models with fixed and random effects, as well as a two-stage dynamic panel model. The results of the study made it possible to identify asymmetric shocks that influenced the development of cultural and creative industries, such as the consequences of the pandemic and the war in Ukraine, which led to the energy and migration crises, slower economic growth and increased inflation. The results obtained indicate that the influence of the selected factors on sustainable development is complex and depends on time dynamics.

Key words: sustainable development, creative economy, creative industries, cultural industries, modelling of territory development, panel modelling

Streszczenie

Badanie analizuje złożoną dynamikę sektora kultury i sektora kreatywnego oraz ich zdolność przyczyniania się do osiągnięcia Celów zrównoważonego rozwoju (SDGs). Opisano dwoisty charakter tych branż, ukazując ich potencjał w zakresie pozytywnego wpływu na zrównoważony rozwój, przy jednoczesnym eliminowaniu zagrożeń, jakie stwarzają, w tym zagrożeń dla środowiska i zwiększania nierówności społecznych. Głównym celem badania była identyfikacja determinantów szoków asymetrycznych, które wpłynęły na rozwój sektora kultury i sektorów kreatywnych. Aby osiągnąć ten cel, zastosowaliśmy zintegrowane podejście do modelowania oparte na modelach panelowych z efektami stałymi i losowymi, a także dwuetapowy dynamiczny model panelowy. Wyniki badania pozwoliły zidentyfikować szoki asymetryczne, które miały wpływ na rozwój sektora kultury i sektorów kreatywnych, takie jak konsekwencje pandemii i wojny na Ukrainie, które doprowadziły do kryzysu energetycznego i migracyjnego, spowolnienia wzrostu gospodarczego i wzrostu inflacji. Uzyskane wyniki wskazują, że wpływ wybranych czynników na zrównoważony rozwój jest złożony i zależny od czasu.

Słowa kluczowe: zrównoważony rozwój, gospodarka kreatywna, sektory kreatywne, sektor kultury, modelowanie rozwoju terytorialnego, modelowanie panelowe

1. Introduction

Cultural, creative industries are playing an increasingly important role on the global stage, including for achieving the sustainable development goals, which are setting the agenda for United Nations (UN) Member States until 2030 (United Nations, 2015). The relevance of the discourse on the impact of creative industries on sustainable development of territories is confirmed by the fact that 2021 was declared the International Year of the Creative Economy for Sustainable Development at the 74th session of the UN General Assembly (UNCTAD, 2021).

Progress on sustainable development is impressive, but it does not show an exclusively positive trend. Opportunities for generalised quantitative assessment are limited and do not always allow analysing spatial and temporal dynamics in terms of individual territories, countries and regions (Xu, Chau, Chen et al., 2020; Geels, Kern, Clark, 2023; Lenzen, Geschke, West et al., 2022). In the context of studying the relationship between the development of the creative industries and sustainable development, it is necessary to consider their mutual influence both in terms of synergies and compromises. Given the relevance of identifying tensions and synergies in the process of achieving sustainable development goals, we consider the wide range of influences that are achieved by the development of cultural, creative industries.

In the academic community, the most frequently raised issues relate to the economic growth achieved through the development of cultural, creative industries, as measured by the industry's contribution to GDP, job creation and the stimulation of innovation. The economic aspects are the most obvious, researched and, for the most part, positive manifestations of the creative industries' impact on the economic component of sustainable development. However, studies increasingly reflect the view that the impact of cultural, creative industries on the economy *goes beyond mere contributions to employment and production, and that they contribute to technological progress and long-term EU development* (Boix-Domènech & Rausell-Köster, 2018).

Cultural, creative industries, through a variety of forms of content, can raise awareness of environmental issues and encourage sustainable practices in production and consumption. Positive effects on the environment are also achieved through the introduction of digital technologies that reduce the environmental impact of production processes in the field under consideration. In addition, significant changes in the development of cultural, creative industries and their increasing influence on socio-economic processes and social consciousness are the result of the fourth industrial revolution (Industry 4.0), associated with the convergence of digital and physical technologies, including artificial intelligence and machine learning, the Internet of Things (IoT), additive manufacturing, robotics and big data analytics (Creative Industries, 2021).

Cultural, creative industries also contribute to social inclusion by providing platforms for diverse opinions, fostering cultural expression and intercultural dialogue, helping to preserve cultural heritage and diversity. This strengthens social cohesion, contributes to a sense of identity and belonging, as well as influences the social dimension of sustainable development. Within the framework of the International Year of the Creative Economy for Sustainable Development, activities were undertaken to support the diversity of cultural expressions, to preserve cultural identity (UNCTAD, 2021).

When examining the impact of the development of cultural, creative industries on sustainable development, it is necessary to consider the asymmetric shocks that the global economy has experienced over the past few decades and to which European states have been particularly sensitive (Borrell, 2022). And while the first asymmetric shock - financial and economic crisis of 2008 and Euro zone crisis that followed – has passed, the consequences of COVID-19 pandemic and full-scale invasion of Ukraine by the Russian Federation in 2022 will continue to shape prospects of the creative industries and possibilities for countries affected by these events to achieve the SDGs for an unpredictable period.

2. Literature review

Achieving sustainability is a multifaceted and ambitious task, discussed worldwide both at the level of international organizations and treaties (United Nations, 1992; United Nations Framework Convention on Climate Change, 2015; United Nations, 2015) as well as at the level of individual states, sectors and clusters. And while for resource-intensive industries the need to address a variety of issues related to their sustainable development has been explored over several decades, for cultural and creative industries this period is much shorter (UNESCO, 2005; UNESCO; 2013; United Nations, 2016; UNCTAD, 2021).

The controversy regarding the need to take into account the potential of cultural and creative industries in the process of transition to a sustainable economy is reflected in the works (Cooke, De Propris, 2011), which present the idea that a sustainable economy depends on the diversity of the industrial base, new knowledge and technological platforms, as well as the willingness to accept innovations in various fields. The importance of integrating cultural and creative industries into a sustainable growth strategy for the *reset* of the economy is emphasized.

Pagán, Salvatella, Pitarch et al. (2020) consider initiatives funded by the EU-H2002, including those that combine cultural heritage with modern creative industries and design innovations. Thus, models of using cultural heritage as a catalyst for innovation in creative industries are gradually being formed, demonstrating its potential for shaping both tangible and intangible aspects of creativity and community engagement.

Gustafsson & Lazzaro (2021) highlights the role of culture and creative industries (CCI) in solving social problems within the framework of current European policy. The transformation of the economy and social life under the influence of COVID-19 and other megatrends such as climate change, globalization, urbanization, digitalization and individualization is considered. The authors emphasize the importance of public policy in supporting CCI; defend the role of CCI in stimulating innovation, growth, sustainable development, welfare, jobs, income and landscaping, and recognize the challenges faced by CCI in times of crisis (Hauge et al.,2016). Knowledge bases and regional development: collaborations between higher education and cultural creative industries. The dynamic relations between higher education institutions and creative and cultural industries are considered; it is emphasized that their cooperation is a key factor of innovation and economic growth at the regional level. Structural and cognitive-cultural barriers to cooperation between universities and CCI, strategies that promote long-term and mutually beneficial cooperation are investigated. The challenges accompanying the development of entrepreneurship in the field of cultural and creative industries are explored by Lerro, Schiuma & Manfredi (2022).

Despite considerable interest in the problems and challenges accompanying the development of creative industries, works on the prospects for sustainable development of the creative economy are still not enough to effectively solve a wide range of problems that need to be solved in order to achieve the SDGs, and asymmetric shocks affecting the development of the world economy and the world order as a whole actualize the search for effective solutions aimed at to solve these tasks. The key conclusions of this article regarding the current theory of dynamic linkages between different processes, are based on a review of research and publications by scholars from different countries and periods. Thus, in research by R. Cellmer, both classical and spatial panel models were used to identify sources of spatial differentiation in housing satisfaction under the influence of external factors (economic, demographic and social) (Cellmer, 2023).

N. Parkhomenko and others use multiple regression in predicting enterprise development in a global environment to assess the correlation between the initial features, noting that the approach is also applicable to global research, on the basis of which they propose various scenarios for further development (Parkhomenko & Otenko, 2023). S. Kapitanets and others, investigating the problems of personnel security in public authorities of countries with economies in transition, establish a link between the quality of regulatory capabilities of public authorities and government efficiency and between the fight against corruption and efficiency improvement, thereby justifying the use of sustainable strategies of personnel security in public authorities (Kapitanets et all, 2021).

In the article of A. Zienkiewicz, T. Podciborski, on the basis of modeling, the authors revealed the dependence between individual elements of space and the level of attractiveness of the described tourism objects, which allowed them to determine the key factors influencing changes and the degree of transformation of the cultural landscape, which were the marginalization of rural areas, migration of the population to cities, progressive suburbanization and the development of mass tourism. (Zienkiewicz & Podciborski, 2019). V. Baranova, studying the development of corporate social responsibility in business, using the linear regression method, establishes the dependence of the sustainability of corporate social responsibility and the effectiveness of fiscal decentralization of local self-government in Ukraine, on the basis of which local self-government strategies are proposed (Baranova et all, 2021). I. Koblianska and other authors, focusing on the formation of a policy of sustainable regional development, note the prospects of circular and creative economies.

Among the works of Ukrainian authors, it is necessary to highlight the results of studies of sustainable development at the junction of the creative economy and digitalization carried out by O. Bochko, O. Maletska, N. Tsitska, O. Kapral, which offer a polygonal model of the competitiveness of countries in terms of the competitiveness of digital economies, focusing on the development of creative industries, which are the future (Bochko, Maletska, Tsitska & Kapral, 2022). O. Polishchuk, T. Kulinich, N. Martynovych, Y. Popova, exploring digitalization as a

tool to overcome the COVID-19 crisis and achieve socio-economic sustainability, note, among other things, that the driver of economic growth along with digitalization is the activation of the creative sector and the transition from a resource to a creative economy, which has proved more stable during the quarantine (Polishchuk, Kulinich, Martynovych & Popova, 2022).

Such authors as O. Pidlisna, A. Simonova, N. Ivanova, V. Bondarenko, A. Yesipov, suggest using the product of creative industries as a tool for the harmonization of the urban environment, namely, fine art, lighting design, landscape architecture (Pidlisna et al., 2023). Paying tribute to the works of these authors, we state the insufficiency of research, Ukrainian science, devoted to the prospects of sustainable development of the creative economy for the effective solution of a wide range of problems that require solutions to achieve the SDGs, as well as asymmetric shocks affecting the development of the world economy and the world order as a whole, actualize the search for effective solutions aimed at solving these problems.

On the basis of a generalized analysis of the works of foreign authors who devoted their works to the concept of sustainable development and the creative economy, a vision of the current problems of further development of the creative sector, as well as tools for its assessment, was formed. In particular, in the work of J. Fazlagić, R. Skikiewicz examines the problems of sustainability that are relevant, first of all, for the creative industries – the lack of intangible resources, including the quality of education, tolerance and leadership (Fazlagić & Skikiewicz, 2019).

G. Harper notes that the possibilities of the influence of cultural creative industries on solving global sustainability problems have not been sufficiently investigated and remain beyond active discussion (Harper, 2021). The author calls for assessing the contribution of cultural and creative industries to ensuring sustainability not formally, but taking into account post-pandemic realities, which demonstrated that a significant proportion of not only large, but also micro and small enterprises in the sector contributed to maintaining employment, supporting creativity and innovation, and also provided a number of additional effects that contributed to the sustainability of the economic systems.

C. Kroll, A. Warchold, P. Pradhan consider examples of successful conversion of compromises into synergy for all seventeen SDGs (Kroll et al., 2019). Contradictions in the process of achieving the SDGs, as well as alternative ways to achieve them, allowing for positive dynamics of indicators, are evaluated by J. Moyer, D. Bohl (Moyer & Bohl, 2019). A special case of synergy and compromises for SDG 3 with other Sustainable Development Goals is analysed by G. Venkatesh (Venkatesh, 2022). Thus, a study of the relationships between creative industries and resilience would be incomplete without sufficient attention to the negative effects and contradictions that arise in the implementation of the SDGs.

It is important to bear in mind that the available empirical evidence allows for the identification and assessment of past relationships between the indicator sets under study, as the dynamic nature and strength of the shocks that are associated with the aftermath of the COVID-19 pandemic and the Russian military aggression in Ukraine require factors that can be quantified over time.

Expanding the boundaries of the study by studying the works on progress in the development of cultural, creative industries in individual EU countries allows not only to assess their impact on sustainable development, but also provides information about the possibilities of overcoming obstacles associated with the achievement of the SDGs and the consistency of measures aimed at achieving them, based on the accumulated experience of addressing the various tasks on the territory of European countries. Such experience is particularly valuable for Ukraine, as the post-war economic recovery makes the need for sustainable development approaches relevant.

Selected sectors of cultural, creative industries in Ukraine have demonstrated resilience throughout the pandemic and during Russia's full-scale invasion of Ukraine, with research reflecting predominantly negative trends associated with industry development during these periods (Skavronska, 2017; Marynenko & Shevchuk, 2022; Nikolayeva et al, 2021; Zhalilo et al., 2020), as the scale of losses in all spheres is large and estimates of the current state are not sufficient to form forecasts with the existing degree of uncertainty (Nazarenko & Sirbu, 2021). Representatives of the Ukrainian Ministry of Culture, referring to World Bank calculations, already voice the amount needed for cultural reconstruction due to military action on Ukrainian territory at $100 billion (Sommerbauer, 2023). The same contribution points out that arts and culture help Ukrainians to overcome the crisis.

Retrospective analysis shows that the processes of development of cultural, creative industries in European countries has been significantly influenced by the experience gained in Britain, which has concentrated *considerable expertise in this area*, became a leader in these processes (UNESCO Institute for Statistics, 2009). This fact has determined the expansion of the list of countries analysed by the UK - the EU countries for which the correlations between cultural, creative industries and sustainable development are investigated. The impressive rate of development of the creative industries in the UK, as well as the commitment to sustainability, is presented by the Creative Industries Federation (Creative UK: Statistics). Creative industries are often seen as catalysts for economic growth and innovation. In this manner, N. Innocenti, L. Lazzeretti analyse in their work how cultural, creative industries can contribute to growth and innovation in the economy (Innocenti & Lazzeretti, 2019). The authors have obtained conclusions confirming that creative industries have a positive effect on employment growth in other industries, especially with a high degree of their relationship with creative industries.

H. Mikic, B. Radulovic, M. Savić analyse the economic contribution of creative industries in Serbia and discuss various methodological approaches to measuring their impact (Mikic et al., 2020). The authors acknowledge that the development of the creative industries in Serbia faces a number of challenges, including limited funding, weak infrastructure and a lack of strategic planning. Nevertheless, the findings confirm that creative industries contribute to economic growth in the country, and assessing their impact using different methodological approaches can provide valuable information for stakeholders and researchers.

The importance of the development of creative industries for economic growth and development is also addressed in other works (Gutierrez Posada, Kitsos, Nathan & Nuccio, 2021). The study uses panel data analysis on UK cities with a focus on assessing the impact of creative industry growth on employment in other sectors. The authors conclude that cultural, creative industries have a significant multiplier effect on employment in UK cities, with the effect depending on the type of creative industry and the size of the city. The strongest multiplier effects are seen in software, publishing and advertising, while the design and cultural industries have weaker effects.

The limitation of the study to individual countries makes it necessary to further explore the impact of cultural, creative industries on economic growth by expanding the analysed empirical base. In the process of identifying the factors that influence the development of cultural and creative industries it is of interest to study the experience gained in European countries to explore the possibility of applying it to solve similar problems in other territories. E. Coll Martínez has analysed the role of location attributes in explaining the entry of firms into the creative industries using data from France (Martínez, 2023). The study focuses on three main attributes of location - market potential, local amenities and agglomeration economics. The crucial role of location attributes in explaining the entry of firms into creative industries is confirmed. Understanding these factors can help in developing strategies to support the growth of creative industries in specific locations, contributing to overall economic development.

D. Hocaoglu explores the role of cultural, creative industries in local economies and the contribution of design to these industries using Turkey as a case study (Hocaoglu, 2016). The paper substantiates that creative industries are experiencing rapid growth worldwide. Creative industries are an important component of a knowledge-based economy that relies on intellectual capital and human resources; their impact is also evident through job creation, attracting investment and fostering innovation. The findings confirm that design is a critical driver of innovation in the creative industries, enabling the development of new products, services and processes, adding value to products and services, leading to increased profits and increased competitiveness. The author's view that the creative industries can play a role in urban regeneration by revitalising underdeveloped areas and stimulating cultural and creative activity is of interest in the current study.

The cultural and creative industries are among the fastest growing sectors of the global economy. This growth has led to increased income, jobs and export earnings. In addition to economic benefits, these industries also contribute to sustainable development and the United Nations 2030 Agenda, especially in urban areas. While scholars recognise the importance of creativity and art in fostering inclusive social progress, empowering people to take control of their economic, social and personal development and fostering innovation for sustainable growth, there is little empirical evidence to support these claims.

3. Materials and methods

Study methods include correlation analysis, panel analysis with fixed and random effects, as well as dynamic models. These methods allow us to assess the complex interrelationships between various factors and their impact on sustainable development.

The study emphasises the importance of creative industries in sustainable development despite global challenges. It identifies the potential of these industries to stimulate economic growth, social inclusion, enrich cultural diversity and promote mental health. In addition, the study suggests ways to minimise the negative impacts and enhance the positive impacts of cultural and creative industries on the SDGs, highlighting the need to promote education, integrate sustainability principles, build partnerships, implement sustainability standards and apply innovative technologies.

The study contributes to the development of understanding of the complex role of cultural and creative industries in sustainable development, offering a holistic and integrated approach to the problem. The paper presents the results of analysing global trends and challenges and assessing their impact on the development of cultural and creative industries and the achievement of the SDGs. Figure 1 reflects the study methodology. Based on the study on the development of cultural and creative industries and their contribution to the achievement of the UN Sustainable Development Goals, the first step is to summarise and systematise the various manifestations of such impact.

The empirical basis for analysing the relationship between the development of cultural and creative industries and sustainable development in the EU countries, the UK and Ukraine, is the data of the rating reflecting the progress of countries in achieving sustainable development goals (Sustainable Development Report 2023, 2024). To carry out the analysis, information was taken for a twelve-year period, namely, 2011-2022, (Table 1). This allowed us to draw a number of conclusions.

Figure. 1. Methodology for researching the relationship between sustainable territorial development, cultural and creative industries, source: own preparation
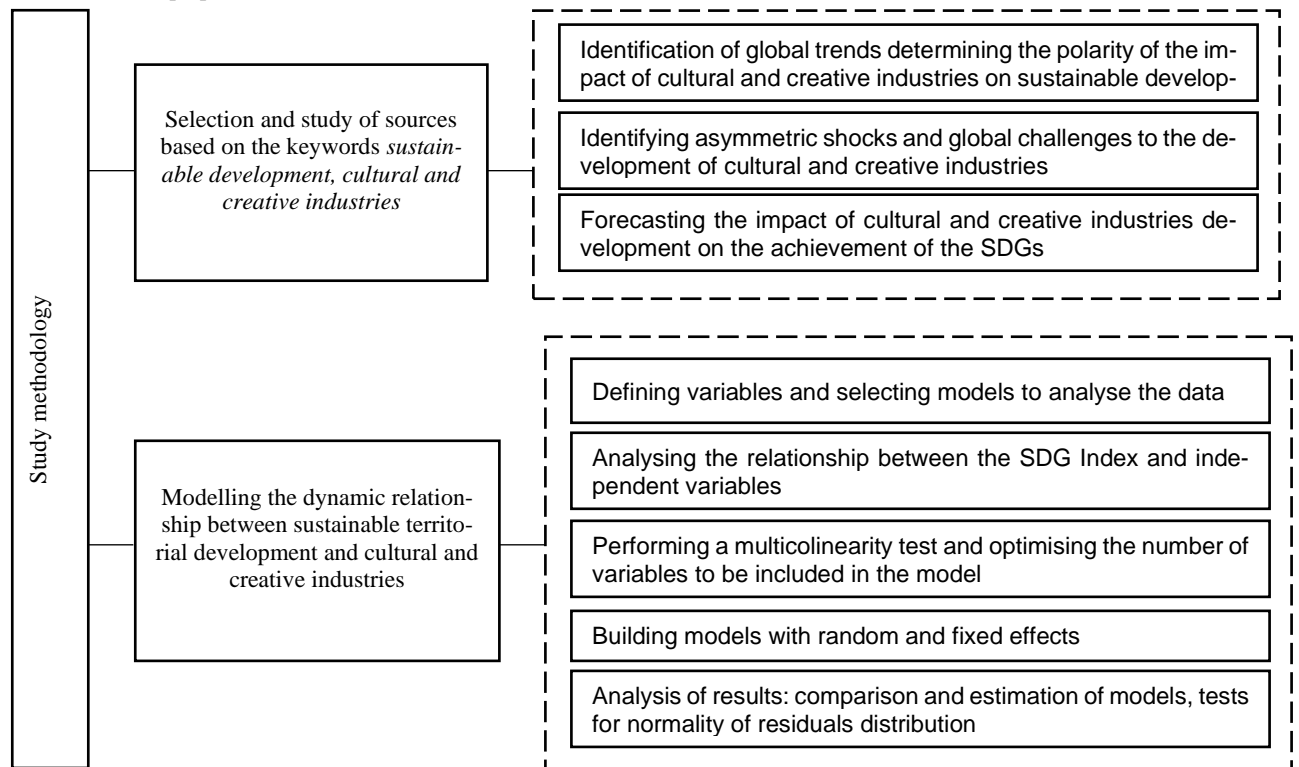

Table 1. Level of achievement of sustainable development goals in the EU, the UK and Ukraine, source: Sustainable Development Report 2023, 2024

Country	Period												Increase for the period, %
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
Finland*	85,15	85,45	85,55	85,54	85,93	85,37	85,97	85,57	86,11	86,4	86,56	86,76	1,89
Sweden*	84,81	85,49	85,25	85,28	85,47	85,47	85,51	85,32	85,97	86,26	86,06	85,98	1,38
Denmark*	83,33	83,97	83,95	83,86	84,63	84,7	84,49	84,32	85,02	85,08	85,78	85,68	2,82
Germany*	79,63	80,1	80,58	80,96	81,92	82	82,14	82,26	82,62	83,05	83,29	83,36	4,68
Austria*	80,63	80,85	81,5	81,58	81,5	81,65	82,64	82,58	83,12	83,11	83,15	82,28	2,05
France	77,73	78,72	79,12	79,56	79,84	79,97	81	80,86	81,55	81,65	81,98	82,05	5,56
Czech	78,09	78,13	78,71	79,52	80,28	80,24	80,54	80,92	81,08	81,84	82,48	81,87	4,84
Poland	76,74	77,43	77,29	78,24	79,02	79,46	80,63	80,22	80,86	80,57	80,96	81,8	6,59
Estonia	76,2	76,79	77,04	77,53	78,83	78,31	79,57	79,75	80,75	81,06	80,98	81,68	7,19
Croatia	75,61	76,59	78,74	78,97	79,24	79,5	79,5	80,23	80,56	81,61	81,55	81,5	7,79
Slovenia	78,58	79,69	79,55	79,35	79,12	79,37	79,75	79,32	80,48	80,96	80,78	81,01	3,09
Latvia	77,11	77,75	77,89	77,92	78,47	78,67	79,31	79,73	80,2	80,49	80,33	80,68	4,63
Spain	76,7	77,05	77,84	78,06	77,88	78,24	78,07	78,86	79,47	80,03	80,46	80,43	4,86
Ireland	78,36	78,95	79,17	79,71	79,28	78,47	79,14	78,79	79,27	79,28	79,38	80,15	2,28
Portugal	76,25	76,1	76,79	76,83	77,11	77,31	78,51	78,45	79,13	79,68	80,1	80,02	4,94
Belgium	76,42	76,73	77,47	77,47	77,97	77,95	77,93	78,19	78,98	79,43	79,54	79,46	3,98
Netherlands	77,39	77,59	78,02	78,15	78,48	78,66	78,65	78,82	78,71	79,35	79,42	79,42	2,62
Hungary	77,37	77,2	77,34	77,86	78	78,7	78,96	78,87	79,14	79,63	80,21	79,39	2,61
Slovakia	76,5	76,7	76,83	77,84	77,98	78	78,59	78,73	79,06	79,64	79,86	79,12	3,42
Italy	75,65	76,47	77,33	77,08	76,88	76,96	77,16	77,91	77,86	78,62	78,67	78,79	4,15
Greece	73,89	73,88	74,32	74,91	75,23	75,71	76,17	76,98	77,53	77,8	78,14	78,37	6,06
Luxembourg	74,6	74,46	75,06	75,65	76,13	76,46	76,68	76,61	77,32	78,08	78,28	77,65	4,09
Romania**	73,69	74,28	74,42	74,56	75,03	75,55	75,93	76,32	76,73	77,07	77,3	77,46	5,12
Lithuania**	73,72	73,71	73,99	74,11	74,91	74,92	75,59	75,08	75,78	76,26	76,31	76,81	4,19
Malta**	71,98	72,55	73,27	73,89	73,97	74,7	74,89	75,23	75,06	75,72	76,13	75,53	4,93
Bulgaria**	73,9	74,57	74,78	74,15	74,37	73,32	73,95	73,83	74,64	74,74	74,94	74,62	0,97
Cyprus**	70,22	69,68	69,59	69,52	70,61	71,06	72,4	71,92	72,46	72,74	72,97	72,49	3,23
Great Britain	79,52	79,63	79,79	80,01	80,43	80,51	80,93	80,92	81,03	81,32	81,7	81,65	2,68
Ukraine	71,04	71,63	71,72	72,08	72,45	72,25	73,38	73,39	74,29	74,97	75,74	76,52	7,71

* - EU countries with the highest SDG Index score in the analysed period,
** - EU countries with the lowest SDG Index score during the analysed period

Comparable for the purposes of the current study are the data for Ukraine presented in the Sustainable Development Report 2023, which range from 71.04 to 76.52 (Sustainable Development Report 2023, 2024). However, we

believe that the challenges faced by Ukraine after 2021 (on the basis of which the Sustainable Development Index) are so significant and the dynamics of change so rapid that any statistical information will provide users with a significant time lag to quantitatively confirm the hypotheses put forward (except for the results of instrumental measurements, where it is acceptable), which complicates the validity of forecasts in all areas, including creative industries. In confirmation, the International Monetary Fund (IMF) in its World Economic Outlook, published in April 2023 (Outlook: A Rocky Recovery, 2023) points out that risks associated with the inability to make the expected progress on global issues, including sustainable development, are increasing. Regarding Ukraine, the forecast does not provide data for the period beyond 2023, noting that 2024-2028 will be characterised by a very high level of uncertainty, hence the lack of forecast data. The increase in uncertainty is particularly noticeable given that a month earlier the IMF published a positive 5-year macro projection for Ukraine (IMF: Press Release, 2023).

The assessment of the dynamics of the SDG Index for 2011 - 2022 allowed us to conclude that both leaders and outsiders of the ranking remain unchanged: both in 2011 and in 2022, according to the generalised assessment reflecting the level of countries' achievement of all 17 SDGs, the five EU countries with the highest score are Finland, Sweden, Denmark, Austria and Germany. The European countries with the lowest score according to 2022 data are Romania, Lithuania, Malta, Bulgaria, Cyprus; if we add two more EU countries to this list - Greece and Luxembourg - it can be stated that these seven countries had the lowest SDG Index score both in 2011 and in 2022. When assessing the growth of the SDG Index, Bulgaria has the lowest value (0.97%).

The source of information on the development of creative industries is Eurostat data (Eurostat: Data Browser, 2024). The choice of data sources is determined by the need to ensure comparability of indicators, while a separate scientific problem is the improvement of approaches to the collection and reflection of data characterising the development of cultural, creative industries, which is reflected in the works (Pratt, Bennett, 2022; Stano, Weziak-Bialowolska, Saisana, 2015).

Table 2. Share of household expenditure on culture and recreation in EU countries in total household expenditure, source: calculated by the authors on the basis of (Eurostat, 2024)

Country	Year, %											
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Bulgaria	7,16	6,76	7,11	7,53	7,57	7,81	7,85	7,77	8,24	7,46	8,09	7,12
Czechia	8,94	8,65	8,61	8,59	8,59	8,93	8,94	8,67	8,96	8,02	8,14	9,11
Denmark	11,11	11,10	10,97	11,14	11,43	11,62	11,81	11,73	11,83	10,96	10,98	11,34
Germany	10,46	10,49	10,50	10,39	10,67	10,78	10,99	10,88	10,83	9,51	9,48	9,98
Estonia	7,15	7,25	7,61	7,81	8,19	8,41	8,69	8,79	8,87	8,59	8,82	8,88
Ireland	7,58	7,29	7,22	6,96	7,01	6,92	6,79	6,75	6,45	5,63	5,40	6,04
Greece	4,96	4,61	4,91	5,22	5,12	5,09	5,22	5,62	5,92	4,85	5,17	6,28
Spain	7,42	7,07	6,99	6,98	7,22	7,38	7,46	7,45	7,54	5,63	6,58	8,02
France	8,44	8,23	7,98	8,03	7,96	7,99	7,95	7,89	7,94	7,50	7,65	7,97
Croatia	8,05	8,04	7,95	8,14	8,20	8,18	8,47	8,65	8,56	8,26	8,94	8,82
Italy	7,14	6,85	6,47	6,52	6,63	6,73	6,71	6,68	6,71	6,10	6,37	6,86
Cyprus	7,48	7,16	6,96	6,86	7,07	6,84	6,59	6,63	6,87	7,18	7,06	6,88
Latvia	8,07	8,42	8,42	8,82	9,61	9,52	9,63	9,83	10,27	8,50	8,67	9,75
Lithuania	6,74	6,83	7,43	7,44	7,71	8,10	8,24	8,24	8,31	7,53	7,57	8,03
Luxembourg	7,08	6,93	6,97	6,88	6,96	6,87	6,68	6,60	6,63	5,97	6,42	6,67
Hungary	7,32	7,19	6,91	7,06	7,11	7,21	7,25	7,37	7,46	7,14	7,45	7,58
Malta	8,92	8,99	9,07	9,13	8,96	9,13	8,84	8,85	8,96	7,42	7,58	8,90
Netherlands	10,89	10,69	10,35	10,13	10,03	9,96	10,05	9,95	9,92	8,77	8,79	9,58
Austria	10,17	10,22	10,14	10,06	10,06	9,99	9,97	10,00	9,91	8,94	9,02	9,89
Poland	6,29	6,38	6,14	6,23	6,87	6,80	6,80	6,93	6,70	5,84	6,06	6,11
Portugal	6,20	6,08	5,82	5,72	5,87	5,54	5,63	5,64	5,71	5,11	5,10	5,02
Romania	5,96	6,02	6,93	6,60	6,40	6,89	7,34	6,75	6,75	6,01	6,14	6,01
Slovenia	8,67	8,35	8,26	8,49	8,79	8,91	9,09	9,21	9,46	7,82	8,03	8,89
Slovakia	9,38	9,30	9,39	9,57	9,72	9,90	10,02	9,87	9,54	8,05	8,01	9,03
Finland	11,69	11,61	11,10	10,74	10,54	10,43	10,39	10,20	10,12	9,31	9,23	9,22
Sweden	11,15	11,22	10,94	10,78	10,76	10,79	11,00	11,17	11,43	11,34	11,44	11,55
Switzerland	8,24	8,12	7,87	7,74	7,67	7,33	7,24	6,91	6,75	6,05	5,88	-
United Kingdom	10,59	10,17	10,26	10,29	10,61	10,68	11,01	11,01	11,19	-	-	-

Among the indicators assessed in the process of the study as independent variables reflecting the dynamics of development of cultural and creative industries, the following were chosen: value added and turnover of cultural

industry enterprises; household expenditures on culture and recreation; employment in the sphere of culture and creative industries; the number of persons working as creative and performing artists, authors, journalists and linguists; state expenditures in the sphere of culture and creative industries; the number of enterprises in the sphere of culture and creative industries.

Using the absolute values of the indicators in the modelling process, we present the data reflecting the share of household expenditures on culture and recreation (Table 2), confirming the impact of global challenges on the development of cultural and creative industries. Table 2 shows the dynamics of changes in household expenditures on culture and recreation.

The data show that in EU countries, the share attributable to culture and recreation in household spending increased gradually from 2011 to 2019 in most countries. The indicator reached its lowest values in 2019-2020, due to the pandemic and its aftermath, and gradually reached pre-pandemic values by 2022 (for countries for which data are available). The dynamics of changes in the indicators characterising the development of cultural and creative industries in the EU countries is presented in Table 3. For all countries for which data are available (Eurostat: Data Browser, 2024), there is a negative trend in the number of cultural and creative industries enterprises and their turnover.

Table 3. Increase in the values of indicators characterising the development of cultural and creative industries in the EU countries, source: calculated by the authors on the basis of (Eurostat, 2024)

Country	Growth of the indicator in the analysed period					
	Public expenditure on culture and creative industries 2021/2011, %	Number of cultural and creative industries enterprises*, %	Turnover of cultural industries*, %	Household expenditure on culture and recreation 2022/2011, %	Number of workers in the creative professions 2022/2011, %	Employment in culture and creative industries 2022/2011, %
Bulgaria	110,26	-90,44	-59,01	82,90	18,64	74,29
Czechia	39,92	-79,43	-62,83	56,04	35,35	43,52
Denmark	22,76	-95,88	-88,64	44,89	0,31	28,13
Germany	48,06	-90,97	-80,29	28,23	3,55	29,30
Estonia	59,84	-83,94	-58,75	162,78	45,28	113,39
Ireland	22,21	-90,43	-	28,31	23,26	82,89
Greece	43,98	-93,87	-87,42	32,24	18,05	14,74
Spain	-10,86	-88,92	-77,19	33,83	14,56	38,49
France	16,27	-88,91	-88,83	17,56	-	31,22
Croatia	20,79	-77,78	-48,03	74,96	-0,81	31,81
Italy	2,23	-93,00	-78,89	11,63	43,48	12,40
Cyprus	-35,30	-87,66%	-90,62	18,75	-11,84	65,65
Latvia	73,29	-86,58	-36,28	133,89	21,51	90,81
Lithuania	114,77	-88,62	-50,52	137,45	-2,04	135,95
Luxembourg	76,01	-95,98	-	45,76	31,52	45,24
Hungary	98,83	-88,21	-71,66	57,81	32,80	68,86
Malta	218,20	-84,72	-18,51	71,91	38,53	124,32
Netherlands	28,29	-93,41	-83,68	23,47	54,31	40,54
Austria	16,59	-94,53	-81,64	32,59	53,57	42,16
Poland	34,03	-85,77	-67,08	57,71	13,43	67,55
Portugal	2,66	-92,80	-75,23	14,37	7,53	93,53
Romania	33,60	-78,91	-58,12	104,06	-15,97	66,30
Slovenia	19,57	-83,11	-60,19	49,35	-3,93	45,53
Slovakia	18,27	-83,54	-66,24	60,38	31,52	44,53
Finland	26,55	-87,92	-81,23	3,33	0,28	32,14
Sweden	37,29	-95,69	-89,91	32,67	21,43	29,38
Switzerland	47,32	-73,46	-54,36	-	-	33,01
United Kingdom	-	22,90	25,97	-	19,02	-

* the value of indicator growth is presented for the period, according to the current Eurostat data as of 01.02.2024 (Eurostat: Data Browser, 2024).

While employment in the cultural sector has increased, the number of persons in the creative professions has a negative trend in five countries (Slovenia, Romania, Lithuania, Cyprus, Croatia), and in Denmark, Finland the growth rate was less than 1 per cent. The increase in household expenditure on culture and recreation is consistent with the data in Table 2 and indicates an increase in the absolute values of the indicator. The next step in the research is to use correlation analysis to identify the relationship between indicators reflecting the

development of creative industries and a composite indicator reflecting countries' progress towards the sustainable development goals. The results of the correlation coefficient calculation are used to test the hypothesis.

Table 4. Scale for interpreting the value of the correlation coefficient between indicators, source: (Mukaka, 2012).

Size of correlation coefficient (r)	Interpretation of the correlation coefficient value
0,90000 ≤ |r| ≤ 1,00000	Very high positive (negative) correlation
0,70000 ≤ |r| ≤ 0,89999	High positive (negative) correlation
0,50000 ≤ |r| ≤ 0,69999	Moderate positive (negative) correlation
0,30000 ≤ |r| ≤ 0,49999	Low positive (negative) correlation
0,00000 ≤ |r| ≤ 0,29999	Insignificant correlation

Table 5. Tests for the normal distribution of SDGs, source: calculated by the authors

Country	Doornik-Hansen test	Shapiro-Wilk W test	Lilliefors test	Jarque-Bera test
1. Ukraine	= 1,89135, The p-value is 0.388418	= 0,932096, The p-value is 0.402859	= 0,183738, The p-value ~= 0.31	= 1,02924, The p-value is 0.597726
2. Great Britain	= 0,878846, The p-value is 0.644408	= 0,93816, The p-value is 0.474605	= 0,153285, The p-value ~= 0.6	= 0,829353, The p-value is 0.660554
3. Poland	= 1,87981, The p-value is 0.390665	0,927191, The p-value is 0.351283	0,180601, The p-value ~= 0.34	1,00711, The p-value is 0.604377
4. Austria	0,979405, The p-value is 0.612809	= 0,914431, The p-value is 0.243061	0,174139, The p-value ~= 0.39	= 0,848259, The p-value is 0.654339
5. Germany	= 1,44572, The p-value is 0.485362	= 0,9295, The p-value is 0.374846	= 0,196808, The p-value ~= 0.22	= 0,924692, The p-value is 0,629804
6. France	= 0,771037, The p-value is 0,680098	= 0,942386, The p-value is 0,529585	= 0,146403, The p-value ~= 0,67	= 0,750914, The p-value is 0,686975
7. Finland	= 1,28205, The p-value is 0,526751	= 0,938775, The p-value is 0,482374	= 0,217248, The p-value ~= 0,12	= 0,887767, The p-value is 0,64154
8. Sweden	= 0,187111, The p-value is 0,910688	= 0,937475, The p-value is 0,466071	= 0,226423, The p-value ~= 0,09	= 0,252867, The p-value is 0,881233
9. Belgium	= 0,142213, The p-value is 0,931362	= 0,927675, The p-value is 0,356121	= 0,143514, The p-value ~= 0,7	= 0,576416, The p-value is 0,749606
10. Bulgaria	= 1,4321, The p-value is 0,488679	= 0,930409, The p-value is 0,384469	= 0,197829, The p-value ~= 0,21	= 0,941354, The p-value is 0,624579
11. Hungary	= 0,455598, The p-value is 0,796284	= 0,943024, The p-value is 0,538207	= 0,141372, The p-value ~= 0,72	= 0,711759, The p-value is 0,700557
12. Greece	= 2,207, The p-value is 0,331708	= 0,919051, The p-value is 0,278151	= 0,14248, The p-value ~= 0,71	= 1,07158, The p-value is 0,585207
13. Denmark	= 0,11547, The p-value is 0,9439	= 0,968691, The p-value is 0,896617	= 0,12342, The p-value ~= 0,88	= 0,369526, The p-value is 0,831301
14. Ireland	= 1,88839, The p-value is 0,388992	= 0,957904, The p-value is 0,753549	= 0,162753, The p-value ~= 0,5	= 0,0750424, The p-value is 0,963174
15. Italy	= 0,151801, The p-value is 0,926908	= 0,949712, The p-value is 0,632783	= 0,140053, The p-value ~= 0,74	= 0,300689, The p-value is 0,860412
16. Spain	= 0,645433, The p-value is 0,724179	= 0,927697, The p-value is 0,356337	= 0,192923, The p-value ~= 0,24	= 0,744042, The p-value is 0,68934
17. Cyprus	= 4,9095, The p-value is 0,0858849	= 0,87404, The p-value is 0,073551	= 0,210439, The p-value ~= 0,15	= 1,3556, The p-value is 0,507733
18. Latvia	= 2,03635, The p-value is 0,361254	= 0,923332, The p-value is 0,314732	= 0,158318, The p-value ~= 0,55	= 1,0458, The p-value is 0,592798
19. Lithuania	= 0,894857, The p-value is 0,63927	= 0,933779, The p-value is 0,421898	= 0,156091, The p-value ~= 0,57	= 0,831703, The p-value is 0,659778
20. Luxembourg	= 0,393578, The p-value is 0,821364	= 0,952039, The p-value is 0,666964	= 0,103107, The p-value ~= 1	= 0,680415, The p-value is 0,711623
21. Malta	= 1,46396, The p-value is 0,480956	= 0,944163, The p-value is 0,553802	= 0,171886, The p-value ~= 0,41	= 0,941089, The p-value is 0,624662
22. Netherlands	= 0,30237, The p-value is 0,859689	= 0,935398, The p-value is 0,440845	= 0,139434, The p-value ~= 0,74	= 0,558484, The p-value is 0,756357
23. Portugal	= 2,6935, The p-value is 0,260084	= 0,908059, The p-value is 0,201454	= 0,186075, The p-value ~= 0,29	= 1,13206, The p-value is 0,567776
24. Romania	= 1,57776, The p-value is 0,454353	= 0,937873, The p-value is 0,471015	= 0,142611, The p-value ~= 0,71	= 0,972048, The p-value is 0,615067
25. Slovakia	= 0,655056, The p-value is 0,720703	= 0,939509, The p-value is 0,491738	= 0,143374, The p-value ~= 0,7	= 0,750059, The p-value is 0,687269
26. Slovenia	= 0,848377, The p-value is 0,6543	= 0,912659, The p-value is 0,230736	= 0,20699, The p-value ~= 0,16	= 0,791485, The p-value is 0,67318
27. Estonia	= 1,56763, The p-value is 0,456661	= 0,938369, The p-value is 0,47724	= 0,152842, The p-value ~= 0,61	= 0,968448, The p-value is 0,616175
28. Croatia	= 2,14941, The p-value is 0,341398	= 0,904493, The p-value is 0,181261	= 0,177315, The p-value ~= 0,37	= 1,29078, The p-value is 0,524457
29. Czech Republic	= 0,460508, The p-value is 0,794332	= 0,945049, The p-value is 0,566091	= 0,147971, The p-value ~= 0,66	= 0,678127, The p-value is 0,712437

Table 6. Tests for the normal distribution of the *Household indicator*, source: calculated by the authors

Country	Doornik-Hansen test	Shapiro-Wilk W test	Lilliefors test	Jarque-Bera test
2	= 2,28138, The p-value is 0,319598	= 0,898636, The p-value is 0,244199	= 0,227998, The p-value ~= 0,19	= 0,911005, The p-value is 0,634129
3	= 0,698557, The p-value is 0,705197	= 0,93504, The p-value is 0,436598	= 0,15546, The p-value ~= 0,58	= 0,701718, The p-value is 0,704083
4	= 3,14759, The p-value is 0,207257	= 0,904403, The p-value is 0,180776	= 0,1644, The p-value ~= 0,49	= 1,93212, The p-value is 0,38058
5	= 2,3761, The p-value is 0,304815	= 0,920152, The p-value is 0,287176	= 0,169338, The p-value ~= 0,44	= 1,08426, The p-value is 0,581508
6	= 5,73582, The p-value is 0,0568176	= 0,863207, The p-value is 0,0536343	= 0,17778, The p-value ~= 0,36	= 4,82073, The p-value is 0,0897825
7	= 2,77865, The p-value is 0,249244	= 0,927408, The p-value is 0,353446	= 0,129855, The p-value ~= 0,83	= 1,50494, The p-value is 0,471201
8	= 4,84971, The p-value is 0,0884912	= 0,862336, The p-value is 0,0522987	= 0,217345, The p-value ~= 0,12	= 2,7603, The p-value is 0,251541
9	= 1,93394, The p-value is 0,380233	= 0,937795, The p-value is 0,470048	= 0,165549, The p-value ~= 0,48	= 1,11149, The p-value is 0,573645
10	= 1,93433, The p-value is 0,380159	= 0,909853, The p-value is 0,212423	= 0,142124, The p-value ~= 0,72	= 1,05017, The p-value is 0,591504
11	= 2,14701, The p-value is 0,341808	= 0,904625, The p-value is 0,181972	= 0,188629, The p-value ~= 0,27	= 1,22122, The p-value is 0,543019
12	= 5,09935, The p-value is 0,078107	= 0,874055, The p-value is 0,0735849	= 0,23828, The p-value ~= 0,06	= 4,0761, The p-value is 0,130282
13	= 0,299678, The p-value is 0,860847	= 0,949532, The p-value is 0,630159	= 0,140196, The p-value ~= 0,74	= 0,576153, The p-value is 0,749704
14	= 2,1712, The p-value is 0,337699	= 0,925678, The p-value is 0,336542	= 0,199706, The p-value ~= 0,2	= 1,28599, The p-value is 0,525716
15	= 3,73446, The p-value is 0,154551	= 0,97042, The p-value is 0,915157	= 0,150458, The p-value ~= 0,63	= 0,207508, The p-value is 0,901447
16	= 3,00758, The p-value is 0,222286	= 0,9653, The p-value is 0,855914	= 0,156868, The p-value ~= 0,56	= 0,194687, The p-value is 0,907244
17	= 3,94162, The p-value is 0,139344	= 0,905211, The p-value is 0,185159	= 0,161459, The p-value ~= 0,52	= 2,72204, The p-value is 0,256399
18	= 2,17219, The p-value is 0,337532	= 0,970273, The p-value is 0,91364	= 0,110824, The p-value ~= 1	= 0,645491, The p-value is 0,724158
19	= 1,63242, The p-value is 0,442104	= 0,957575, The p-value is 0,748734	= 0,129192, The p-value ~= 0,84	= 0,590816, The p-value is 0,744228
20	= 3,31892, The p-value is 0,190242	= 0,911534, The p-value is 0,223219	= 0,152851, The p-value ~= 0,61	= 2,1137, The p-value is 0,347549
21	= 2,70478, The p-value is 0,258621	= 0,9108, The p-value is 0,21844	= 0,177532, The p-value ~= 0,36	= 1,46075, The p-value is 0,481727
22	= 7,63001, The p-value is 0,0220376	= 0,819376, The p-value is 0,0156921	= 0,24718, The p-value ~= 0,04	= 6,82114, The p-value is 0,0330224
23	= 2,7226, The p-value is 0,256328	= 0,893964, The p-value is 0,132565	= 0,175019, The p-value ~= 0,39	= 1,22711, The p-value is 0,541422
24	= 0,662382, The p-value is 0,718068	= 0,934714, The p-value is 0,432757	= 0,187723, The p-value ~= 0,28	= 0,74632, The p-value is 0,688555
25	= 2,98663, The p-value is 0,224627	= 0,917364, The p-value is 0,264827	= 0,1494, The p-value ~= 0,64	= 1,85808, The p-value is 0,394932
26	= 4,08052, The p-value is 0,129995	= 0,875493, The p-value is 0,0767555	= 0,191095, The p-value ~= 0,26	= 2,18276, The p-value is 0,335753
27	= 0,953123, The p-value is 0,620915	= 0,96835, The p-value is 0,892774	= 0,0917459, The p-value ~= 1	= 0,568625, The p-value is 0,752531
28	= 6,28138, The p-value is 0,043253	= 0,803459, The p-value is 0,0102597	= 0,250152, The p-value ~= 0,04	= 4,06361, The p-value is 0,131099
29	= 5,4105, The p-value is 0,0668536	= 0,861883, The p-value is 0,0516182	= 0,190692, The p-value ~= 0,26	= 4,30338, The p-value is 0,116287

that the relationship between the indicators under study is significant. The interpretation of the correlation coefficient depends on the study area and the context in which it is applied. In the course of the study, the strength of the correlation relationship between the indicators and the interpretation of the correlation coefficient was assessed based on the grading applied by M. M. Mukaka (Mukaka, 2012) (Table 4).

Based on an assessment of the strength of the correlation relationship determined by the value of the correlation coefficient, countries were grouped according to the degree of influence of individual indicators on the change

in the SDG index. The analysis of multicolinearity of indicators made it possible to reduce the list of variables used to build the model. Optimisation of the number of variables used for inclusion in the model was also carried out taking into account the results of tests for normality of distribution of residuals. The results of the normality test for the SDG Index are presented in Table 5, and for the indicator reflecting the amount of household spending on culture and recreation in the EU countries - in Table 6. In Tables 5, 6 and further on in the modelling process numerical values will be used to take into account the countries according to the numbering of Table 5.

Based on the test data presented in the Table, it can be concluded that the normality of the SDGs distribution varies for different territories. The inclusion of multiple normality tests provides a comprehensive assessment of the distribution of data, since each of the tests is sensitive to various aspects of deviation from normality. In most cases, the p-values of the tests are above the 0.05 threshold, which is interpreted as the absence of a statistically significant deviation from the normal distribution. This assumes that the distribution of SDGs in these countries is normal.

Despite the general trend towards a normal distribution, the identified deviations in some countries emphasize the need to take into account local peculiarities when analyzing the impact of spending on culture and recreation on sustainable development. Deviations may be related to unique factors such as national cultural policies, economic conditions, or social norms. Government spending in the field of culture and creative industries, household spending on culture and recreation, the number of employees in creative professions, employment in the field of culture and creative industries are defined as independent variables; the SDG Index as a complex indicator reflecting progress in the sustainable development of territories is determined as a dependent one (Table 7).

Table 7. Variables used in the modeling process, source: calculated by the authors

Type of variable	Name of the variable	Abbreviated name of the variable
Dependent variable	The Country's Sustainable Development Index (SDG)	SDGS
Independent variables	household spending on culture and recreation,	Household
	employment in the field of culture and creative industries	Employmen
	the number of employees of creative professions	Persons
	government expenditures in the field of culture and creative industries	Government

Table 8. Consequences of asymmetric shocks that affected the development of cultural and creative industries, source: compiled by the authors

Consequences of asymmetric shocks	Manifestation of the consequences of asymmetric shocks on the development of creative industries
Reduction in income	Organizations in the field of culture and creative industries have faced a sharp decline in income due to the closure of museums, theatres, concert halls and other cultural institutions, the cancellation of public events. In the post-pandemic period, the gradual recovery of income was accompanied by initiatives in support of Ukraine as a whole, including territories, organizations, groups of individuals, and public figures affected by hostilities
Digital transformation	The pandemic has spurred digital transformation in the creative industries. Online movie viewing platforms, virtual exhibitions, webinars, online concerts and other forms of remote cultural presentation have become more common. The trend intensified after the full-scale Russian invasion of Ukraine, as there was an interest in obtaining accessible information about Ukrainian culture, as well as platforms and platforms were updated to allow refugees to adapt in host countries.
Increasing the importance of the creative industries	With restrictions on movement and social interactions, the creative industries have become even more important in providing for the cultural and entertainment needs of people, maintaining social balance, and promoting mental health. In this context, the content continued to perform these functions, which is especially in demand by children and other vulnerable groups who find themselves in the status of refugees or VPO
Threat to the preservation of cultural heritage	Many cultural institutions are experiencing serious financial difficulties, which jeopardize the preservation of historical and cultural values.
The need for new funding and support models	The current situation highlights the need for new models of funding and support for creative industries that can ensure their sustainable development during the crisis and beyond.
Impact on employment	Many workers in the creative industries have lost their jobs or faced cuts in hours and income. At the same time, a significant number of refugees have the necessary skills and desire to find a job, which increases competition in the labor market. This requires governments and other stakeholders to take action to support employment and create new jobs.

The calculations presented in Tables 5-6, as well as panel data modeling, were carried out in the GRETL 2023c environment. The data that did not pass the normality test of the distribution were not used in the construction of models. Thus, according to the results of the analysis of Table 6, the Netherlands and Croatia are excluded, the countries with numbers 22 and 28, respectively.

Table 9. Projected impact of the development of cultural industries on the SDGs, source: compiled by the authors

Goal	Direct and indirect positive impact	Potential negative impact
Goal 1: No poverty	creation of jobs; increasing the level of income and raising the standard of living; supporting sustainable economic growth	employment insecurity (informal, project-based employment, when workers do not have access to social protection and job security) contributes to poverty and vulnerability of workers
Goal 2: Zero hunger	increasing social cohesion; support for mental and psychological health and well-being; providing opportunities for self-expression and self-realization; – physical health support	the danger of occupational exposure to chemicals on workers (including chemicals, solvents and dust); dependence and problems in the use of digital devices and content, which can have negative consequences for mental and physical health as a result of the growth of the games and entertainment industry; stress as a result of informal or temporary employment, unstable income, high demands on creativity
Goal 4: Quality education	development of skills of creativity and critical thinking; popularization of education in the field of culture and creativity; support and enrichment of education through the development of creative skills and practice-oriented learning; development of alternative teaching methods	insufficient accessibility and inequality in education, when access to educational opportunities is limited for certain groups
Goal 5: Gender equality	diversity of opportunities for self-expression, training and employment of women and girls; challenging gender norms and stereotypes through artistic expression	support and strengthening of gender stereotypes, especially through media and advertising; discrimination, unequal access to leadership positions or unequal pay
Goal 8: Decent work and economic growth	promotion of economic growth through contribution to GDP; creation of jobs, especially for youth and women, opportunities for self-employment and entrepreneurship; facilitating the development of skills and abilities that are important for the economy of the 21st century, including creativity, innovation, critical thinking and intercultural understanding	employment insecurity, which creates uncertainty and vulnerability for workers; increasing economic inequality, when benefits are unevenly distributed among different groups and regions; exploitation and undervaluation, including low wages, long hours and undervaluation of creative work
Goal 9: Industry, innovation and infrastructure	support for innovation by creating new products, services and business models; contribution to the development of sustainable industrial sectors, offering new ideas and approaches to the production, distribution and consumption of goods and services; development of infrastructure, for example, through architectural design, urban planning and development of digital technologies	widening digital divide with those who do not have access to new technologies or do not have the skills to use them; increase in environmental impact, including through increased consumption of energy and materials; privileging certain sectors at the expense of others, which can increase inequality and social differences
Goal 10: Reduced inequalities	reducing inequality through accessibility, such as access to information, education and opportunities for self-expression; stimulation of economic growth in marginalized communities, creating jobs and opportunities for entrepreneurship; social integration; preservation of cultural diversity	an increase in the digital divide, if access to digital technologies, the Internet or ICT education is limited; risk of gentrification and exclusion, raising the cost of living in certain areas and crowding out less well-off groups
Goal 11: Sustainable cities and communities	support for the revival of cities, the preservation of cultural heritage; strengthening social cohesion and improving the quality of life in urban areas; improving the quality of the urban environment	gentrification, displacement of vulnerable communities; flow of resources
Goal 12: Responsible consumption and production	raising awareness of environmental and social issues; development of sustainable products and services	the use of significant amounts of resources and the creation of waste; unsustainable consumption patterns that lead to overconsumption and increased waste; over-commercialization of cultural products
Goal 13: Climate action	increasing awareness of the environment; promoting sustainable practices, protecting climate policy and supporting a low-carbon economy; promoting the principles of the circular economy, energy efficiency and renewable energy sources	increased resource consumption, exacerbating climate change through increased greenhouse gas emissions, waste production and resource depletion; promoting an unsustainable lifestyle through the encouragement of excessive consumption
Goal 17: Partnerships for the goals	intensification of international cooperation by creating platforms for the international exchange of ideas, skills and cultural heritage; promoting economic development and job creation, which helps to attract investment and cooperation	unequal distribution of benefits, which leads to inequality between countries and within countries; commercialization of cultural property and heritage, which can undermine respect for the diversity of cultures and traditions

4. Results

4.1. Global trends and challenges determining the polarity of the impact of cultural, creative industries on the sustainable development of territories

Global trends which are the consequence of asymmetric shocks and the effects of which cannot always be accurately estimated at present - the COVID-19 pandemic and war in Ukraine, including the consequent global energy crisis, the slowdown of global economic growth and rising inflation, as well as the unprecedented number of refugees (8 240 289 people registered in Europe as of 16.05.2023, the highest number - 1 602 062 people - in Poland) (UNHCR, 2023). The consequences of the global challenges faced by the creative industries as a result of asymmetric shocks are, in our view, the following (Table 8). In line with our objectives, we will examine them in an aggregate manner, as a detailed analysis is the subject of a separate study.

Despite the difficulties, the creative industries continue to play an important role in society. They stimulate economic development, promote social inclusion, enrich cultural diversity and strengthen people's mental health. The study's consistent challenge is to examine the global trends and challenges determining the polarity of the influence of cultural and creative industries on sustainable development in territories, making it possible to assess how culture and the creative industries can contribute to achieving the UN Sustainable Development Goals. Table 9 presents the results of the study on the impacts of the development of cultural, creative industries on selected SDGs to prepare for future changes.

The impacts of cultural industries development on sustainability are not limited to those discussed in the table, but they are, in our view, the most representative of the full range of possible impacts, including both positive and potential negative ones.

In the field of creative industries, there are many opportunities to minimise negative and maximise positive impacts on the SDGs. These include:
- promoting education and awareness of sustainability issues, which will help workers in the creative industries to make more responsible decisions;
- integrating sustainability principles into business models, including using business models that minimise resource consumption and waste;
- developing partnerships between creative industries, government, civil society and academia that will facilitate the sharing of knowledge, expertise and resources to achieve the SDGs;
- development and implementation of sustainability standards and norms in creative industries that will help minimise negative impacts;
- application of digital and other advanced technologies to increase resource efficiency, reduce waste and environmental impacts, increase accessibility and inclusiveness of creative products and services;
- facilitating the participation of marginalised and vulnerable groups in creative industries that will help improve social inclusion and equity and enrich cultural diversity;
- creating an enabling policy and regulatory environment conducive to sustainable development in the creative industries through the development and implementation of policies, regulatory measures, promotion tools and support programmes.

Using the opportunities discussed, the creative industries will contribute to the achievement of the Sustainable Development Goals through a holistic and integrated approach that takes into account all SDGs and their interlinkages.

4.2. Modeling the relationship between sustainable development of territories, cultural and creative industries
To identify and assess the dynamic relationship between the sustainable development of territories, cultural and creative industries, a formalized approach to solving the problem was used, which, within the framework of the study, was implemented by building panel models: with fixed effects, with random effects, with a dynamic model. Taking into account the polarity of the influence of cultural and creative industries on the sustainable development of territories, we formulate hypotheses for this stage of the study.

Hypothesis 1: Household spending on culture and recreation has a statistically significant impact on the overall SDG Index in the EU countries. Hypothesis 2: Demographic factors, such as the level of employment in the cultural and creative industries, have a statistically significant impact on the overall SDG Index in the EU countries. Hypothesis 3: Demographic factors, such as the number of creative professionals, have a statistically significant impact on the overall SDG Index in the EU countries. Hypothesis 4: Public administration and policies, including through government spending in the field of culture and creative industries, have a statistically significant impact on the overall SDG Index in the EU countries. In the models with fixed effects and with random effects (Generalised Least Squares, GLS) 24 spatial objects - EU countries - are included. The length of the time series is 11 years (from 2011 to 2021, which is due to the lack of data for 2022 of the Government variable).

The resulting equation for the model with fixed effects is as follows:

$\hat{SDGS} = 72,4 - 2,32e\text{-}05*Household + 0,0245*Employmen + 0,0389*Persons - 0,000332*Government$

A constant equal to 72.3997 represents the SDGS level at zero values of all explanatory variables. A high Z-value (68.8399) and a p-value of 0 indicate its statistical significance. Household (-0.00002318) shows a slight decrease in SDGS with an increase in the indicator. The standard error and the p-value (0.0707) on the verge of statistical significance indicate its potential importance, but requiring additional more detailed analysis.

Table 10. Standard errors of panel models: with fixed effects, with random effects, with a dynamic model, grouped by units of measurement, source: calculated by the authors

	coefficient	Stand. error	z	p-value
Model 1: Fixed effects, observations used - 264				
const	72.399661261648	1.05171099662567	68.8398823383386	0
Household	-2.31817424432634e-005	1.2827718746618e-005	-1.80716017408592	0.0707373085620103
Employment	0.0244561738930549	0.00370063166682947	6.60864849432796	3.87844383126595e-011
Persons	0.0389270930620561	0.0175405046022989	2.21926871231254	0.0264684488513284
Government	-0.000332146306135867	0.000211755418655069	-1.56853745819324	0.116755755218001
Model 2: Random Effects (GLS), observations used - 264				
const	75.6347000220852	0.947757451506778	79.803856885365	0
Household	-5.2923683196915e-005	3.19536660581834e-005	-1.65626326257989	0.0976685167814575
Employment	0.0227626667213387	0.003518663098123	6.46912366616776	9.85729010607103e-011
Persons	0.0031496188193537	0.0164308574580784	0.191689254647216	0.84798562345137
Government	-0.000359532535347605	0.000167677505470729	-2.1441906255599	0.0320176159103665
Model 3: Two-step dynamic panel, observations used - 216				
SDGS (-1)	0.919074941653806	0.0636275479606262	14.4446072670056	2.71098122828338e-047
Household	-5.52856355729791e-006	7.52674914434275e-006	-0.734522095964004	0.462630598442518
Employment	0.00076357086009524	0.00363109488345784	0.210286672368115	0.833443936646485
Persons	0.0123843796705189	0.00647409666470301	1.91291238174416	0.0557592702016812
Government	4.35372258265263e-005	8.62672559305354e-005	0.504678459479268	0.613784692714996

An increase in Employmen indicator provides an increase in the dependent variable SDGS. Given the low p-value, this indicates a strong and statistically significant relationship between the level of employment in the cultural and creative industries and sustainable development. Similarly, an increase in the Persons variable is associated with an increase in SDGS, which may indicate the impact of the number of creative professions on sustainable development. The decrease in the Government indicator corresponds to a decrease in SDGS, but this relationship is not statistically significant ($p > 0.05$), which means that the influence of this factor is not strong enough. Data for evaluating the quality of panel models with fixed and random effects are presented in Table 11.

Table 11. Data for evaluating the quality of models with fixed and random effects, source: calculated by the authors

	The Fixed effects model	Random Effects Model (GLS)
Average rel. variable	78.8040151515151	78.8040151515151
Sum of square balances	181.756648348515	6090.04394943517
LSDV R-square	0.946127670830544	
Log. plausibility	-325.326758940722	-788.876687358798
Schwartz crit.	806.780092769542	1605.63312023333
Stat. resp. of the depend. Variable	3.58166037496503	3.58166037496503
Model st. error	0.877584918747099	4.83975680787434
Within the R-square	0.423772549481215	
Akaike crit.	706.653517881445	1587.7533747176
Hennan-Quinn crit.	746.887420433553	1594.93800017333

We will evaluate the quality of the fixed effects model based on the data in Table 11. The R-squared value (LSDV) 0.9461 indicates that the model explains the changes in SDGS well, covering a significant part of the variability of the dependent variable. The intragroup R-squared 0.4238 demonstrates that intragroup differences are less significant for the model, which is important when analyzing differences between spatial objects. The standard error of the model 0.8776 indicates the accuracy of the model's predictions. Figure 2 clearly shows the results of the test for the normality of the distribution of residues for a fixed-effect model.

Belsley-Kuh-Welsch collinearity diagnostics demonstrates that there are 4 conditional indices with a value>= 30, which in turn indicates strong multicollinearity. Thus, some of the independent variables are strongly correlated with each other, which can lead to problems in interpreting the coefficients of the model, to overestimated standard errors and, consequently, to incorrect conclusions about statistical significance.

The random effects model (Generalized Least Squares, GLS) describes the equation:

^SDGS = 75,6 - 5,29e-05*Household + 0,0228*Employmen + 0,00315*Persons - 0,000360*Government.

The high Z-value (79.8039) of the constant (see Table 10) and a p-value of 0 indicate statistical significance. This is the basic SDGS level with zero values of all explanatory variables. The Househol coefficient has a negative sign (-0.0000529), indicating a feedback relationship with SDGS, but the p-value (0.0977) is above the standard threshold of 0.05, indicating a lack of statistical significance. A positive Employmen coefficient (0.02276) with a low p-value (almost 0) indicates a strong and statistically significant positive association with SDGS. A low positive Persons coefficient (0.00315) with a high p-value (0.8480) indicates its statistical insignificance. A negative Government coefficient (-0.000359) with a p-value of 0.0320 indicates its statistical significance, which indicates an

inverse relationship between the variable and SDGS. The standard error of the random effects model (GLS) at 4.8398 indicates its accuracy in predictions. The logarithmic likelihood (-788.877) reflects the fit of the model to the data. The criteria of informativeness: Akaike (AIC), Schwartz (BIC) and Hennan-Quinn (HQC) help to assess quality. The results of the test for the normality of the residue distribution for the random effects model (GLS) are shown in Figure 3.

Figure 2. The results of the residue normality test for a fixed effects model, source: compiled by the authors
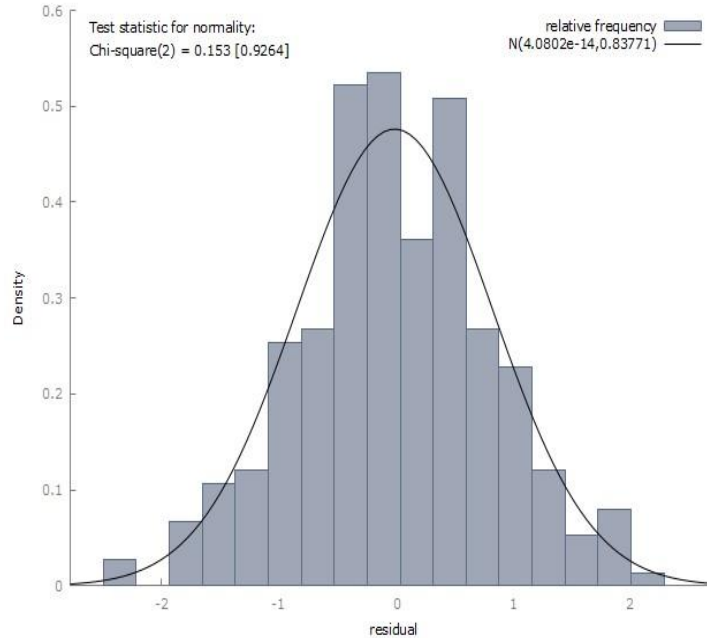
Figure 3. The results of the residue normality test for the random effects model (GLS), source: compiled by the authors
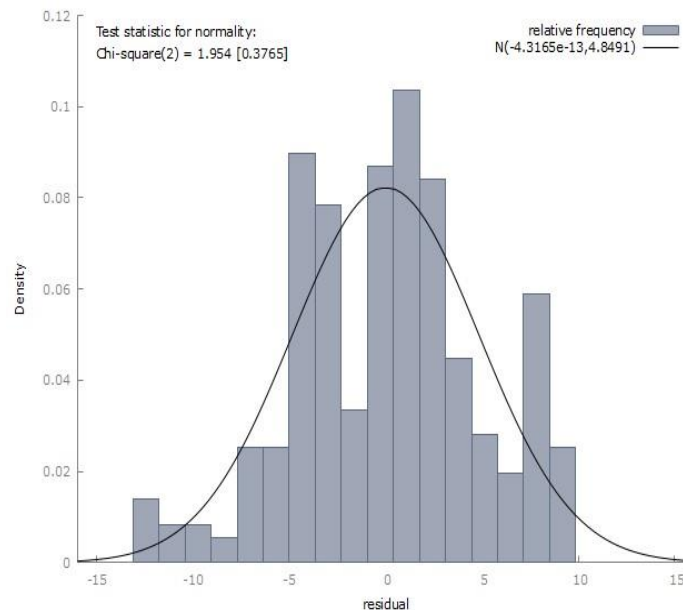
Given the results obtained, it can be concluded that each independent variable makes a unique contribution to the model, and their coefficients can be interpreted without concerns about distortions due to collinearity. Evaluating the considered models, it is possible to draw intermediate conclusions that a model with random effects is preferable for analyzing the relationship between cultural, creative industries and sustainable development of territories, since it does not demonstrate the problem of multicollinearity, unlike a model with fixed effects.

The results of the Hausman test (*test statistics* 42.2035685260183; *p-value* 1.51369672633111e-008) also justify the expediency of using a model with random effects. Thus, a model with random effects is preferable in terms of stability and reliability of coefficient estimates. The third model used in this study to study the dependence of

sustainable development of territories on the state and dynamics in the field of cultural and creative industries is a two-step dynamic panel. We will interpret the Coefficients based on the data presented in Table 10.
SDGS (-1) is the coefficient for the lagging dependent variable 0.9191, which confirms a strong and statistically significant ($p < 0.05$) positive relationship with the current SDGS level. This indicates a high persistence of the variable over time. Household shows an insignificant effect on SDGS with a high p-value (0.4626) indicating a lack of statistical significance. Employees has a positive effect on SDGS, but with a p-value of 0.8334, which makes it statistically insignificant. Persons has a moderate effect on SDGS with a p-value of 0.0558, which is on the border of statistical significance. Government has a minimal effect on SDGS, a high p-value (0.6138) indicating its statistical insignificance. We will evaluate the quality of the model based on the test data shown in Table 12.

Table 12. Test results for a two-step dynamic panel, source: calculated by the authors

Tests	p-value
AR (1) error test: z = -3.50611	[0.0005]
AR (2) error test: z = 2.42384	[0.0154]
Sargan Overidentification Test: Chi-squared (44) = 51.3846	[0.2069]
Sargan-Hansen Overidentification Test: Chi-squared (44) = 20.3024	[0.9992]
Wald's Joint test: Chi-squared (5) = 1219.71	[0.0000]

AR (1) is statistically significant and indicates first-order autocorrelation. AR (2) is also significant, but indicates the absence of second-order autocorrelation, which is a good sign for dynamic models. The overidentification tests (Sargan and Sargan-Hansen) both show that the instruments are probably adequate ($p > 0.05$). The Wald joint test is statistically significant, indicating that the model as a whole makes sense. The results of the residue normality test are shown in Figure 4 and demonstrate that the residues are normally distributed ($p > 0.05$).

Figure 4. The results of the residue normality test for a two-step dynamic panel
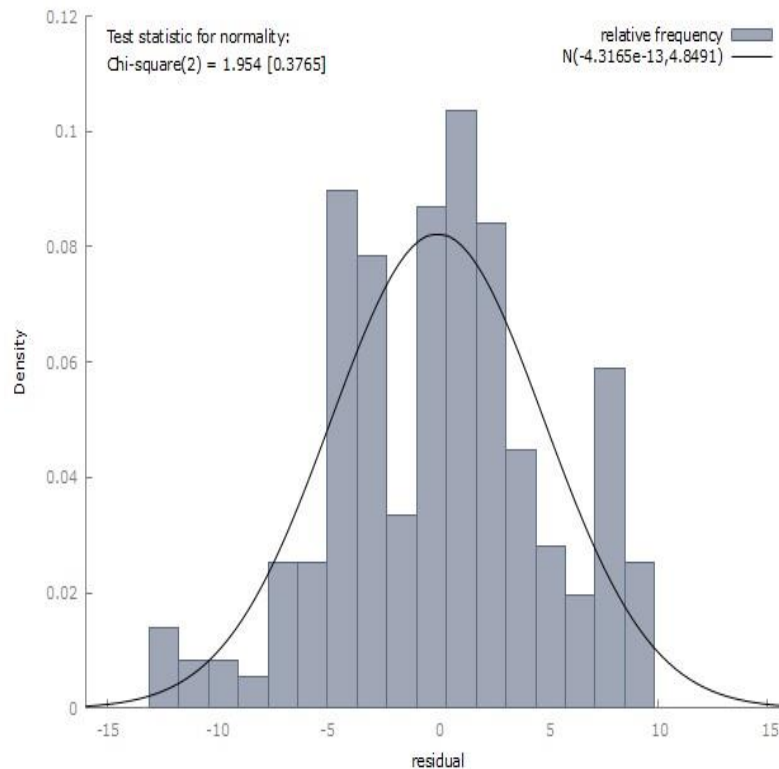
The data of collinearity diagnostics using the Belsley-Ku-Welsh (BKW) method for a two-step dynamic panel model showed the absence of collinearity. Number of status indexes >= 30: 0; Number of status indexes >= 10: 0. The absence of collinearity means that the coefficients of the model are not distorted due to the correlation between the independent variables and the results of the model can be interpreted with greater confidence in the absence of distortions due to the collinearity of the variables.
The two-step dynamic panel model demonstrates that past SDGS values strongly influence current values, which indicates the dynamic aspect of the process under study. However, most of the independent variables do not show statistical significance in their effect on SDGS. Autocorrelation and overidentification tests confirm the adequacy

of the selected tools and the absence of problems with second-order autocorrelation, which is a positive aspect for the dynamic panel model.

The result of the simulation is the conclusion that for studying the dependence of cultural, creative industries and sustainable development of territories, the model with random effects is preferred (among the first two models), which is confirmed by the lack of collinearity and the results of the Hausman test. The two-step dynamic panel model represents an alternative method for investigating the dependence of cultural, creative industries and sustainable development of territories, the expediency of which is enhanced if the purpose of the study includes an analysis of time dynamics. The absence of collinearity and the positive results of specific tests strengthen the validity of its application.

Thus, the results of the study allow us to formulate conclusions regarding the hypotheses, which are as follows:

Hypothesis 1. is confirmed only in the dynamic model. No statistically significant effect was found in models with fixed and random effects. This indicates that the impact of spending on culture and recreation on sustainable development is a more complex process in terms of influencing the sustainable development of territories and depends on temporary factors, while household spending on culture and recreation does have a statistically significant impact on the SDG Index, but this impact is negative. This may indicate that increased spending on culture and recreation for EU countries may have negative consequences for sustainable development due to increased resource consumption and other factors that need to be further investigated.

According to hypothesis 2, *the impact of employment in cultural and creative industries on sustainable development, measured through the SDG Index*, is not confirmed in all three models, indicating its limited impact. In hypothesis 3. The fixed and random effects model demonstrated limited impact, the two-step dynamic panel model showed that the number of creative professionals can have a moderate impact on the SDG Index, especially in a dynamic context. Finally, hypothesis 4, on the importance of public administration and politics, estimated through government spending in the field of culture and creative industries on the overall SDG Index in the EU countries, was not confirmed in all three models.

5. Conclusions

The study of the impact of cultural and creative industries on the sustainable development of territories confirms the existence of significant potential, the implementation of which will ensure progress towards achieving the SDGs. The challenges faced by representatives of the creative industries required significant resources for adaptation, while for different countries the strength of the consequences of asymmetric shocks – the pandemic, the military actions in Ukraine, the recession of the world economy – outlines a wide range of problems. The slow recovery of economies after the pandemic and the subsequent full-scale Russian invasion of Ukraine, active military operations and war crimes, rising inflation and economic recession, the subsequent energy and migration crisis in European countries, have become the challenges that in the near future will have a decisive role in the development of creative industries.

The study identifies the main consequences of global trends and challenges that determine the polarity of the influence of cultural and creative industries on the sustainable development of territories. It is proved that creative industries continue to have a stimulating effect on economic development, promote social inclusion of society, enrich cultural diversity and strengthen mental health. The presented results of forecasting the impact of the development of cultural and creative industries on the achievement of the SDGs make it possible to prepare and adapt to changes, as well as provide the necessary tools to minimize the potential negative impact of creative industries on sustainable development. From the point of view of the SDGs, the key areas in which creative industries play a decisive role have been identified:

SDG 8 (Decent work and economic growth): through job creation and economic growth, including for young people and women, which contributes to increasing their incomes and reducing inequality. SDG 9 (Industry, innovation and infrastructure): The development of creative industries promotes innovation and infrastructure improvement, especially in the field of digital technologies. SDG 10 (Reduced inequalities): Creative industries can offer new opportunities to improve the economic situation of marginalized groups and ensure equal access to resources and opportunities. SDG 17 (Partnership for the Goals): The development of creative industries promotes international cooperation and the exchange of knowledge and experience in the field of sustainable development. In general, it is proved that creative industries have a significant impact on sustainable development, but in order to realize the potential, it is necessary to adhere to a holistic, integrated approach that takes into account the interrelationships of the SDGs, which minimizes negative impacts. The study confirms that cultural and creative industries play a critical role in the sustainable development of territories. They not only promote economic growth and job creation, but also strengthen social integration and cultural diversity. At the same time, it is necessary to reorient development policies and strategies, including more active involvement of cultural and creative industries in the process of forming a sustainable economy. This requires defining the role of these industries in economic growth and innovation, as well as developing integrated policy solutions that take into account their potential.

The panel models used in the study showed a significant impact of cultural and creative industries on the SDG Index in the EU countries. They found that factors such as spending on culture and recreation, employment levels, the number of creative professionals and public administration have a statistically significant impact on sustainable development. The hypothesis about the impact of household spending on sustainable development is confirmed only in the dynamic model. This indicates the complex nature of the interaction of these costs with the achievement of sustainable development goals, which is clearly demonstrated when taking into account time dynamics. The negative impact of spending on culture and recreation on the SDG Index in the EU indicates potential negative consequences for sustainable development associated with increased resource consumption and other factors that are still subject to identification and research. The results of all three models do not confirm the significant impact of employment in cultural and creative industries on sustainable development (SDG Index). This indicates a limited impact of the factor, which is due to the variety of ways in which cultural and creative industries influence sustainable development.

Models with fixed and random effects showed a limited impact of this factor on sustainable development, while a two-step dynamic panel model revealed a moderate impact of the number of creative professions on the SDG Index. This highlights the importance of taking into account temporary changes and dynamics in the field of cultural and creative industries. The analysis of all three models did not reveal a statistically significant impact of public administration and policies assessed through government spending in the field of culture and creative industries on the SDG Index in the EU countries. As a result, it is necessary to further explore and rethink the role of public policy and management in supporting cultural and creative industries to promote sustainable development.

Considering that different models have strengths and weaknesses, we consider it advisable to use a combined approach, including the use of several models (with fixed and random effects, as well as a dynamic model) in the study process, which gives a more complete understanding of the dynamics and relationships studied. For the future of Ukraine, including as a source of changes taking place in the world, the study is relevant to identify patterns to justify the expediency of the development of cultural and creative industries; identify the direction of development, taking into account the need to ensure the sustainability of the territory.

To strengthen the role of creative industries in sustainable development, it is proposed to focus on the development of education in these areas, the integration of sustainability into business models, the development of sustainability standards, as well as the development of partnerships between various stakeholders. It is also important to continue research in this area to better understand the impact of cultural and creative industries on various aspects of sustainable development.

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