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Index-Based Measurement of Creative Industries' Impact on National Economy

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For more than 20 years creative industries (CI) have been experiencing increasing attention from both academia and policymakers alike. Capable of creating jobs, invigorating cities and regions, cultural and social life, contributing to the increase in value added, exports and quality of life, numerous studies proved CI to have broad impact on national economy, as evident not only in economic, but also in sociocultural and environmental areas. Authors aim to develop a model of CI impact on national economy integrating economic, sociocultural, and environmental indicators, to create the index for measuring the CI impact on national economy, and to adapt it empirically to the case of the EU countries in 2008 – 2016. Research confirms that the impact of CI is observed in economic, sociocultural, and environmental impact areas. CIIE index allows estimating CI impact on national economy and enables to draw comparisons among the EU countries in 2008 – 2016 based on CI impact on national economy. This study reveals direct dependence between the factors of CI development and CI impact on national economy. With reference to the index describing the conditions of CI development (Global Creativity Index), three clusters of the EU countries were identified using CI impact on national economy (CIIE) index. Clustering confirms that historical, social, economic, and political development of a country determines conditions for CI emergence and development, and, consequently, influences CI impact on national economy.

Keywords: *Creative Industries; Cultural Industries; Creative Economy; Creativity Index; European Union.*

Introduction

Since most Western countries lean towards ideas and knowledge generation as opposed to producing services and goods, the field of creative industries (CI) gathers increasing attention from academia and policy makers alike. In addition to this, arguments backing CI as an indispensable component of modern post-industrial knowledge society grow in both number and depth: capable of creating jobs, invigorating cities and regions, cultural and social life, contributing to the increase in value added, exports and quality of life, numerous studies proved CI to have an impact on national economy. CI exceed other sectors in terms of higher than average development and new jobs (Blair *et al.,* 2001; Florida & Tinagli, 2004; Garnham, 2005; KEA, 2006; UNESCO, 2006; van der Pol 2007; Hotho & Champion, 2011; Bandarin *et al.,* 2011; De Propris 2013; Goede & Louisa, 2012; EY, 2014; OE, 2014; Daubaraite & Startiene, 2015; Cong 2019; Yum 2020); in addition to this, CI provide means to express cultural identity crucial for diversity (Smallbone, Bertotti & Ekanem, 2005; Matheson, 2006; van der Pol, 2007; EC, 2010; Sigurdardottir & Young, 2011; Bandarin *et al.,* 2011; Barauskaite & Verikiene, 2011; European Parliament and EU Council, 2013). Cultural diversity defines societal viability and economic success much more than cultural homogeneity (Florida, 2002; Florida and Tinagli, 2004; Florida, 2008, and other works by Florida; UNESCO, 2006; Boschma & Fritsch, 2007; Goede & Louisa, 2012; Daubaraite & Startiene, 2017; Innocenti & Lazzeretti, 2019; Yum, 2020 and other authors). It is important to note that the same holds true in countries with economies in transition (Bilan, 2019). The term 'creative industries' itself may be analysed solely in the context of information society (Flew, 2002; Thomassen, 2007; Collins *et al.,* 2018; Yum, 2020), especially considering the latest developments in light of a global pandemic and consequential lockdowns, when all possible products and services were only available online. In addition to this, culture was always associated with the life of a city, however, a growing body of research analyses the role CI play in regional development (Collins *et al.,* 2018; Innocenti & Lazzeretti, 2019; Yum, 2020 and others). At the same time, since the digital revolution improved accessibility of many sectors, culture should follow the same trend (Fanea-Ivanovici & Pana, 2020). CI undoubtedly constitute a part of digital economy and the bond between those concepts will increase and deepen in the future. Furthermore, CI should be associated with innovations, information and communication technologies (Garnham, 2005; Power & Nielsen, 2010; Cong, 2019; Yum, 2020); therefore, it is logical that CI are the source of both economic and social development and growth, yet certain conditions are required to ensure CI emergence and further growth and development.

Scientific literature analysis proved that measuring the impact CI have on national economy is an important issue, however, it has received relatively little attention from researchers since most of the research in this field is based on measuring specific solitary indicators. In addition to this, the impact of CI on national economy is of a much broader scope, as evident not only in economic, but also in sociocultural and environmental areas. Consequently, the aim of this study is to develop an index of CI impact on national economy, integrating economic, sociocultural, and environmental indicators, and to adapt it empirically to the case of the EU countries.

Literature Review

Undoubtedly, one of the most significant researchers of CI is Richard Florida. One of his first studies on CI and creative class is *The Rise of the Creative Class* (2002). At the time of its release, the book was revolutionary and drew society's and politicians' attention to the importance of CI. Later, the ideas it proclaimed were criticised, corrected, and improved, which led to a variety of approaches and viewpoints. Nevertheless, Richard Florida remains an authority in the research field of CI, creative class, and other related topics. Based on Florida's ideas, different authors developed complementing theories, proposed evaluation methodologies, debated, resulting in varied perception and evaluation of CI. Florida suggested assessing CI by the Creativity Index (2002), allowing to measure and compare creativity in different countries based on the assumption that creativity defines country's economic development. Structure of the index is presented in Table 1.

Table 1

Creativity Index (Florida, 2002)

Subindex	Indicators
Technology	Estimates (1) innovation as the number of patents granted per capita, and (2) high-technologies in terms of size and concentration of clusters of technology-related industries (such as software, technologies, biomedical products, and engineering services).
Talent	Estimates (1) a share of creative class in total working population, and (2) education, i.e. the number of people with a bachelor's or higher degree.
Tolerance	Estimates (1) *Gay Index,* i.e. the number of homosexual couples, (2) *Bohemian Index,* i.e. the number of artistically creative people, (3) *Melting Pot Index*, i.e. the relative percentage of foreign-born people.

Creativity Index combines technology, talent, and tolerance indices. Value of each subindex is calculated in accordance with country ranking among other countries taken into evaluation: each country is evaluated in points, and the country reaching the highest value is awarded the highest score. Creativity Index is calculated by adding evaluation points in each subindex and dividing the sum by the number of subindices.

Supplementary studies, available statistics, and the process of data gathering resulted in a corrected version of the Creativity Index: a group of researchers led by Richard Florida improved the Index so that it could be applicable worldwide. Although they modified the structure of the Index, the logic behind the calculation remained the same as that of the original Creativity Index. The Index was corrected in 2011, and it was renamed to Global Creativity Index in 2015. The latest structure of the Global Creativity Index is presented in Table 2.

Table 2

Global Creativity Index (Florida *et al*., 2015)

Subindex	Indicators
Technology	Estimated in terms of (1) investment into R&D as a percentage of GDP, and (2) innovations as the number of patent applications per million people.
Talent	Estimated in terms of (1) a percentage of creative class, i.e. people working in CI out of total working population, (2) access to education, i.e. a share of people studying at graduate school level out of all people who graduated from high school or educational institution of similar level.
Tolerance	Estimated in terms of (1) tolerance towards ethnic and racial minorities, and (2) tolerance towards sexual minorities.

Following the Creativity Index proposed by Florida (2002), Euro-Creativity Index, which is very similar to the Creativity Index, was developed (Florida & Tinagli 2004) and adapted to measuring and comparing creativity amongst European countries. The core idea remained the same, i.e., a country's capability to attract and retain creative people determines its economic development. The structure of the index is presented in Table 3.

Table 3

Euro-Creativity Index (Florida & Tinagli, 2004)

Subindex	Indicators
Euro-Talent	Estimated in terms of (1) a share of creative class amongst total working population, (2) the percentage of population aged 24–64 with bachelor's degree or higher, and (3) the number of research scientists and engineers per 1,000 workers.
Euro-Technology	Estimated in terms of (1) the number of patents per million people, (2) the number of high-tech patents per million people, and (3) R&D expenditure as percentage of GDP.
Euro-Tolerance	Estimated in terms of (1) attitudes towards minorities (based on the Eurobarometer Survey), (2) values and attitudes that cover different aspects of the value system (such as religion, nationalism, family, women's rights, divorce, and abortion), and (3) attitudes towards self-expression, quality of life, democracy, and culture.

The Euro-Creativity Index follows the same calculation logic as the Creativity Index: the value of Euro-Creativity Index is the sum of country's scores of all three subindices divided by the maximum possible score.

Based on the works of Florida (2002), and Florida and Tinagli (2004), Hui et al. (2006) developed an index to measure creativity in Hong Kong. The Hong Kong Creativity Index was meant to measure the impact of creativity, and to

evaluate the influence of creativity on economy of the region. The index structure is presented in Table 4.

Hong Kong Creativity Index was calculated for each year of research (from 1999 to 2004), considering that 100 per cent value was reached in each area in 2004. Therefore, to apply this index in further estimations, a reference point should be chosen, and index values should be recalculated accordingly.

Table 4

Hong Kong Creativity Index (Hui *et al.,* 2006)

Subindex	Indicators
Structural – institutional capital	Estimated in terms of (1) independence of legal system, (2) perception of corruption, (3) freedom of expression, (4) ICT infrastructure, (5) strength of social and cultural system, (6) accessibility to community facilities, (7) financial infrastructure, and (8) entrepreneurship conditions.
Human capital	Estimated in terms of (1) government investment in R&D and education, (2) share of knowledge economy jobs, and (3) labour force mobility.
Social capital	Estimated in terms of (1) development of social capital, e.g. the amount of charity donations, (2) attitudes towards traditional norms and values prevailing in the society, and (3) involvement in social decision-making, elections.
Cultural capital	Estimated in terms of (1) government investment into culture sector, (2) societal attitudes towards cultural events and environmental protection, and (3) participation in cultural activities.

Analysis of the most widely used CI and related fields measurement indices reveals that such evaluation is a relevant and perspective approach, especially when estimating the impact of CI on economy under the conditions of growing integration and globalisation.

Methodology of the Study

This study suggests an index-based CI impact on national economy measurement by identifying core CI development determinants (Florida, 2008; Comunian *et al.,* 2010; Tomczak & Stachowiak, 2015; White *et al.,* 2014, etc.) and CI impact on national economy areas (UNESCO, UNDP, UNCTAD, EC, OE, EY, KEA reports; Florida & Tinagli, 2004; Potts & Cunningham, 2008; White *et al.,* 2014; Levickaite & Reimeris, 2011; Oakley, 2004; Champion, 2010; De Propris, 2013; Matheson, 2006, etc.) while combining the constituents into a conceptual framework of CI impact on national economy (see Figure 1).

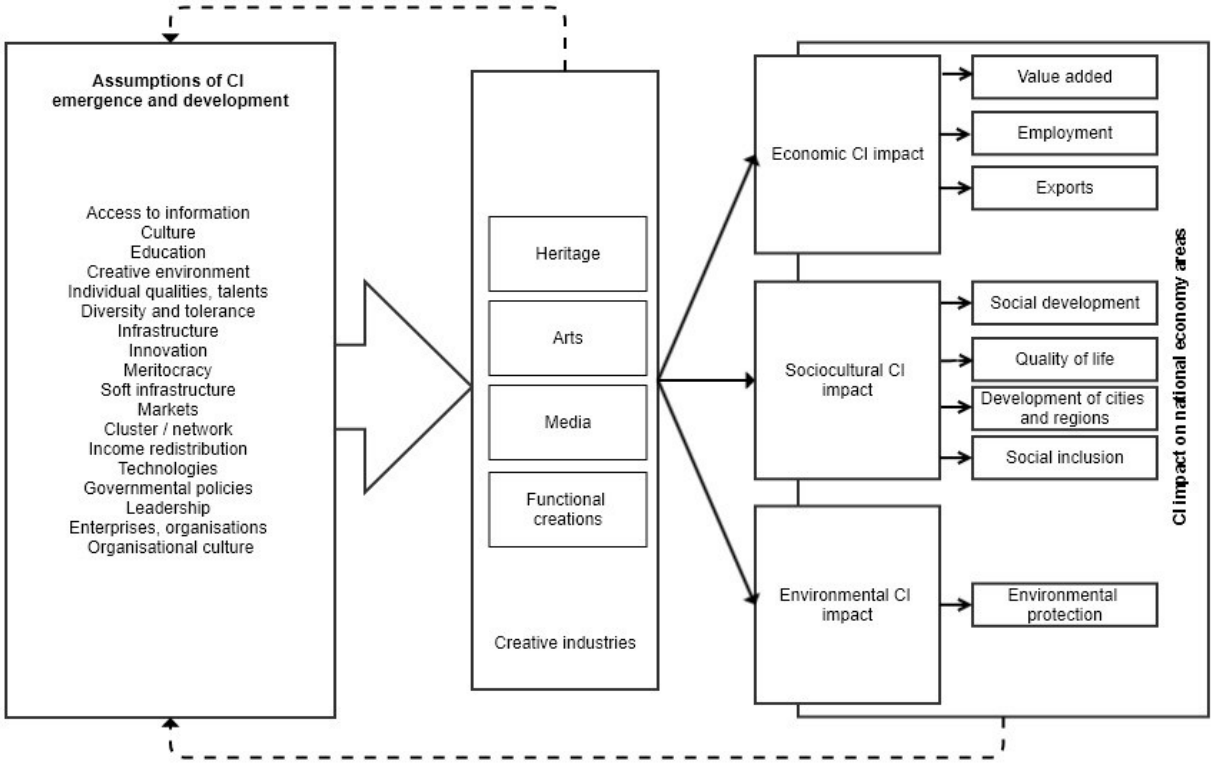

Figure 1. Conceptual Framework of the Impact of Creative Industries on National Economy (Developed by Authors)

It is crucial to note that CI impact on national economy varies from area to area. Scientific literature analysis revealed that CI impact on national economy manifests itself via economic impact (Florida & Tinagli, 2004; Cunningham & Potts, 2014; Pitts, 2015; Daubaraite & Startiene, 2017; Collins *et al.,* 2018; Cong, 2019; Yum, 2020, etc.), sociocultural impact (Oakley, 2004; van der Pol, 2007; Pratt, 2008; White, 2010; Levickaite & Reimeris, 2011; Sigurdardottir & Young 2011; Daubaraite & Startiene 2015; Yum 2020, etc.), and environmental impact (Bandarin, Hosagrahar, & Albernaz, 2011; Goede & Louisa, 2012; Collins *et al.,* 2018; Bilan *et al.,* 2019, etc.).

Based on the conceptual framework, CI impact on national economy (CIIE) index and its components are defined by the following equations:

$$CIIE = w_1 EC_{CIIE} + w_2 SC_{CIIE} + w_3 EN_{CIIE}, \quad (1)$$

where EC_{CIIE} is the subindex of CI economic impact,
SC_{CIIE} is the subindex of CI sociocultural impact,
EN_{CIIE} is the subindex of CI environmental impact, and
$w_1 \dots w_3$ are weights of CI impact on national economy subindices, the sum of which equals 1;

$$EC_{CIIE} = a_1 J_E + a_2 VA_E + a_3 E_E, \quad (2)$$

where E_{CIIE} is the subindex of CI economic impact,
J_E is the number of jobs created by CI,
VA_E is the value added created by CI,
E_E is the exports created by CI,
$a_1 \dots a_3$ are weights of CI economic impact subindices, the sum of which equals 1;

$$SC_{CIIE} = b_1 SD_{SC} + b_2 QL_{SC} + b_3 RU_{SC} + b_4 SI_{SC}, \quad (3)$$

where SC_{CIIE} is the subindex of CI sociocultural impact,
SD_{SC} is the social development caused by CI,
QL_{SC} is the quality of life caused by CI,
RU_{SC} is the regional and urban development caused by CI,
SI_{SC} is the social inclusion caused by CI, and
$b_1 \dots b_4$ are weights of CI sociocultural impact subindices, the sum of which equals 1;

$$EN_{CIIE} = EN_E, \quad (4)$$

where EN_{CIIE} is the subindex of environmental impact of CI, EN_E is the environmental impact caused by CI.

Index of CI impact on national economy may acquire values from 0 (CI have no influence on country's economy) to 1 (country's economy is solely based on CI). The change of index from 0 to 1 shows the impact of CI on national economy, i.e. the closer index values are to 1, the more significant is the CI economic sector.

It is important to note that impact areas are not equally significant, thus attributing different weight coefficients ensures they are distinguished from one another, and the impact of CI on each is reflected properly in the index.

Each area of CI impact on economy is estimated using relevant indicators. It is fair to mention that economic impact measurement could include indicators of circular economy as well as environmental impact could contain indicators to evaluate waste management specifics, however, literature and research review shows that data on such indicators cannot be connected to CI explicitly. In addition to this, when selecting indicators, criteria of indicator reliability and data accessibility (UN 2007) were followed. The structure of CIIE index combining indicators used for evaluation is presented in Table 5.

Table 5

Structure of CIIE

Area of impact	Directions constituting the impact area	Direction indicators	Calculation of indicators
Economic	Jobs created by CI	Percentage of people employed in CI	Number of people employed in CI / total number of working people in the country x 100.
	Value added created by CI	Share of value added created by CI (%)	Value added created by CI (MEUR) / value added in the country (MEUR) x 100.
	Exports created by CI	Share of exports created by CI (%)	Exports created by CI (MEUR) / exports value in the country (MEUR) x 100.
Sociocultural	Social development caused by CI	Freedom of expression	Evaluation received from the official website of Reporters Without Borders RSF.org.
		Level of education of workers in the CI	Number of people with higher education in the CI / total number of people employed in CI x 100.
		Difference in earnings of men and women working in the CI	Average man's hourly gross earning (EUR) – average woman's hourly gross earnings (EUR) / average man's hourly gross earning (EUR) x 100.
	Quality of life caused by CI	Weekly load of working hours of people employed in the CI	Number of working hours per week / total number of hours per week x 100.
	Regional and urban development caused by CI	Household costs for cultural products according to purchasing power standards	Evaluation obtained from the official EUROSTAT website.
		Percentage of people who visit cultural objects	Percentage of people aged 25–64 who went to cinema, theatre or concert, visited cultural objects (historical monuments, museums, art galleries, objects of archaeological value) at least once within the last 12 months. Evaluation obtained from the official EUROSTAT website.
		Share of CI enterprises in total number of country's enterprises	Number of CI enterprises / total number of enterprises in the country x 100.
	Social inclusion caused by CI	Global tolerance index	Evaluation obtained from the report *The Global Creativity Index* (Florida et al., 2015).
Environmental	CI impact on environment protection	Share of air pollution generated by CI enterprises (%)	Air pollution caused by CI enterprises (PM10, t) / air pollution caused by enterprises in the country (PM10, t) x 100.

The area of sociocultural CI impact on national economy is rather complex and much broader in scope, especially in comparison to the economic impact area: analysis of social development, quality of life, regional and urban development, and social inclusion directions revealed that each of the impact directions can be evaluated by different indicators; most relevant ones were selected by usage frequency in CI research and accessibility of data. Environmental quality and natural conditions are assessed in terms of sector's ability not to pollute or worsen natural environment. Analysis of indicators and indices disclosed that the impact of CI and related areas on environment protection is usually measured by air pollution level (Fox, 2013; OECD, 2013; Social Progress Imperative 2016; OECD 2016, etc.). Criteria, such as water pollution and environmental noise, are not as frequent in measuring the environmental impact (OECD 2013), thus the measure of air pollution caused by CI is used to estimate the value of environmental impact subindex. Since the environmental impact of CI is defined by one indicator, the indicator's weight EN_E equals 1.

Having calculated values for each subindex using formulas (2), (3), and (4), we normalise the data following the rules of Global Creativity Index calculation, i.e. obtained subindex values are divided by the number of countries studied.

Empirical Study

This study is based on statistical data of European Union (EU-28) countries (based on the data provided by EUROSTAT, Reporters without Borders, The Global Creativity Index (Florida *et al.*, 2015)) that define the impact of CI on national economy. It should be noted that the majority CI studies confirmed needed statistical data to not be detailed, accurate, or present in general (e.g. Florida & Tinagli, 2004; Pratt, 2008; Goede & Louisa, 2012; White *et al.,* 2014; De Beukelaer, 2014; Pitts, 2015; Daubaraite & Startiene, 2017; Bilan *et al.,* 2019, etc.). On one hand, this issue is caused by different CI definitions; on the other hand, countries collect different statistical data. This research uses uniform CI definition established by UNCTAD (2008), dividing CI into four subsectors: heritage, arts, media and functional creations. CI subsectors were identified using NACE rev. 2 classification; and in order to ensure adequacy and comparability of the data used in the study, creative sectors in all EU countries are described according to the classification provided by EUROSTAT, the statistical office of the EU. It is crucial to note that while the first term to be used was "cultural industries", due to changes in political and socioeconomic circumstances, cultural industries are now a part of CI. This perspective is sustained in this research, as cultural industries fall under CI due to NACE rev. 2 classification. CI subsectors according to the NACE rev. 2 classification system are given in Table 6.

Table 6

Classification of CI Categories According to NACE rev. 2

CI categories	Type of economic activity according to NACE rev. 2 classification system
Cultural heritage	Class R – Arts, entertainment and recreation
Arts	Class R – Arts, entertainment and recreation Class M – Professional, scientific and technical activities
Media	Class J – Information and communication
Applied creativity	Class M – Professional, scientific and technical activities

Although classes J, M and R of NACE rev. 2 include activities that are not attributed to CI *per se*, this is the prerequisite for data collection in the analysis and comparison of all EU-28 countries. It should be noted that when the same classes are chosen, deviations in all countries are analogous; therefore, the selected assessment benchmark allows for comparative analysis.

In order to evaluate CI impact on national economy, weights of CIIE subindices are determined, and then the analysis and assessment of each subindex is provided. CIIE values serve as a basis for assessing EU countries in accordance to the impact CI have on national economy.

Subindex weights were determined by expert survey: CI experts provided their competent and practice-based insights (see Table 7 for reliability of expert survey). In order to ensure equal representation of all CI subsectors, two experts from each subsector took part in the survey. Three experts have more than 10 years' experience in CI, three experts have 5–10 years and two have less than 5 years' experience. Kendall's coefficient of concordance shows that there is quite little agreement among experts. However, as the p-value of Friedman test is less than the significance level of 0.05, the null hypothesis (H0: there is no significant difference in rating of questions) is rejected and we can conclude that questions are rated differently, thus survey results can be used for further research.

Table 7

Assessment of Expert Opinion Compatibility and Statistically Significant Difference

Part of survey	Cronbach's alpha coefficient	Kendall's concordance coefficient (W)	Friedman's criterion (p-value)
Questions in parts B and C	0.76	x	x
Part B. Assessing the importance of indicators for CI development	x	W = 0.321	p = 0.000
Part C. Assessing the directions of CI impact on national economy	x	W = 0.364	p = 0.000

Based on average scores attributed to areas and directions of CI impact on national economy by experts (where 1 is least important and 5 is most important), weights of each subindex and assessment direction were determined (see Table 8).

Table 8

Weights of CIIE Subindices and Assessment Directions

Subindex, assessment direction	Weight
Subindex of economic impact EC $_{CIIE}$	**$w_1 = 0.362$**
Jobs created by creative industries J_E	$a_1 = 0.337$
Value added created by creative industries VA_E	$a_2 = 0.368$
Exports created by creative industries E_E	$a_3 = 0.295$
Total weight of all assessment directions:	$a_1 + a_2 + a_3 = 1$
Subindex of sociocultural impact SC $_{CIIE}$	**$w_2 = 0.383$**
Social development *SD* $_{SC}$	$b_1 = 0.314$
Improvement of quality of life QL $_{SC}$	$b_2 = 0.280$
Regional and urban development *RU* $_{SC}$	$b_3 = 0.220$
Social inclusion *SI* $_{SC}$	$b_4 = 0.186$
Total weight of all assessment directions:	$b_1 + b_2 + b_3 + b_4 = 1$
Subindex of environmental impact EN $_{CIIE}$	**$w_3 = 0.255$**
Total weight of all subindices:	**$w_1 + w_2 + w_3 = 1$**

Using the weights of subindices (Table 8), previous formula (1) for calculating CIIE index is:

$$CIIE = 0.362 \times EC_{CIIE} + 0.383 \times SC_{CIIE} + 0.255 \times EN_{CIIE} \quad (5)$$

As mentioned earlier, subindex of CI sociocultural impact is rather complex, and due this reason, several indicators are used to describe it (Table 5). Indicators for each direction are equally important, thus their weight coefficients are calculated proportionally to the number of indicators. Due to different and / or inconsistent data, CI assessment is often based on ranking (see, for example, studies by Florida, 2002; Florida & Tinagli, 2004; Jancoras *et al.,* 2014; Florida *et al.,* 2015, etc.). Following the above-mentioned authors, this study ranks the countries according to each assessment direction, and each of the countries is attributed a score from 1 (the lowest CI impact) to 28 (the highest CI impact) or other highest possible score considering accessibility of statistical data. In case the statistical data cannot be accessed, country gets 0 points.

Annexes 1, 2 and 3 present the calculated values of the CIIE subindex for economic, sociocultural and environmental impact, respectively, during the period 2008–2016.

CI impact on national economy is estimated using formula (5) considering economic, sociocultural, and environmental impact of CI; results are presented in Table 9 and Figure 2.

Table 9

Values of the CIIE Index 2008–2016

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
Austria	0.377	0.374	0.399	0.408	0.417	0.394	0.415	0.422	0.413	0.402
Belgium	0.497	0.483	0.493	0.484	0.486	0.475	0.473	0.527	0.530	0.494
Bulgaria	0.371	0.378	0.371	0.370	0.337	0.369	0.369	0.376	0.362	0.367
Cyprus	0.423	0.424	0.426	0.468	0.440	0.450	0.478	0.442	0.420	0.441
Croatia	0.318	0.331	0.327	0.303	0.325	0.319	0.337	0.271	0.286	0.313
Czechia	0.402	0.395	0.378	0.377	0.384	0.397	0.387	0.380	0.273	0.375
Denmark	0.645	0.646	0.636	0.641	0.635	0.647	0.654	0.671	0.679	0.650
Estonia	0.359	0.385	0.461	0.534	0.467	0.388	0.390	0.423	0.439	0.427
Finland	0.557	0.584	0.588	0.601	0.594	0.605	0.621	0.569	0.592	0.590
France	0.495	0.538	0.527	0.541	0.551	0.564	0.566	0.524	0.527	0.537
Germany	0.418	0.426	0.471	0.456	0.470	0.462	0.477	0.448	0.434	0.452
Greece	0.191	0.190	0.147	0.133	0.153	0.167	0.168	0.238	0.258	0.183
Hungary	0.350	0.354	0.336	0.320	0.321	0.331	0.307	0.369	0.397	0.343
Ireland	0.585	0.615	0.593	0.593	0.587	0.570	0.583	0.645	0.647	0.602
Italy	0.533	0.547	0.535	0.529	0.535	0.543	0.548	0.506	0.510	0.532
Latvia	0.390	0.429	0.439	0.460	0.451	0.425	0.432	0.511	0.514	0.450
Lithuania	0.453	0.501	0.486	0.444	0.471	0.448	0.463	0.577	0.564	0.490
Luxembourg	0.613	0.645	0.627	0.634	0.656	0.657	0.682	0.644	0.655	0.646
Malta	0.403	0.466	0.453	0.455	0.465	0.462	0.466	0.449	0.466	0.454
Netherlands	0.598	0.632	0.613	0.593	0.578	0.581	0.595	0.613	0.602	0.601
Poland	0.210	0.210	0.241	0.247	0.246	0.250	0.266	0.315	0.281	0.252
Portugal	0.369	0.368	0.360	0.336	0.346	0.358	0.354	0.355	0.353	0.355
Romania	0.331	0.346	0.370	0.361	0.377	0.390	0.378	0.282	0.246	0.342
Slovakia	0.458	0.467	0.475	0.478	0.472	0.460	0.451	0.432	0.443	0.460

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
Slovenia	0.516	0.476	0.495	0.529	0.557	0.549	0.551	0.558	0.572	0.534
Spain	0.534	0.468	0.541	0.518	0.521	0.510	0.527	0.426	0.420	0.496
Sweden	0.522	0.521	0.537	0.546	0.542	0.546	0.558	0.535	0.527	0.537
United Kingdom	0.627	0.609	0.620	0.633	0.643	0.647	0.656	0.677	0.684	0.644

According to results presented in Table 9 and Figure 2, CI have the lowest impact on national economy in Greece (2008–2015) and Romania (2016), whereas the highest CI impact on national economy is observed in Denmark (2008–2011), Luxembourg (2012–2014), and the United Kingdom (2015–2016).

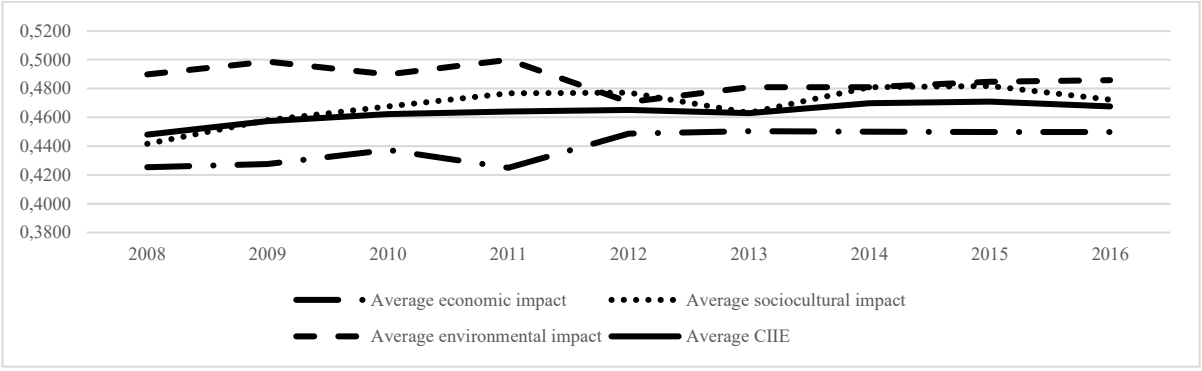

Figure 2. Dynamics of Average Economic, Sociocultural and Environmental Impact and Average CIIE 2008 – 2016

Figure 2 visually demonstrates that CI impact on national economy grew throughout the whole analysed period. It comes as no surprise that the economic impact of CI decreased following the economic crisis of 2008–2009: even though the sector was rapid to recover in 2010, as other sectors caught up and reached pre-crisis levels, importance of CI dipped in 2011. It is important to point out that average sociocultural impact decreased in 2013 due to a drop in quality of life caused by CI: workload or number of working hours increased in CI, helping to grow its average economic impact but decreasing quality of life for the employed at the same time. Average environmental impact dropped significantly in 2012 and remained at more or less the same level throughout the analysed period, showing decreasing impact of CI on air pollution in the EU. Despite a couple of hiccups, average CIIE shows increasing importance CI have on national economy in Europe as a whole.

Theoretically, the index may vary from 0 to 1, yet its actual lowest value is estimated in Greece in 2011 (CIIE index value is 0.133), and the highest value is estimated in the United Kingdom in 2016 (CIIE index value is 0.684). Calculation results are further checked for normal distribution and correlation, then used for hierarchical clustering of the analyzed EU countries.

Research Results

Analysis of scientific literature (see Figure 1) revealed a causal link between (1) the assumptions about CI emergence and development and (2) CI impact on national economy. CIIE index measures the outcome, i.e., CI impact on national economy, whereas the assumptions about CI emergence and development assess the conditions that cause CI development. In order to determine the link between the assumptions about CI emergence and development and CI impact on national economy areas, correlation analysis between Global Creativity Index of 2015 (Florida *et al.,* 2015) and CIIE of 2016 is performed.

Table 10

P-values of CIIE and Global Creativity Index

	P-value of Kolmogorov–Smirnov criterion
CIIE	0.97
Global Creativity Index	0.33

Since the data is distributed normally (P-value of Kolmogorov–Smirnov criterion > 0.05, see Table 10), Pearson correlation coefficient denoting correlation strength among variables is calculated (Table 11).

Table 11

Pearson Correlation Coefficient

Pearson correlation coefficient	0.7082
P-value of Kolmogorov–Smirnov criterion	0.0000
N	28

Calculations confirm direct dependence between assumptions about CI emergence and development and CI impact on national economy; based on this dependence, hierarchical clustering is performed, insights and recommendations on how to increase CI impact on national economy are offered. Hierarchical clustering is provided in Figure 3.

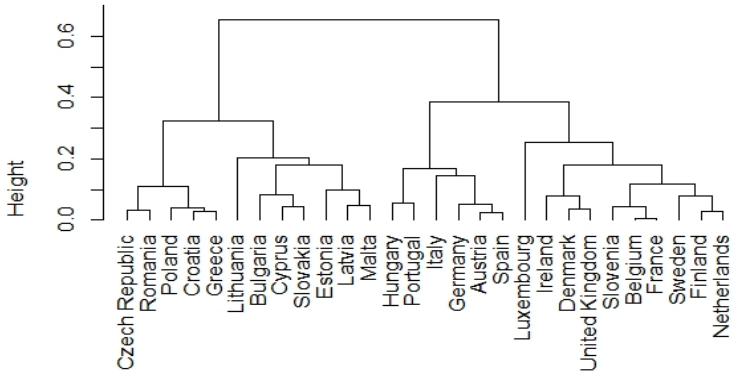

Figure 3. Hierarchical Clustering of EU Countries According to Conditions for the Development of CI and CI Impact on National Economy

According to the principles of this research, one cluster cannot contain more than 50 % of countries, yet the number of clusters should be the least possible. Calculations allowed allocating all countries into the following three clusters:

1st cluster (12 countries): Czech Republic, Romania, Poland, Croatia, Greece, Lithuania, Bulgaria, Cyprus, Slovakia, Estonia, Latvia, Malta.

2nd cluster (6 countries): Hungary, Portugal, Italy, Germany, Austria, Spain.

3rd cluster (10 countries): Luxembourg, Ireland, Denmark, United Kingdom, Slovenia, Belgium, France, Sweden, Finland, Netherlands.

Most countries of the 1st cluster are relatively new democracies, with past experiences that include loss of statehood, socialist, fascist cultural and political repressions, planned economy; these countries joined the European Union, and their respective democratic societies are still developing. 3rd cluster countries are considered to have the best conducive environment for CI development and experience the highest CI impact on national economy.

To clearly identify country groups in terms of CI impact on economy and conditions for CI development, cluster assessments based on CIIE index of 2016, and the Global Creativity Index of 2015 are listed in Table 12.

Table 12

Average Scores of Cluster Countries by CIIE Index and Global Creativity Index

Cluster	Average score of cluster countries by GCI index (2015)	Average score of cluster countries by CIIE index (2016)
1st cluster	0.498	0.379
2nd cluster	0.756	0.421
3rd cluster	0.852	0.601

Research data (see Table 12) confirms direct dependence between CI development conditions (estimated using GCI) and CI impact on national economy (estimated using CIIE); significant difference between the highest and the lowest scores by CIIE and GCI attributed to the country clusters exists.

Obviously, the 1st cluster countries create the least favourable conditions for emergence and development of CI; therefore, CI impact on national economy is the lowest.

Countries in the 2nd cluster have average conditions for emergence and development of CI; thus, the impact of CI on national economy in these countries is rather high.

Finally, 3rd cluster countries have favourable conditions for development of CI, hence the highest CI impact on national economy of cluster countries. Geographical distribution of clusters is mapped in Figure 4.

Figure 4. Geographic Distribution of Clusters

Discussion and Conclusions

The research results show that the impact of CI is observed in economic, sociocultural, and environmental impact areas. Accordingly, CI promotion and development is not only beneficial economically (increase in new jobs, value added, and exports), which can be easily measured, but it is also helpful in solving social-cultural environment related issues (social development, quality of life, rural and urban development, and growth in social inclusion). It is important to note that CI contribute to air pollution less than other economy sectors, thus they have higher than average environmental impact.

CIIE index allows estimating CI impact on national economy and enables to draw comparisons among the EU countries in 2008–2016 based on CI impact on national economy. Theoretically, CIIE index may vary from 0 to 1; however, calculations revealed that its lowest value was estimated in Greece in 2011 (CIIE = 0.133), and the highest value was noted in the United Kingdom in 2016 (CIIE = 0.684). Greece and Romania were estimated lowest CIIE index values during the studied period (Greece: 2008 – 2015, Romania: 2016), while leading countries in terms of CI impact on national economy were Denmark (2008–2011), Luxembourg (2012–2014), and the United Kingdom (2015–2016).

Apart from statistical calculations, it is important to recognize that Europe is an extremely diverse continent and the EU countries have multiple connections and relationships between them, leading to spill over effects in neighbouring countries; they share historical circumstances of constituting one state or being at war with one another, and so on. Consequently, any mathematical analysis lacks identities of each country, which is an extremely important question when analysing such culture and history driven and formulated economy sector as creative industries. For the sake of this research, clusters are determined; however, this could be further analysed and explored, starting with one sector at a time. Study revealed direct dependence between factors of CI development and CI impact on national economy. With reference to the index describing the conditions of CI development (Global Creativity Index), three clusters of the EU countries were identified using CI impact on national economy (CIIE) index. Clustering confirms that historical, social, economic, and political development of a country determines conditions for CI emergence and development, and, consequently, influences CI impact on national economy. Thus, we conclude that in order to enhance the creative sector, various social and economic policy measures can be employed.

Limitations and Practical Application of Research

While the empirical research covers an outstanding amount of statistical data, there are limitations to the research, such as availability of the data (e.g., not all needed data was available, and it did not cover all the period evenly) and comparability of the data (research was built on data provided by EUROSTAT which might differ from analogous statistical data collected by other statistical offices).

However, since the research has covered and delved deeply into a significant number of theoretical studies, minted a general definition of CI and its constituents, and entails solid empirical research, it can be used by governmental and non-governmental organisations for policy making as well as by educational establishments in order to provide a simpler and clearer understanding of CI.

It is also fair to mention that no economic concept can be fully analysed without first examining its role in circular economy. Consequently, as circular economy is an extremely wide concept, covering various fields and reaching far beyond limits of traditional understanding of economy, it was considered a given in this research and was not analysed in detail. However, as the importance of circular economy increases, authors of the study admit it to have significant impact on CI and this could become a basis for further studies in the area.

It is important to note that the research was based on historical data analysis as specific circumstances are already known and can be evaluated and measured. Data analysis covered the period when the UK was still a part of the EU and pandemic was only foreseen as merely a futuristic idea. These and other changes must be considered, based on comparable and full data, and could become basis for further studies in the future.

Annex 1

Values of the CIIE Economic Impact Subindex 2008–2016

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
Austria	0.436	0.380	0.424	0.414	0.456	0.432	0.420	0.396	0.384	0.416
Belgium	0.676	0.631	0.665	0.656	0.677	0.677	0.677	0.665	0.665	0.666
Bulgaria	0.103	0.104	0.091	0.094	0.116	0.116	0.104	0.104	0.127	0.106
Cyprus	0.295	0.307	0.364	0.400	0.399	0.411	0.423	0.447	0.446	0.388
Czechia	0.354	0.321	0.336	0.255	0.277	0.265	0.254	0.230	0.242	0.282
Denmark	0.402	0.345	0.344	0.287	0.329	0.305	0.294	0.294	0.282	0.320
Estonia	0.553	0.514	0.477	0.488	0.505	0.516	0.505	0.505	0.540	0.511
Finland	0.370	0.374	0.395	0.339	0.385	0.409	0.409	0.433	0.421	0.393
France	0.434	0.446	0.479	0.493	0.514	0.502	0.502	0.514	0.514	0.489
Germany	0.581	0.738	0.738	0.739	0.770	0.758	0.746	0.734	0.722	0.725
Greece	0.510	0.498	0.549	0.515	0.536	0.524	0.524	0.500	0.488	0.516
Hungary	0.286	0.275	0.215	0.172	0.193	0.193	0.181	0.181	0.158	0.206
Ireland	0.295	0.295	0.271	0.271	0.259	0.295	0.295	0.272	0.332	0.287
Italy	0.565	0.555	0.552	0.564	0.598	0.622	0.622	0.551	0.574	0.578
Latvia	0.438	0.469	0.478	0.446	0.456	0.444	0.444	0.397	0.420	0.444

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
Lithuania	0.297	0.242	0.285	0.288	0.297	0.309	0.333	0.345	0.369	0.307
Luxembourg	0.601	0.625	0.612	0.601	0.613	0.639	0.627	0.622	0.631	0.619
Malta	0.559	0.593	0.570	0.559	0.559	0.559	0.559	0.559	0.548	0.563
Netherlands	0.484	0.679	0.691	0.692	0.776	0.788	0.788	0.837	0.861	0.733
Norway	0.692	0.671	0.658	0.594	0.582	0.582	0.594	0.594	0.593	0.618
Poland	0.171	0.115	0.159	0.115	0.125	0.137	0.161	0.161	0.149	0.144
Portugal	0.116	0.115	0.137	0.114	0.113	0.101	0.113	0.113	0.101	0.114
Romania	0.183	0.171	0.184	0.220	0.252	0.287	0.276	0.381	0.299	0.250
Slovakia	0.326	0.399	0.373	0.351	0.426	0.414	0.402	0.414	0.437	0.394
Slovenia	0.497	0.485	0.544	0.546	0.588	0.588	0.600	0.565	0.565	0.553
Spain	0.341	0.317	0.350	0.351	0.350	0.326	0.337	0.314	0.290	0.331
Sweden	0.556	0.544	0.535	0.588	0.609	0.620	0.620	0.667	0.632	0.597
United Kingdom	0.788	0.768	0.769	0.748	0.801	0.789	0.789	0.801	0.801	0.784

Annex 2

Values of the CIIE Sociocultural Impact Subindex 2008–2016

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
Austria	0.478	0.522	0.546	0.579	0.562	0.525	0.592	0.609	0.597	0.557
Belgium	0.611	0.616	0.611	0.595	0.605	0.576	0.571	0.605	0.612	0.600
Bulgaria	0.278	0.295	0.311	0.284	0.246	0.235	0.246	0.289	0.301	0.276
Cyprus	0.351	0.317	0.317	0.393	0.345	0.334	0.396	0.400	0.319	0.352
Croatia	0.257	0.227	0.252	0.241	0.277	0.249	0.308	0.301	0.303	0.268
Czechia	0.219	0.229	0.258	0.285	0.288	0.298	0.281	0.288	0.279	0.269
Denmark	0.590	0.631	0.662	0.689	0.680	0.679	0.709	0.704	0.691	0.671
Estonia	0.398	0.462	0.473	0.526	0.474	0.460	0.464	0.481	0.511	0.472
Finland	0.664	0.699	0.703	0.722	0.733	0.725	0.767	0.761	0.727	0.722
France	0.480	0.446	0.465	0.475	0.497	0.517	0.536	0.508	0.503	0.492
Germany	0.539	0.571	0.569	0.586	0.579	0.569	0.608	0.602	0.575	0.577
Greece	0.204	0.211	0.158	0.161	0.168	0.182	0.195	0.212	0.192	0.187
Hungary	0.421	0.431	0.430	0.366	0.402	0.396	0.331	0.349	0.344	0.386
Ireland	0.661	0.700	0.693	0.683	0.682	0.615	0.650	0.689	0.671	0.672
Italy	0.406	0.415	0.375	0.390	0.420	0.403	0.417	0.424	0.388	0.404
Latvia	0.380	0.464	0.448	0.455	0.445	0.414	0.408	0.460	0.469	0.438
Lithuania	0.305	0.361	0.381	0.401	0.412	0.353	0.403	0.372	0.378	0.374
Luxembourg	0.548	0.577	0.574	0.627	0.637	0.617	0.682	0.629	0.621	0.613
Malta	0.477	0.432	0.460	0.462	0.410	0.413	0.425	0.334	0.380	0.421
Netherlands	0.694	0.731	0.741	0.725	0.722	0.706	0.730	0.731	0.701	0.720
Poland	0.245	0.272	0.360	0.370	0.356	0.356	0.376	0.386	0.308	0.337
Portugal	0.355	0.330	0.336	0.295	0.320	0.338	0.318	0.319	0.327	0.327
Romania	0.286	0.290	0.292	0.330	0.342	0.319	0.299	0.305	0.290	0.306
Slovakia	0.269	0.224	0.293	0.299	0.284	0.262	0.251	0.285	0.291	0.273
Slovenia	0.449	0.475	0.492	0.508	0.543	0.521	0.514	0.519	0.531	0.506
Spain	0.526	0.542	0.534	0.520	0.555	0.549	0.583	0.555	0.560	0.547
Sweden	0.672	0.728	0.731	0.727	0.720	0.721	0.751	0.744	0.731	0.725
United Kingdom	0.606	0.626	0.629	0.660	0.660	0.635	0.658	0.630	0.624	0.636

Annex 3

Values of the CIIE Environmental Impact Subindex 2008–2016

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
Austria	0.143	0.143	0.143	0.143	0.143	0.143	0.143	0.179	0.179	0.151
Belgium	0.071	0.071	0.071	0.071	0.036	0.036	0.036	0.214	0.214	0.091
Bulgaria	0.893	0.893	0.857	0.893	0.786	0.929	0.929	0.893	0.786	0.873
Cyprus	0.714	0.750	0.679	0.679	0.643	0.679	0.679	0.500	0.536	0.651
Croatia	0.357	0.500	0.429	0.464	0.464	0.500	0.500	0.286	0.321	0.425
Czechia	0.679	0.714	0.607	0.643	0.607	0.679	0.679	0.643	0.250	0.611
Denmark	0.857	0.857	0.821	0.786	0.750	0.786	0.786	0.857	0.857	0.817
Estonia	0.286	0.286	0.536	0.821	0.571	0.250	0.250	0.321	0.357	0.409
Finland	0.571	0.607	0.571	0.571	0.500	0.571	0.571	0.357	0.500	0.536
France	0.393	0.393	0.321	0.357	0.321	0.357	0.357	0.250	0.286	0.337
Germany	0.107	0.107	0.214	0.179	0.214	0.214	0.214	0.143	0.143	0.171
Greece	0.036	0.036	0.036	0.036	0.071	0.107	0.107	0.357	0.500	0.143

	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average
Hungary	0.321	0.321	0.286	0.321	0.286	0.286	0.286	0.536	0.571	0.357
Ireland	0.500	0.571	0.500	0.500	0.429	0.429	0.429	0.714	0.714	0.532
Italy	0.857	0.857	0.857	0.857	0.821	0.893	0.893	0.786	0.821	0.849
Latvia	0.536	0.643	0.643	0.714	0.679	0.607	0.607	0.821	0.786	0.671
Lithuania	0.464	0.536	0.464	0.286	0.357	0.321	0.321	0.821	0.750	0.480
Luxembourg	0.786	0.821	0.786	0.750	0.821	0.857	0.857	0.786	0.857	0.813
Malta	0.179	0.214	0.107	0.107	0.107	0.071	0.071	0.071	0.036	0.107
Netherlands	0.321	0.429	0.357	0.393	0.357	0.393	0.393	0.464	0.464	0.397
Poland	0.214	0.250	0.179	0.250	0.250	0.250	0.250	0.429	0.429	0.278
Portugal	0.750	0.786	0.714	0.714	0.714	0.750	0.750	0.750	0.750	0.742
Romania	0.607	0.679	0.750	0.607	0.607	0.643	0.643	0.107	0.107	0.528
Slovakia	0.929	0.929	0.893	0.929	0.821	0.821	0.821	0.679	0.679	0.833
Slovenia	0.643	0.464	0.429	0.536	0.536	0.536	0.536	0.607	0.643	0.548
Spain	0.821	0.571	0.821	0.750	0.714	0.714	0.714	0.393	0.393	0.655
Sweden	0.250	0.179	0.250	0.214	0.179	0.179	0.179	0.036	0.071	0.171
United Kingdom	0.429	0.357	0.393	0.429	0.393	0.464	0.464	0.571	0.607	0.456

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