

Measuring Creativity in the EU Member States

Carlos Miguel Correia*, José da Silva Costa**

ABSTRACT: With the increasing role of creativity in economic growth, researchers have gained great interest in the study of the creative economy and placed it as an important topic in their research and political agendas. Given the increasing importance attributed by researchers and policymakers to the concept of creativity and creative economy, the increasing interest of researchers in defining and estimating indexes of creativity is no surprise. These indexes provide analytical tools to assess the economic impact of the creative economy and are useful to measure the effectiveness of political decisions. In this paper we compare twelve selected indexes of creativity and we identify their strengths and weaknesses. Then, based on the evaluated indexes of creativity, we propose a new one. Estimating the proposed index of creativity, we compare our results with Florida's global creativity index (Florida *et al.*, 2011).

JEL Classification: O30; O31.

Keywords: Creativity indexes; creativity; innovation.

Medición de la Creatividad en los Estados Miembros de la UE

RESUMEN: El continuo crecimiento del papel de la creatividad en el crecimiento económico ha generado un creciente interés entre los investigadores por el estudio de la economía creativa, convirtiéndola en una cuestión muy relevante dentro del ámbito político y de la investigación. Esta creciente importancia del concepto de la economía creativa ha generado un gran interés por la definición y la estimación de índices de creatividad. Estos índices son una herramienta analítica de gran utilidad para evaluar el impacto económico de la economía creativa, así como para la medición de la efectividad de medidas políticas. En este trabajo comparamos doce índices de creatividad alternativos identificando sus ventajas e inconvenientes. Posteriormente, basándonos en los índices de creatividad evaluados, proponemos uno nuevo. Los resultados obtenidos en la estimación mediante este nuevo índice de creatividad se comparan con los del índice de creatividad global de Florida desarrollado en Florida *et al.* (2011).

* Mestrado em Economia, FEP, University of Porto.

** Professor, FEP, University of Porto, Rua Roberto Frias, 4200-Porto-Portugal, jcosta@fep.up.pt, phone 351 220426202.

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1. Introduction

Creativity is a complex phenomenon with multiple dimensions and there is no simple definition capturing all of them. A psychological definition of creativity is «the process of producing something that is both original and worthwhile» (Csíkszentmihályi, 1999). There are many other definitions with slightly divergent meanings, but all of them generally agree with the one aforementioned. Although this definition claims that creative products have some kind of value, it can be of many different kinds and it is not necessarily economic. It can be social, historical, personal, cultural or symbolic. In fact, for a long time it was presumed that creativity was something without economic value and insusceptible of economic analysis. That is one of the reasons why economists have ignored this subject for research, when compared to other science fields such as psychology and sociology.

Creative Economy is an «evolving concept, based on creative assets potentially generating economic growth and development» (United Nations, 2010), that consists of «all those activities which have their origin in individual creativity, skill and talent, and which have a potential for wealth and job creation through the generation and exploitation of intellectual property» (Department of Culture Media and Sports, 1998). These activities result from the action or interaction of enterprises, organizations and individuals in a creative place (New England Foundation for the Arts, 2007), and can be delineated according to their type of intellectual property: copyright, patent, trademark and design (Howkins, 2001).

Creativity and its importance to economic development is now more than ever a subject of debate and research, both by academic and political institutions. The creative economy is developing fast as it integrates and influences the rest of the economy. The value of world trade of creative goods and services reached \$624 billion in 2011, and that more than doubled from 2002 to 2011 (United Nations, 2013).

With the increasing role of creativity in economic growth, policymakers placed creativity as an important topic in their political agendas. The pioneer country was the United Kingdom by establishing the Creative Industries Task Force in 1997. Many other countries followed this trend and some are noteworthy. Flanders was the first region to organise the «Creativity World Forum» and one of the founders of the «Districts of Creativity Network» whose conferences have become a world benchmark in creativity discussion, with the participation of government leaders, entrepreneurs and knowledge institutions from the network. In 2002, the Australian Government has developed a report called «Creative Industries Cluster Study» (Department of Communications, Information Technology and the Arts, 2002). In the same year, the New Zealand Institute of Economic Research published the «Creative Industries in New Zealand: Economic Contribution» (New Zealand Institute of Eco-

omic Research, 2002). More recently in 2011, Brazil has created the Secretariat for the Creative Economy under control of the Department of Culture. Almost every state of the United States of America has a public department, institution or organism dedicated to creativity as a motor of economic development and growth. Also many Asian countries are researching and investing on the creative economy. African countries are starting to take part on creativity matters which they see as a motor to revitalise less developed economies. The European Commission launched the European Year of Creativity and Innovation 2009. Its main goal was to raise awareness to the importance of creativity and innovation, contribute to economic prosperity as well as to social and individual wellbeing. Corporations have also perceived the importance of fostering creativity both in workers and managers and the necessity of deepening the knowledge about this phenomenon.

Given the increasing importance attributed by researchers and policymakers to the concept of creativity and creative economy, it is no surprise the increasing interest of researchers in defining and estimating indexes of creativity. These indexes provide analytical tools to assess the economic impact of the creative economy and are useful to measure the effectiveness of political decisions.

To compare twelve selected indexes of creativity and to identify their strengths and weaknesses was a first motivation in this paper. Then, based on the comparison done, we constructed a new index of creativity and estimated it for the EU member states. Finally we evaluate our index comparing our results with Florida's results (Florida *et al.*, 2011).

This paper is organized in the following way: in section 2, we present a comparison of twelve selected indexes of creativity; in section 3, we propose a new index; in section 4, we use the proposed index to measure the creativity on EU-27 at country level; finally, in the last section we present some conclusions.

2. A Comparison of Twelve Indexes of Creativity

We have selected, by a chronological order, twelve indexes of creativity that we consider to be the most relevant and indubitable references in creativity indexes literature. Then, we present a brief description of these indexes and we compare them identifying their strengths and weaknesses.

In the book «The Rise of The Creative Class» Richard Florida (2002) has pointed out the importance of the creative economy and has presented the concept of «creative class» in an occupational point of view, defined into two major sub-components: «super-creative core» and «creative professionals». Florida argues that policymakers should focus on «people climate» rather than on «business climate», that is, instead of investing on attracting firms and capital, cities should invest on its attractiveness to creative people. According to the author, the creative class is a key factor in economic development and those cities capable of attracting creative people are more likely to succeed, because this class includes those who are more innovative, more entrepre-

neurial and attract creative enterprises. He explains the geographical distribution of the creative class based on a 3T model: talent, tolerance and technology.

The «Creative Community Index» (SV-CCI) stems from a collaborative project between the Knight Foundation, Americans for the Arts, the City of San Jose Office of Cultural Affairs and Cultural Initiatives Silicon Valley (2002). In the SV-CCI the indicators are organized into four categories:

Outcomes - the desired outcomes of a healthy cultural life, broad-based creativity, social connectedness among diverse people and contribution to the quality of life in Silicon Valley;

Participation - residents' participation in arts and cultural activities, including the extent to which diverse people participate together;

Assets - the mix of cultural assets present in the community, including talent in the creative sector (non-profit, public and private), venues and facilities, and the aesthetic quality of our environment;

Levers - the extent to which we leverage and build our cultural assets and encouraging peoples' interaction with them through arts education, leadership, investment, and policies.

A few years later, Florida, in a joint work with Irene Tinagli, designed his model to fit European reality (Florida and Tinagli, 2004). The main changes were made in the «tolerance» sub-index which was built based on a completely different set of indicators with a more subjective nature. Nevertheless, it keeps the main hypothesis of Florida's Creative Capital Theory whose relevance is proven empirically for European regions.

The Hong Kong Creativity Index (HKCI) was developed by the Centre for Cultural Policy Research of the University of Hong Kong and commissioned by Home Affairs Bureau, The Hong Kong Special Administrative Region Government (2004). The HKCI framework builds on a 5C's model: creativity outcomes; structural/institutional capital; human capital; social capital; cultural capital. The HKCI comprises 88 indicators. This option increases the difficulty of collecting data and analysing it, but, on the other hand, results in a more complete and effective assessment of a region's creativity and allows to extend the scope of indicators to other important dimensions.

The Czech Creative Index (CZCI) was developed by Kloudova and Stehlikova (2007), based on Florida's model and its index dimensions: «talent», «technology» and «tolerance». Their main concern was to analyse the creativity overall and individual scores of Czech regions in terms of regional similarities and geographic location. According to the authors, creative regions tend to cluster; there is spatial autocorrelation between creative regions, where individual regions affect one another and the neighbouring regions are similar; the hypothesis about the formation of a creative core or centre in Czech Republic was rejected.

The Composite Index of the Creative Economy (CICE) was developed to measure the creative capacity and capability of the Flanders District of Creativity regions (Bowen *et al.*, 2008). This index has three key dimensions: «innovation», «entrepreneurship» and «openness». These categories are clearly inspired in Florida's theory, but the CICE extends the selected indicators to new aspects such as business activity and ICT infrastructure. This index stands out by proposing an innovative method to

determine the weight that each indicator has on the index global value. Normally, in order to ease the index calculation, it is adopted a simple aggregation procedure which consists of assigning equal weights to each indicator which can be perceived as attributing the same importance to each dimension. Unequal weights can be determined based on the opinion of experts, but, this is an expensive procedure, not to mention that is a subjective judgement. The methodology proposed by the CICE selects the set of weights that maximise the index value for each region. A good performance in a particular dimension can reveal that it should be given a higher priority and each region will have its own set of weights.

The Creative City Index (J-CCI) was developed by the Fukuoka Benchmarking Consortium in the context of an international conference in 2008 (Fukuoka Benchmarking Consortium, 2008). The approach used in the construction of this index is noteworthy due to the classification of the selected indicators. The index comprises seventy-eight indicators which are separated into two main categories: «fundamental» and «flow» factors. This differentiation is useful for an evolutionary analysis of a creative city.

The European Creativity Index (ECI) was developed by KEA European Affairs as part of a study conducted for the European Commission (2009). The major purpose of this study was to extend the indicators of existing indexes to a dimension specifically related to arts and culture. This index comprises thirty-two indicators organized into six pillars: «human capital»; «openness and diversity»; «cultural environment»; «technology»; «institutional environment»; «creative outputs».

The Baltimore Creativity Index (BCI) was developed by Acs and Megyesi (2009) that adapted Florida's model in order to assess the potential of transforming Baltimore, a traditionally industrial region, into a creative region. Although BCI is essentially identical to FCI, a fourth dimension is included in the index: «territory». It accounts for territorial and communal amenities, also focusing on a «wage inequality index» and «housing affordability index». The study points out to the importance of Baltimore's geographical proximity to Washington, DC, a recognised creative and high-tech epicentre.

The Landry's Creative City Index (L-CCI) was developed in 2009 by Charles Landry and Jonathan Hyams in collaboration with Bilbao and the Bizkaya region (Landry, 2010). Very few details have been released to the public about the indicators and metrics used. On his website, Landry only identifies ten dimensions that characterise a creative place (political and public framework; distinctiveness, diversity, vitality and expression; openness, trust, tolerance and accessibility; entrepreneurship, exploration and innovation; strategic leadership, agility and vision; talent and the learning landscape; communication, connectivity and networking; the place and place making; liveability and well-being; professionalism and effectiveness).

The Creative City Index (CCI-CCI) was constructed for the Beijing Research Centre for Science of Science (BJSS), Beijing Academy of Science and Technology (BJAST) (ARC Centre of Excellence for Creative Industries and Innovation, 2012). The CCI-CCI comprises seventy-two indicators grouped into eight dimensions (creativity industries scale and scope; micro-productivity; attractions and economy of

attention; participation and expenditure; public support; human capital; global integration, openness, tolerance and diversity). The first three dimensions are new inclusions in indexes.

Recently, the Martin Prosperity Institute (Florida *et al.*, 2011) published the results of a new index of creativity (The Global Creative Index – GCI) for eighty two countries using data for the period 2000 to 2009. Twenty five countries are EU member states. The index, as the other indexes developed by Richard Florida, considers three dimensions: technology (R&D as a percentage of GDP; professional researchers engaged in R&D per million capita; patents granted per capita); talent (rate of enrolment in tertiary or post-high school education; share of country’s labour force engaged in a higher degree of problem solving in their everyday work); tolerance (survey on tolerance towards ethnic and racial minorities; survey on tolerance towards gays and lesbians).

Table 1. Checklist of Indexes Dimensions and Indicators

<i>Dimensions</i>		<i>Indexes</i>											
		<i>1. FCI</i>	<i>2. SV-CCI</i>	<i>3. F-ECI</i>	<i>4. HKCI</i>	<i>5. CZCI</i>	<i>6. CICE</i>	<i>7. J-CCI</i>	<i>8. ECI</i>	<i>9. BCI</i>	<i>10. L-CCI</i>	<i>11. CCI-CCI</i>	<i>12. GCI</i>
1	Human Capital, Creative Class and Education	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2	Openness / Diversity / Tolerance	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
3	Cultural Environment and Tourism		✓		✓			✓	✓		✓	✓	
4	Technology and Innovation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5	Regulations and Financial Policies		✓		✓				✓		✓	✓	
6	Employment, Outputs and Outcomes		✓		✓				✓			✓	
7	Entrepreneurship		✓		✓		✓	✓			✓		
8	Infrastructure				✓						✓	✓	
9	Liveability and Amenities						✓			✓	✓	✓	
10	Branding and Notoriety		✓								✓	✓	
Number of Indicators		9	11	9	88	6	8	78	32	9	?	72	7

FCI-Florida’s Creative Index (2002); SV-CCI – Silicon Valley’s Creative Community Index; F-ECI – Euro Creativity Index; HKCI – Hong Kong Creative Index; CZCI – Czech Creative Index; CICE – Composite Index of the Creative Economy; J-CCI – Creative City Index; ECI – European Creativity Index; BCI – Baltimore Creativity Index; L-CCI – Landry’s Creative City Index; CCI-CCI – Creative City Index; GCI – Global Creative Index.

Two of the indexes are developments of the first index constructed by Florida in 2002 (F-ECI; GCI). The CZCI and BCI indexes are similar to Florida’s creativity index, but they stand out because more attention is attributed to territory. The other

indexes are quite different in what concerns the number and type of indicators, the included dimensions, the underlying theoretical framework and the adopted methodology. Table 1 presents a checklist of the indicators covered by the indexes, organised into ten dimensions which we take as key creative aspects and which comprise all the indicators. These dimensions will also serve as a basis for the construction of our own index.

Table 2. Indexes Strengths and Weaknesses

<i>Index</i>	<i>Strengths</i>	<i>Weaknesses</i>
1. FCI	One of the most popular, successful and discussed indexes with high acceptance by policymakers. Focuses on «People climate» instead of «business climate».	Too broad definition of creativity, including industries and occupations beyond the so-called creative. Limited number of dimensions to assess such a complex phenomenon as creativity.
2. SV-CCI	Emphasises the importance of culture for creativity, technological progress and social connectedness.	Built on personal interviews and surveys which makes it very specific to Silicon Valley and difficult to use in other regions.
3. F-ECI	The first rank of European countries.	Only 14 European countries analysed.
4. HKCI	Comprises 88 indicators which make the index more complete and effective.	The large number of indicators also increases the difficulty of collecting data and analysing it.
5. CZCI	Introduces spatial matters into the analysis.	Only tested in Czech Republic.
6. CICE	Proposes an innovative method to determine weights: endogenous weighting	Reduced number of dimensions and indicators.
7. J-CCI	Differentiation between fundamental and flow factors, focused on the analysis of cities evolution over time.	Does not provide information about methodology and metrics.
8. ECI	Very good set of dimensions and a proper number of indicators. Specifies the data sources.	Not tested empirically. Data sources only at country level.
9. BCI	Spatial dimension added to the analysis through territorial amenities and the study of proximity impact on creativity.	Only analyses Baltimore.
10. L-CCI	Ten dimensions well explained with an efficient coverage of creativity. Uses both an internal and an external assessment and a web based survey.	Methodology and metrics not revealed to public.
11. CCI-CCI	Gathers the best of all previous indexes and presents some new indicators.	Ignores an important dimension: entrepreneurship.
12. GCI	Covers 82 countries; improvements in the measurement of tolerance	Limited number of dimensions.

Analysing table 1, it becomes clear that three dimensions are considered mandatory for building a creativity index: «human capital, creative class and education», «openness, diversity and tolerance» and «technology and innovation». Nevertheless, we consider they are insufficient to address such a complex concept as creativity and its economic impact. In our point of view, an optimum index must include nine dimensions (we recognize that at country level dimension 10 and 3 captures similar aspects). Some can be more or less important than the rest, but such limitation can be solved by adjusting the weighting based on statistical evidence or on the opinion of experts.

3. A Proposal of an Index of Creativity (CSI)

In this paper we propose a new index seeking to fill the existing gaps identified above. We call it Creative Space Index (CSI). It aims to be a comprehensive index by gathering the best aspects of the existing ones and complementing them with additional features. The index was developed to be *universal* (it should be able to analyse different realities and to enable comparisons across the globe), *flexible* (it should be adaptable to work with different scopes —country level, regional level and city level— and with different data sources), *efficient* (it should cover as many aspects as possible of the creative phenomenon, keeping the data collection easy and simple) and *unbiased* (creativity does not depend on a single dimension and it is important for the index to be wide ranging and properly weighted for a better policymaking).

In the CSI index we consider nine groups of indicators:

D1 - Talent: a creative place should nurture, foster, promote and reward all talents (Landry, 2010). It is a place that offers a wide range of learning options, enabling people to find their right vocation. These are provided by institutions such as universities as well as by a more informal interaction between individuals, organisations and places. Economists agree that skilled and educated people, normally referred as human capital, play a role in economic progress. The creative class has an equally important role (Florida, 2002)

D2 - Openness: a creative place should be open minded and tolerant in order to welcome people with different backgrounds and cultures (Florida, 2002; Landry, 2010). An environment of diversity increases the generation and the flow of ideas. It eases the interaction communication and it attracts talent.

D3 - Cultural Environment and Tourism: cultural life is a key element in a region's quality of life and the participation in cultural activities increases people connections to each other and to place (Knight Foundation *et al.*, 2002). So, the cultural offering must include a variety of experiences and ways for the community to express itself. Tourism is one of the best ways to promote and potentiate the cultural assets that a region has to offer and culture is an important motivation for tourists to visit a specific place.

D4 - Technology and Innovation: technology and innovation simultaneously foster and depend on creativity. People's creativity is the motor of technological progress and innovation (Knight Foundation *et al.*, 2002; Florida, 2002; Hong Kong Special Administrative Region Government, 2004; Landry, 2010).

D5 - Industry: a high share of creative industries is a good indicator of good creative performance. However, a region should also have a diversified business structure with international reach in order to maximise positive externalities and spillovers.

D6 - Regulation and Incentives: both creative individuals and businesses play an important role, but they need a favourable environment to create. A place should ensure good conditions for creativity to develop, whether with public support or with a fair regulatory system (CISV, 2002).

D7 - Entrepreneurship: without entrepreneurship, creativity is not likely to lead to economic growth as ideas are not translated to the market. On the other hand, the economic success of a creative individual or organisation depends very much on the level of easiness of doing business combined with the financial resources available.

D8 - Accessibility: a creative place is well connected internally and externally (Landry, 2010). So, it should have a good transport system and infrastructure. Proximity to other creative regions increases the creative potential of the place, but only if it is accessible.

D9 - Liveability: a region should be able not only to attract creative talent but also to retain it (Florida, 2002). Therefore, a creative place must have a good quality of life and should offer local amenities that make it a place where people like to live and work.

Creativity is a complex concept and, therefore, in order to build an index that addresses its characteristics as efficiently and logically as possible, each dimension is composed by indicators that, if applicable, measure both inputs and outputs, both demand and supply, both investments and results, both hard and soft characteristics, both people and business climate, both stock and flow factors.

In order to remove the scale effect from the index and to make the scores directly comparable between all elements, when necessary, the indicators are expressed in relative terms using auxiliary indicators such as Population, GDP and Area. The type of number and the nature of each indicator are well explained in its description in table 3.

A structure analysis has been done aiming to study the overall structure of the index and to check if there are any indicators statistically similar (providing the same information) and, therefore, at least one is redundant. Using a correlation matrix of all indicators we have checked that all of them are relevant and their presence in the index is advantageous. Only a few indicators presented high values of correlation: Air, Road and Rail, used to measure the dimension Accessibility, are highly correlated, but all of them are important, otherwise the exclusion of any of them would bias the analysis.

Indicators distributions outside the 2.5 and 97.5 percentile scores were trimmed to partially correct for outliers, as well as avoiding having extreme values overly dominating the aggregation procedure (OECD and European Commission, 2008).

For all indicators data is transformed using the Min-Max normalisation method (OECD and European Commission, 2008). This process transforms data from its original units to a value between 0 and 1. The normalised value for country, region or city i are defined as:

$$N_i = \frac{X_i - \text{MIN}(\forall_i X_i)}{\text{MAX}(\forall_i X_i) - \text{MIN}(\forall_i X_i)} \quad (1)$$

Table 3. CSI - Dimensions, Indicators and Sources Dimensions

<i>Dimension</i>	<i>Indicator</i>	<i>Description</i>	<i>Source</i>	<i>Year</i>
D1 - Talent	Human capital	Number of bachelors per capita	Eurostat	2011
	Creative class	Number of persons in creative occupations per capita	International Labour Organization	2012
	Education	Number of universities in THEWUR per million inhabitants	Times Higher Education	2011
	Diversity	Share of non-nationals among residents	Eurostat	2011
	Discrimination	FRA1's multiple discrimination index	Special Euro barometer 296	2008
D2 - Openness	Foreign talent	Share of foreign students in tertiary education	Eurostat	2010
	Cultural offering	Number of museums and cinemas per million inhabitants	EGMUS	2011
	Cultural participation	Number of annual visitors per museum	EGMUS	2011
	Cultural values	Degree of personal importance of culture ² (%)	Special Euro barometer 278	2007
	Cultural expend.	Share of household expenditure on culture	Eurostat	2005
D3 - Cultural Environment and Tourism	Tourism capacity	Number of bed-places per capita	Eurostat	2011
	Tourism occupancy	Tourism establishments occupancy rate	Eurostat	2011
	R&D	R&D expenditure as percentage of GDP	Eurostat	2010
	HRST	Percentage of human resources in science and technology	Eurostat	2010
	Internet access	Share of households with internet access at home	Eurostat	2011
D4 - Technology and Innovation	Patents	Number of patents registered per million of inhabitants	Eurostat	2006

D5 - Industry	Creative industries	Number of creative enterprises per capita	Eurostat	2009
	Creative employment	Share of employment in creative industries	Eurostat	2009
	Creative diversity	Shannon's diversity index	Eurostat	2009
	Internationalisation	Export of cultural goods (million €)	Eurostat	2011
D6 - Regulation and Incentives	Value added	Value added of creative industries as percentage of GDP	Eurostat	2009
	Turnover	Turnover in creative industries per capita	Eurostat	2009
	Public incentive	Direct public expenditure on culture per capita	KEA	2006
	Royalties	Author's royalties collected per capita	CISAC	2010
D7 - Entrepreneurship	Property rights	Score in the International Property Rights Index	IPRI	2012
	Start-ups	Newly established enterprises per 1000 inhabitants	Eurostat	2009
	Venture capital	Venture capital per capita	Eurostat	2010
	Business angels	Business angels funding per capita	Eurostat	2007
D8 - Accessibility	Business	Level of easiness of starting a business	World Bank	2012
	Air	Number of airports per capita	Eurostat	2009
	Road	Length of motorway per area	Eurostat	2010
	Rail	Length of railway per area	Eurostat	2010
D9 - Liveability	Purchase power	National price level indexes (EU27=100)	Eurostat	2011
	Crime	Number of recorded crimes per thousand	Eurostat	2009
	Health Care	Number of health care facilities per capita	Eurostat	2009
	Leisure and recreation	Share of land in recreational and leisure use	Urban Audit – LUCAS	2009
	Well-being	Experienced well-being score in Happy Planet Index	Happy Planet Index	2012

¹ FRA - European Union Agency for Fundamental Rights.

² Special Eurobarometer's respondents where asked about the personal importance they accord to culture – QA3: «How important is culture to you personally?».

The maximum normalised score is equal to 1 and the minimum normalised score is equal to 0.

In all composite indicators, aggregation is an important step of their construction and should not be taken lightly. Any modification in the weightings will change the overall score of the index and, consequently, the rankings. Normally, in order to ease the indexes calculation, it is adopted a simple aggregation method which consists of assigning equal weights to each dimension. This may give the wrong perception that each dimension has the same importance, which may not be true. Unequal weights can be determined based on the opinion of experts, but, this is an expensive procedure, not to mention that is a subjective judgement and, as such, probably will result in several divergent opinions. In CSI we first use equal weights and then we also apply an endogenous weighting technique.

We estimate the index using an endogenous weighting technique adapted to creativity indexes by Bowen *et al.* (2008). The endogenous weighting methodology selects the set of weights that maximise the index value for each region. Thus, each region will have its own set of weights and a good performance in a particular dimension can reveal that it should be given a higher priority.

Given n regions and J dimensions, the linear programming problem for region i can be written

$$\max_{w_{ij}} CSI_i = \max \sum_{j=1}^j w_{ij} D_{ij} \quad (2)$$

subject to

$$\sum_{j=1}^j w_{ij} = 1 \quad \forall i = 1, \dots, n \quad (3)$$

$$\frac{1}{12} \leq w_{ij} \leq \frac{3}{12} \quad \forall i = 1, \dots, n; \quad \forall j = 1, \dots, J \quad (4)$$

Expression (2) states that region i 's CSI value is to be maximised by choice of the W_{ij} . Restriction (3) requires that the weights assigned to each dimension D_{ij} sum to one; this restriction is minimal and allows flexibility in determining the optimal weights for a region. Expression (4) restricts the value each weight can take to a particular interval. This restriction, in practice, assigns the dimension with the best score with a 3/12 weight, the second best dimension with a 2/12 weight and the rest of the dimensions with 1/12. This way all dimensions have a 1/12 weight, except the best and the second best dimensions which weigh three and two times more, respectively. We have changed the original model weight boundaries to better suit the higher number of dimensions.

4. Empirical Application for the EU Member States

We used the CSI to assess EU-27 member states creativity, with the exception of Malta due to the lack of available data. Table 4 ranks the European countries on the CSI. It presents the countries overall score in creativity and their performance on each dimension.

Only four countries score higher than 6.00: Sweden, Denmark, Netherlands, and Finland. Germany, Luxembourg, United Kingdom, France, Belgium and Austria complete the top ten creative countries. Bulgaria scores below 2 and Romania below 1.

Figure 1 depicts the geographical distribution of creativity in Europe. It makes clear the heterogeneity of the CSI results and the concentration of higher scores in North and Central Europe, which decrease as we move to the peripheral countries.

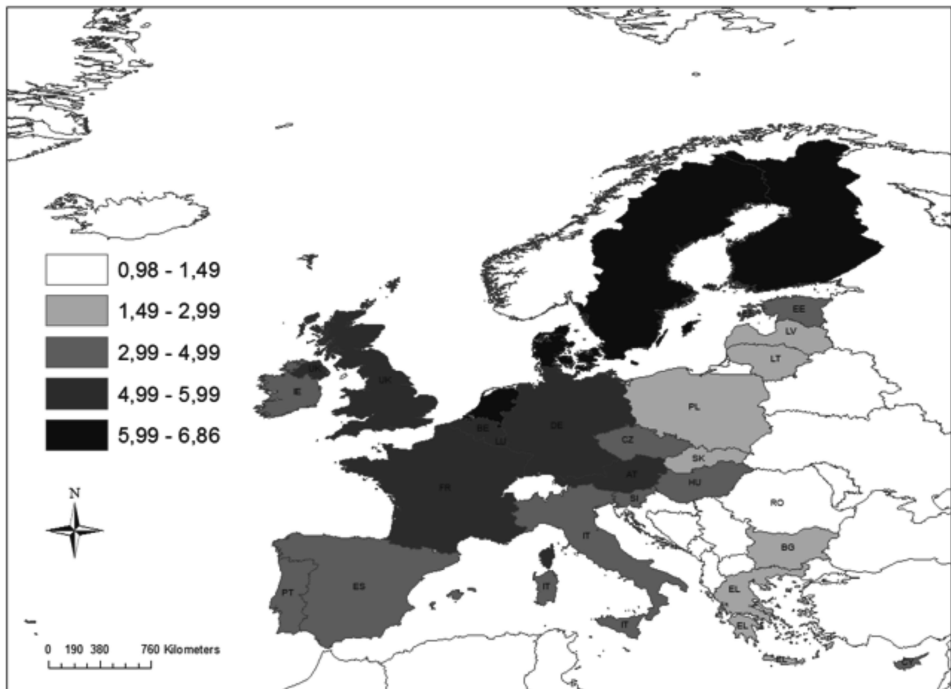
Table 4. CSI with Equal Weights

Country	Code	Score	Rank	D1	D2	D3	D4	D5	D6	D7	D8	D9
Sweden	SE	6.86	1	0.62	0.55	0.58	0.99	0.51	0.76	0.85	0.62	0.70
Denmark	DK	6.65	2	0.58	0.61	0.53	0.89	0.51	0.84	0.58	0.66	0.78
Netherlands	NL	6.52	3	0.59	0.53	0.47	0.81	0.49	0.82	0.76	0.63	0.77
Finland	FI	6.38	4	0.56	0.37	0.39	0.95	0.51	0.74	0.81	0.56	0.84
Germany	DE	5.99	5	0.65	0.54	0.52	0.83	0.53	0.52	0.49	0.58	0.71
Luxembourg	LU	5.98	6	0.51	0.77	0.30	0.83	0.35	0.60	0.46	0.90	0.65
United Kingdom	UK	5.90	7	0.80	0.53	0.48	0.65	0.51	0.56	0.72	0.51	0.56
France	FR	5.80	8	0.46	0.49	0.59	0.62	0.43	0.78	0.71	0.52	0.62
Belgium	BE	5.76	9	0.56	0.51	0.30	0.64	0.41	0.65	0.51	0.82	0.78
Austria	AT	5.37	10	0.42	0.67	0.39	0.64	0.38	0.66	0.39	0.54	0.76
Ireland	IE	4.73	11	0.65	0.51	0.31	0.59	0.36	0.37	0.50	0.45	0.52
Spain	ES	4.14	12	0.48	0.48	0.52	0.36	0.37	0.43	0.39	0.38	0.32
Czech Republic	CZ	4.11	13	0.34	0.45	0.48	0.36	0.33	0.45	0.43	0.42	0.44
Slovenia	SI	3.83	14	0.17	0.41	0.40	0.47	0.36	0.38	0.40	0.47	0.38
Estonia	EE	3.68	15	0.39	0.39	0.42	0.44	0.28	0.34	0.36	0.25	0.43
Cyprus	CY	3.66	16	0.47	0.62	0.34	0.29	0.35	0.24	0.24	0.49	0.24
Italy	IT	3.64	17	0.32	0.42	0.61	0.32	0.31	0.30	0.19	0.44	0.38
Portugal	PT	3.37	18	0.22	0.38	0.28	0.19	0.25	0.55	0.67	0.31	0.18
Hungary	HU	3.30	19	0.23	0.47	0.43	0.28	0.35	0.31	0.32	0.25	0.32
Slovakia	SK	2.88	20	0.31	0.27	0.29	0.22	0.15	0.38	0.39	0.24	0.34

Table 4. (cont.)

Country	Code	Score	Rank	D1	D2	D3	D4	D5	D6	D7	D8	D9
Latvia	LV	2.67	21	0.20	0.27	0.33	0.24	0.23	0.30	0.41	0.14	0.27
Greece	EL	2.44	22	0.19	0.29	0.14	0.13	0.26	0.25	0.22	0.40	0.32
Poland	PL	2.36	23	0.17	0.14	0.44	0.26	0.26	0.13	0.14	0.24	0.34
Lithuania	LT	2.09	24	0.10	0.10	0.22	0.27	0.13	0.23	0.34	0.17	0.32
Bulgaria	BG	1.54	25	0.10	0.07	0.05	0.12	0.28	0.22	0.28	0.11	0.17
Romania	RO	0.99	26	0.05	0.10	0.09	0.04	0.18	0.02	0.10	0.13	0.17

D1 – Talent; D2 – Openness; D3 – Cultural Environment and Tourism; D4 – Technology and Innovation; D5 – Industry; D6 – Regulation and Incentives; D7 – Entrepreneurship; D8 – Accessibility; D9 – Liveability.

Figure 1. Creative Space Index in EU member states

The results by dimension show that there is not a unique recipe for reaching higher creativity scores. But it reveals a pattern in which the top 6 countries have relatively higher and lower scores in the same dimensions. Luxembourg stands out from the other five countries with higher scores in openness and accessibility and lower scores in cultural environment /tourism and industry.

Table 5 shows the rankings of the CSI with endogenous weights. One can see that 13 out of 26 countries have their rank affected. The biggest changes occurs in Italy, Cyprus and Portugal that climb two positions and Slovenia and Estonia that slip down three positions. This is justified by the fact that endogenous weights favour countries which are stronger in two or three dimensions and disfavour countries which have similar scores in all dimensions. For the countries in the top ten, the

Table 5. CSI with Equal Weights and with Endogenous Weights

<i>Country</i>	<i>CSI (A)</i>	<i>Rank (A)</i>	<i>CSI (B)</i>	<i>Rank (B)</i>	<i>Rank (A) – Rank (B)</i>
Sweden	6.86	1	7.50	1	0
Denmark	6.65	2	7.17	2	0
Netherlands	6.52	3	6.92	4	-1
Finland	6.38	4	7.07	3	1
Germany	5.99	5	6.47	6	-1
Luxembourg	5.98	6	6.69	5	1
United Kingdom	5.90	7	6.36	7	0
France	5.80	8	6.25	9	-1
Belgium	5.76	9	6.33	8	1
Austria	5.37	10	5.84	10	0
Ireland	4.73	11	5.12	11	0
Spain	4.14	12	4.37	12	0
Czech Republic	4.11	13	4.27	13	0
Slovenia	3.83	14	4.05	17	-3
Estonia	3.68	15	3.86	18	-3
Cyprus	3.66	16	4.20	14	2
Italy	3.64	17	4.12	15	2
Portugal	3.37	18	4.10	16	2
Hungary	3.30	19	3.62	19	0
Slovakia	2.88	20	3.12	20	0
Latvia	2.67	21	2.96	21	0
Greece	2.44	22	2.76	23	-1
Poland	2.36	23	2.79	22	1
Lithuania	2.09	24	2.41	24	0
Bulgaria	1.54	25	1.86	25	0
Romania	0.99	26	1.19	26	0

Note: CSI (A) - CSI with equal weights; CSI (B) – CSI with endogenous weights.

endogenous weighting method favours the ranking of Finland, Luxembourg and Belgium that climb one position and disfavors Netherlands, Germany and France that slip down one position.

In table 6 we compare the change in the rankings when we use of a comprehensive index. To this purpose, we compare CSI (A) with CSI (C) corresponding to CSI

Table 6. Comparison of CSI (A) Ranking with CSI(C) Ranking

<i>Country</i>	<i>Rank CSI(A)</i>	<i>Score CSI(C)</i>	<i>Rank CSI(C)</i>	<i>Rank CSI(C) – CSI(A)</i>
Sweden	1	7.20	1	0
Denmark	2	6.93	3	1
Netherlands	3	6.41	6	3
Finland	4	6.29	7	3
Germany	5	6.74	4	-1
Luxembourg	6	7.04	2	-4
United Kingdom	7	6.57	5	-2
France	8	5.25	11	3
Belgium	9	5.73	10	1
Austria	10	5.74	9	-1
Ireland	11	5.85	8	-3
Spain	12	4.41	13	1
Czech Republic	13	3.85	15	2
Slovenia	14	3.50	17	3
Estonia	15	4.08	14	-1
Cyprus	16	4.62	12	-4
Italy	17	3.52	16	-1
Portugal	18	2.65	20	2
Hungary	19	3.28	18	-1
Slovakia	20	2.66	19	-1
Latvia	21	2.39	21	0
Greece	22	2.03	22	0
Poland	23	1.90	23	0
Lithuania	24	1.57	24	0
Bulgaria	25	0.94	25	0
Romania	26	0.64	26	0

Note: CSI(A) - CSI with equal weights; CSI (C) – CSI with D1, D2 and D4.

only considering dimensions D1, D2 and D4, the dimensions used by Florida and considered mandatory in any index of creativity. As we can observe in this table, the use of a comprehensive index changes the ranking of some countries. The countries that benefit the most are Portugal that climbs four positions; Netherlands, Finland and France climb three positions. On the contrary, some countries see their ranking slip down more than two positions such as Luxembourg and Cyprus (four positions) and Ireland (three positions). The list of the top ten countries is very similar (France enters and Ireland is excluded).

The Global Creativity Index developed by Richard Florida and published in 2011 by the Martin Prosperity Institute contains a ranking of 82 countries covering 25 EU countries (EU 27 countries except Malta and Luxembourg). This index was estimated with data for the period 2000-2009 whereas our index was estimated with data for the period 2005-2012, which may contribute to different rankings. In Table 7, by comparing the ranking of CSI (A), CSI(B) and CSI (C) with GCI, one can see that there are significant differences between the results of the two indexes.

Table 7. Comparisson of Rankings of CSI (A), CSI(B) and CSI(C) with GCI

Country	Rank CSI (A)*	Rank CSI (B)*	Rank CSI(C)*	Rank GCI	Rank GCI – Rank CSI (A)	Rank GCI – Rank CSI (B)	Rank GCI – Rank CSI (C)
Sweden	1	1	1	1	0	0	0
Denmark	2	2	2	3	1	1	1
Netherlands	3	4	5	4	1	0	-1
Finland	4	3	6	2	-2	-1	-4
Germany	5	5	3	9	4	4	6
Luxembourg	—	—	—	—	—	—	—
United Kingdom	6	6	4	7	1	1	3
France	7	8	10	8	1	0	-2
Belgium	8	7	9	5	-3	-2	-4
Austria	9	9	8	12	3	3	4
Ireland	10	10	7	6	-4	-4	-1
Spain	11	11	12	10	-1	-1	-2
Czech Republic	12	12	14	17	5	5	3
Slovenia	13	16	16	14	1	-2	-2
Estonia	14	17	13	18	4	1	5
Cyprus	15	13	11	24	9	11	13
Italy	16	14	15	11	-5	-3	-4
Portugal	17	15	19	16	-1	-2	-3
Hungary	18	18	17	15	-3	-3	-2

Table 7. (cont.)

<i>Country</i>	<i>Rank CSI (A)*</i>	<i>Rank CSI (B)*</i>	<i>Rank CSI(C)*</i>	<i>Rank GCI</i>	<i>Rank GCI – Rank CSI (A)</i>	<i>Rank GCI – Rank CSI (B)</i>	<i>Rank GCI – Rank CSI (C)</i>
Slovakia	19	19	18	22	3	3	4
Latvia	20	20	20	19	-1	-1	-1
Greece	21	22	21	13	-8	-9	-8
Poland	22	21	22	23	1	2	1
Lithuania	23	23	23	20	-3	-3	-3
Bulgaria	24	24	24	21	-3	-3	-3
Romania	25	25	25	25	0	0	0

Note: CSI(A) – CSI with equal weights; CSI(B) – CSI with endogenous weights; CSI(C) – CSI only with dimensions D1, D2 and D4; (*) excluding Luxembourg; GCI – Global Creative Index 2011.

The comparisons of the rankings show that this instrument is sensitive to the dimensions considered and the indicators chosen, but the methodology produces consistent results when we organize countries into groups according to creativity. If we analyse the list of the top ten creative countries, excluding Luxembourg, we conclude that it is very similar in our index and in the Global Creativity Index (see table 8). The exceptions are Spain that only enters in the GCI top ten EU countries and Austria that only enters in the CSI top ten EU countries. Despite the similarity between the two lists, our index favours countries such as Germany, Austria, Denmark and United Kingdom that consistently are positioned above its position in the GCI.

Table 8. List of the Top Ten Creative EU countries excluding Luxembourg

<i>Rank</i>	<i>CSI (A)*</i>	<i>CSI(B)*</i>	<i>CSI(C)*</i>	<i>GCI</i>
1	Sweden	Sweden	Sweden	Sweden
2	Denmark	Denmark	Denmark	Finland
3	Netherlands	Finland	Germany	Denmark
4	Finland	Netherlands	UK	Netherlands
5	Germany	Germany	Netherlands	Belgium
6	UK	UK	Finland	Ireland
7	France	Belgium	Ireland	UK
8	Belgium	France	Austria	France
9	Austria	Austria	Belgium	Germany
10	Ireland	Ireland	France	Spain

5. Conclusions

The interest in the estimation of indexes of creativity has been increasing in the last years, not only for territorial marketing purposes but also because they provide analytical tools to assess the economic impact of the creative economy and are useful to measure the effectiveness of political decisions. There is still not an index accepted by the majority and used across the globe. The comparison of twelve creativity indexes presented in section 2 highlighted their main gaps and weaknesses which served as a basis for designing our own index.

In this paper we propose a new index (CSI) including nine dimensions. It aims to be a comprehensive index by gathering the best aspects of the existing ones and complementing them with additional features. Comparing with the existing indexes it has the advantage of covering more dimensions but at the same time requiring data that is available. The index was designed to analyse different realities and to enable comparisons across the globe. It is adaptable to work with different scopes—country level, regional level and city level—and with different data sources. The index covers as many aspects as possible of the creative phenomenon, keeping the data collection easy and simple.

The Index CSI was estimated for 26 EU member states using equal weights, as well as, using an endogenous weighting technique adapted to creativity indexes by Bowen *et al.* (2008).

Considering the CSI with equal weights, only four countries score higher than 6.00: Sweden, Denmark, Netherlands, and Finland. Germany, Luxembourg, United Kingdom, France, Belgium and Austria complete the top ten creative countries. The results show a great heterogeneity of the CSI scores with the concentration of higher scores in North and Central Europe, which decrease as we move to the peripheral countries (South and East).

In this study we have compared the ranking using CSI and the Global Creativity Index considering the scores of the 27 EU member states, excluding Malta and Luxembourg. The comparisons show that to measure creativity is not an easy task and that rankings are strongly subject to the dimensions considered in the index and the indicators chosen for each dimension. The rankings of our index differ from the ranking in the GCI although, when we organize countries into groups according to creativity, the differences are much smaller. For example, the list of the top ten creative countries, excluding Luxembourg, is very similar in both indexes.

In general, we conclude that the indexes of creativity are a good instrument for policymakers to set goals and to monitor results, but we have to be aware that small changes in the rankings are still subject to the index chosen, the dimensions considered, and the aggregation methodology used.

References

- Acs, Z., and Megyesi, M. (2009): «Creativity and industrial cities: A case study of Baltimore», *Entrepreneurship & Regional Development*, vol. 1, no. 4, 421-439.
- ARC Centre of Excellence for Creative Industries and Innovation (2012): «The CCI Creative City Index 2012», *Cultural Science Journal*, no. 5, no. 1.
- Bowen, H., Moesen, W., and Sleuwaegen, L. (2008): «A Composite Index of the Creative Economy», *Review of Business and Economics*, v. 54, iss. 4, 375-397.
- Csikszentmihályi, M. (1999): «Implications of a systems perspective for the study of creativity», in R. J. Sternberg, *Handbook of Creativity*, Cambridge University Press.
- Department of Communications, Informations Technology and the Arts and the National Office for the Information Economy (2002): *Creative Industries Cluster Study*, Report 1, National Office for the Information Economy, DCITA, Australia.
- Department of Culture Media and Sports (1998): *Creative Industries Mapping Document*, London: DCMS.
- European Commission (2009): *The impact of culture on creativity*, K E Affairs, Retrieved april 2012, from <http://www.keanet.eu/docs/impactculturecreativityfull.pdf>.
- Florida, R. (2002): *The Rise of the Creative Class: Transforming Work, Leisure, Community and Everyday Life*, New York: Basic Books.
- Florida, R., Charlotte Mellander and Kevin Stolarick (2011): *Creativity and Prosperity: The Global Creativity Index*, Martin Prosperity Institute.
- Florida, R., and Tinagli, I. (2004): *Europe in the Creative Age*, DEMOS, february.
- Fukuoka Benchmarking Consortium (2008): *Comparison of Cities (Creative City Index)*, Retrieved april 2012, from http://www.internationalregions.org/docs/InnovativeRegion_Nagase.pdf.
- Hong Kong Special Administrative Region Government (2004): *A Study on Creativity Index*, Hong Kong, HKSAR.
- Howkins, J. (2001): *The Creative Economy: How people make money from ideas*, London: Penguin Books.
- Kloudova, J., and Stehlikova, B. (2010): «Creativity Index for the Czech Republic in Terms of Regional Similarities and Geographic Location», *Economics and Management*, 100-109.
- Knight Foundation, Americans for the Arts, the City of San Jose Office of Cultural Affairs and Cultural Initiatives Silicon Valley (2002): *Creative Community Index*, Cultural Initiatives Silicon Valley, San Jose.
- Landry, C. (2000): *The Creative City: A Toolkit for Urban Innovators*, London: Earthscan.
- (2010): *The Creative City Index: Measuring the creative pulse of your city*, Retrieved april 2012, from http://www.vwec2010.be/notulen/VWEC2010_Landry_Creative_City_20Index.pdf.
- New England Foundation for the Arts (2007): *The Creative Economy: A New Definitio*, Retrieved may 2012, from <http://www.nefa.org/sites/default/files/ResearchCreativeEconReport2007.pdf>.
- New Zealand Institute of Economic Research (2002): *Creative Industries in New Zealand: Economic Contribution*, Wellington, March.
- OECD and European Commission, Joint Research Centre (2008): *Handbook on Constructing Composite Indicators: Methodology and User Guide*, by Nardo, M. M. Saisana, A. Saltelli and S. Tarantola (EC/JRC), A. Hoffman and E. Giovannini (OECD).
- United Nations (2010): *Creative Economy Report 2010*. Geneva: UNCTAD, UNDP; United Nations.
- (2013): *Creative Economy Report 2013 – Widening Local Development Pathways*, UNCTAD, United Nations.