4. Design, Creativity and Innovation: a scoreboard approach [1]

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Abstract

Creativity and design are important features of a well-developed knowledge economy. Design transforms creative ideas into new products, services and systems. Design links creativity to innovation and has the potential to substantially improve brand image, sales and profitability of a company.

The measurement of creativity and design is hampered by a lack of quantitative indicators which directly measure performance and we have to rely on proxy indicators, which only indirectly measure performance in creativity and design. Following the European Innovation Scoreboard (EIS), we adopt a 'scoreboard approach' to measure performance in creativity and design using 35 indicators which are classified in seven different dimensions of which three capture the Creative climate and four capture Creativity & design.

The quality of the educational system, the desire of people to express themselves artistically and the openness of a society towards different cultures determine the creative climate in a country. The analysis confirms that a favourable creative climate has a positive effect on the creativity of a country. A more favourable creative climate results in more ideas and more creativity, which in turn increases R & D and design activities. R & D and design not only develop new ideas but also shape them into commercially attractive new products and processes, thus increasing innovation.

[1] This chapter is based on the INNO Metrics publication 'Design, Creativity and Innovation: A Scoreboard Approach', February 2009.

Countries showing a higher performance in creativity and design also show a stronger innovation performance as measured in the EIS. Creative education shows the strongest relation to innovation. Policies aimed at improving levels of educational attainment and creative thinking in education will have a positive effect on a innovative performance.

Introduction

Creativity and design have distinct roles in the innovation and the broader business performance context. Design has emerged as a key differentiator for businesses. As a result of the growing access to technology, firms increasingly have to compete at equal prices and functionality. Design increasingly assumes a new role, one of competitive advantage and differentiator, creating new markets by linking technology with commercial and user considerations, whether linked to functionality, aesthetics, brand or other intangibles.

But measuring creativity and design in statistical terms is still a problem, as there is a lack of indicators to measure their contribution not only at national and international levels, but also in comparison with other economic sectors. In 2005 the UK Department of Trade and Industry concluded that '(t)here are few official statistics to support analysis of creativity and design' (DTI, 2005).

In this report we try to quantify countries' performance in creativity and design using proxy indicators to build composite indicators. These composite indicators are then used to examine the link with the innovation performance data from the 2008 European Innovation Scoreboard (EIS).

Section 2 will discuss the concepts of creativity and design and their relation to innovation. Section 3 will discuss the scoreboard approach used for measuring performance in creativity and design and will discuss the statistical indicators in detail. Section 4 presents statistical results on the relation between creativity, design an innovation and present rankings of countries' relative performance in creativity and design and Section 5 concludes.

Creativity and design as potential drivers of innovation

Defining creativity and design

According to Florida (2002) creativity is multidimensional and three different 'types' of creativity can be distinguished: technological creativity (invention), economic creativity (entrepreneurship) and artistic/cultural creativity. All these dimensions of creativity are interrelated, sharing a common process of thinking and reinforcing each other. The creative economy is then the result of the interrelations among technology, arts and businesses. Following the UK Department of Trade and Industry, creativity can be defined '… as the production of new ideas that are fit for a particular business purpose' (DTI, 2005).

As there are only a few indirect indicators for measuring the generation of new ideas, the creative sector is used as a proxy to measure creativity. The creative sector not only covers activities with an artistic component but also activities with creative output involving intellectual property, activities using creative input to add value, as in the service sector and more recently user-created activities and networks.(cf. Box 1). The existence of a vibrant creative sector is an indication of an underlying creativity activity permeating the whole economy.

Design is a key driver not only of firms, but also of countries' competitiveness. It is not only integrated into businesses as a strategic tool to drive innovation and growth, but also to foster national competitiveness by contributing to general creativity and the image of countries as a brand. For example, countries such as Denmark, Spain, Ireland, Finland and the UK have all developed national design policies and invested in design excellence, as a mean of producing unique and globally competitive products and services, a differentiator and driver of national competitiveness (Design Singapore Report, 2002). The New Zealand Design Taskforce (2003) found that 67 % of exporters identified design as a key factor in economic success and for 80 % of the companies design had added value to their business.

Box 1: Definition of creativity industries

According to Hartley (2008) the term 'creative industries' was introduced by the UK Department of Culture, Media and Sport (DCMS) in 1990, which focused on the industry itself by referring to firms whose outputs were considered creative. A major contribution by DCMS was to move the concept away from its association only with activities with a strong artistic component, to any activity producing symbolic products, and relying on intellectual property. These activities included advertising, film and video, architecture, music, art and antique markets, performing arts, computer and video games, publishing, crafts, software, design, television and radio, and designer fashion. According to this first definition, the creative industries are based on individual creativity, skill and talent.

In a second phase, which according to Hartley (2008) is taking place now, the focus has widened from creative output to the whole economy, taking into account how creative inputs add value to businesses which are not considered creative, in particular in the services sector.

In a third phase (emergent), which is being developed in parallel to the extension of digital media into popular culture, the focus is shifting to user-created content and open networks. Creativity is now seen as a collective process. The focus has been changing from a supply-driven approach to a demand-driven one. Consequently, any model to access creativity and its impact on innovation should incorporate variables that are not only supply but also demand oriented.

What is now defined as the creative sector [2] is developing at a higher pace than other economic sectors. Employment is not only growing at a high pace but the sector also offers a high share of highly skilled jobs. The creative sector is estimated to account for more than 7 % of the world's domestic product (World Bank, 2003) and is expected to grow by 10 % per year (UN, 2004). The creative industries represent a leading sector in many OECD countries, with annual growth rates between 5 and 20 % (UN, 2004) and having a positive impact on trade. Moreover, the creative industries produce significant economic spin-offs and promote integration between technology, arts and business.

The concept of design has been defined in different ways either focusing on design as an economic activity or, more generally, as the translation of the ideas generated by creativity into new products and processes (cf. Bitard and Basset, 2008):

> 'Design is what links creativity and innovation. It shapes ideas to become practical and attractive propositions for users or customers. Design may be described as creativity deployed to a specific end.'
>
> '… design can be approached as an economic sector of activity. Basically, design definitions are based on design professions with the following four main ensembles: fashion design, graphic design, interior design and product design … The list can be even more detailed, encompassing industrial design, product design (furniture, toys, jewellery), visual, communication, advertising, packaging, fashion design, architecture design, landscape design, interior design, urban design, etc.'

[2] The creative sector is defined as the mix of non-profit arts and for-profit creative industries, such as technology development, arts and entertainment, design, film-making, architecture that exhibit high rates of per employee value added input to the goods and services they produce (Creative Community Index, 2006).

In this chapter creativity is defined as the generation of new ideas; design is defined as the shaping (or transformation) of ideas into new products and processes; and innovation is defined as the exploitation of ideas, i.e. the successful marketing of these new products and processes. It should be emphasised that creativity, design and innovation are therefore not limited to certain sectors or professions, but apply across the economy.

Creativity, design and innovation

A number of existing studies have examined the link between creativity, design and economic performance. The Danish Design Centre (2003) found a correlation between the use of design and economic performance and macroeconomic growth and that job creation, revenues and exports were higher in firms that used design compared to other firms that did not. Power (2004), in his comparative study of the design sector in five Nordic countries (Denmark, Finland, Iceland, Norway and Sweden), concluded that in spite of the small size of the design industry in these countries, design is crucial to the competitiveness of firms in other industries. The use of design by Nordic firms helped to increase their profitably and level of innovation. Moreover, Power concludes that the design industry has experienced high levels of growth and tends to be concentrated in large cities.

Creativity and design can thus be linked to innovation as the first contributes to the expansion of available ideas and the second to increased chance of successfully commercialising these ideas. Swann and Birke (2005) identified three different models linking creativity and design to innovation. In the linear model creativity has a positive effect on R & D which is turn has a positive effect on innovation (cf. in the top graph in Figure 1). The interactive model not only includes feedback effects between the different elements of the linear model (cf. in the middle graph in Figure 1) but also acknowledges the importance of design. Creativity relates directly with design and design relates directly with innovation. In the third and most complete model the creative climate takes a central position (cf. the bottom graph in Figure 1).

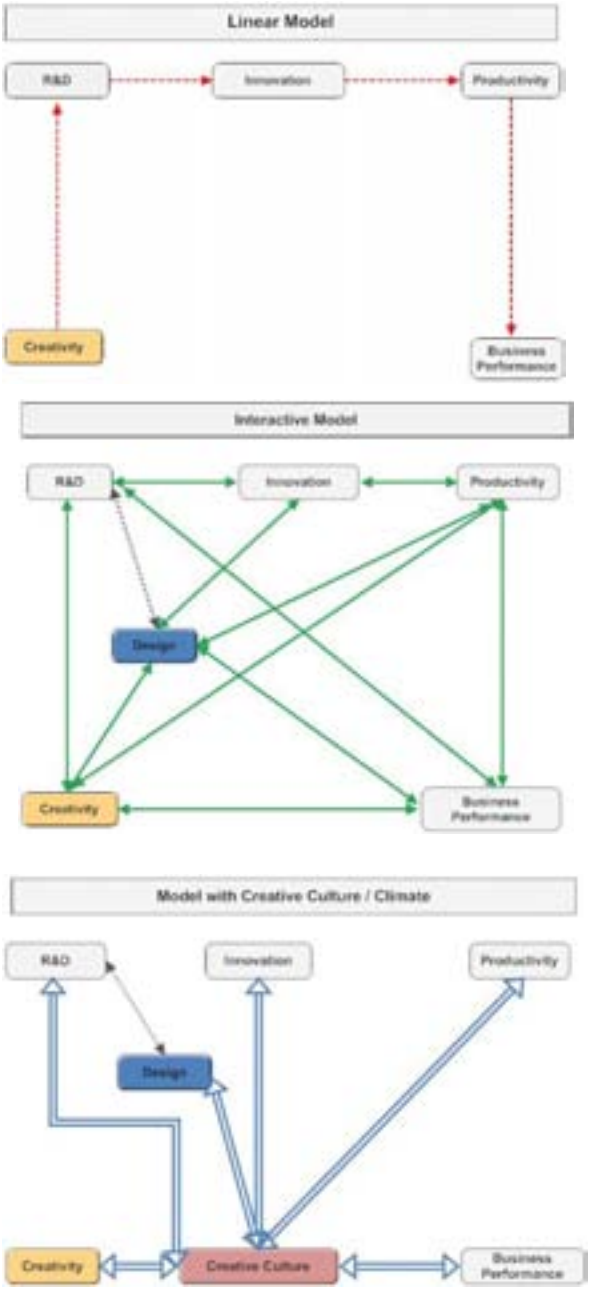

Figure 1: Linking creativity, design and innovation
Source: Adapted from Swann and Birke (2005).

Swann and Birke treat design separately from R & D. Tether (2006) suggests that 'much innovation-related design is hidden in "development"'. Lambert (2006) using British data indicated that design inputs into the innovation process have most impact when used together with more technology-based inputs, suggesting that although design and technology are different forms of activity, they complement each other.

The flow-chart model in this report, which will be discussed in the following section, is an adapted version of the third model placing more emphasis on the creative climate and allowing an interaction effect between R & D and design.

Measuring creativity and design: a scoreboard approach

Previous studies creating an index to measure creativity or design are rare. A creativity index for Hong Kong using a wide range of indicators has been developed by Hui et al. (2005). The Hong Kong Creativity Index uses six societal conditions (legal system, freedom of expression, international commitment to cultural development, ICT infrastructure, entrepreneurship and financial structure) to provide the context in which creativity takes place. Moreover, this context not only provides conditions for the development of creativity but also for its protection. Many of the indicators used were also used in other studies and come from the Global Competitiveness Report published by the World Forum.

Following the European Innovation Scoreboard (EIS), we adopt a 'scoreboard approach' using a large set of indicators to capture the different dimensions. The 35 indicators are classified in seven different dimensions of which three capture performance in the creative climate and four capture performance in Creativity & design (cf. Figure 2).

For benchmarking countries' performance on design and creativity, we follow a similar approach as in the 2003 NIS and 2004 EXIS reports (cf. Arundel, 2004 respectively Arundel and Hollanders, 2005), by summarising performance on relevant dimensions using a small sample of indicators in so-called composite indicators, i.e. a 'scoreboard approach'. In the scoreboard approach, the performance of an observed phenomenon is measured using a set of indicators which grasp some of the key features of that phenomenon. Potential indicators to be included in the analysis are identified based on a literature review and the indicators are then selected based on the results of both statistical analyses (correlation analyses and factor analyses) and what 'common sense' suggests would be the most directly relevant indicators.

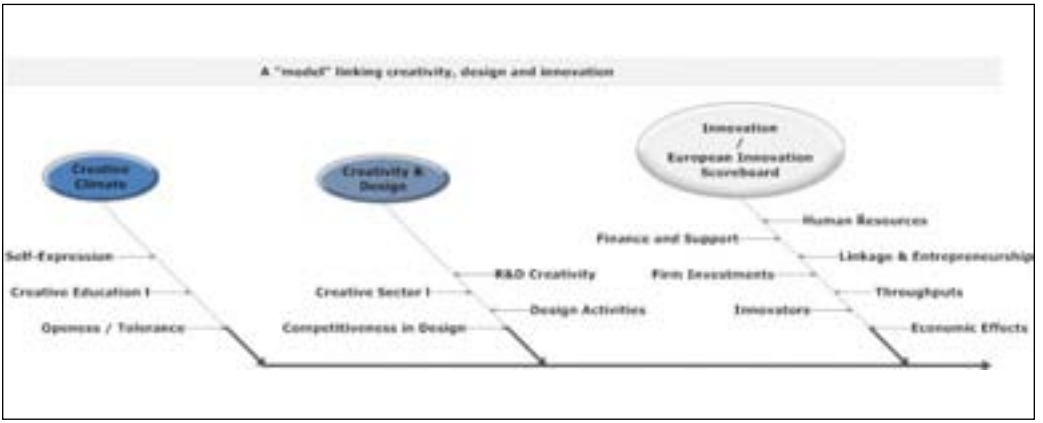

Figure 2: A 'model' linking creativity, design and innovation

The quality of the educational system, the desire of people to express themselves (artistically) and the openness of the society towards different countries and cultures determine the Creative climate. In a more favourable Creative climate the creation of new ideas is stimulated as people are better educated, have a stronger inclination to self-expression and the creation of new ideas, and are being exposed more to new ideas and thoughts from both foreigners and other cultures within the same country. Creativity generates new ideas, so a more favourable Creative climate should increase creativity as it raises the number of ideas. More creativity will result in a stronger creative sector and higher levels of creativity in R & D and design activities. We also introduce a dimension capturing the international competitiveness in design, to highlight the importance of design both within the wider innovation process and as an economic sector. The flow chart is completed with the European Innovation Scoreboard (EIS) dimensions capturing enablers of innovation (Human resources and Finance and support), innovation at the firm level (Firm investments, Linkages & entrepreneurship and Throughputs) and the Effects innovation (Innovators and Economic effects).

The selected indicators and dimensions adopted for measuring creativity and design are shown in Table 1. The rationale for selecting these indicators will be explained in the remainder of this section.

Table 1: Creativity and Design Scoreboard indicators and dimensions

	Indicators	Time period	Data source
	A CREATIVE CLIMATE		
A1	**CREATIVE EDUCATION**		
A1.1	**Number of art schools per million population**		**ELIA (European League of Institutes of the Arts)/Eurostat (population)**
A1.2	**Quality of educational system (1 = does not meet the needs of a competitive economy, 7 = meets the needs of a competitive economy)**	**2006/07**	**Global Competitiveness Report 2007/08**
A1.3	**Public expenditure on education per capita**	**Average 2001–05**	**Eurostat**
A1.4	**Share of tertiary students by field of education related to culture**	**2004/05**	**Eurostat**
A1.5	**Extent of staff training (the general approach of companies in your country to human resources is: 1 = to invest little in training and employee development, 7 = to invest heavily to attract, train and retain employees)**	**2006/07**	**Global Competitiveness Report 2007/08**
A2	**SELF-EXPRESSION**		
A2.1	**Language skills (share of population being able to have a conversation in at least one other language besides their mother tongue)**	**2005**	**Special Eurobarometer 243**
A2.2	**Share of population involved in artistic activities**	**2007**	**Eurobarometer 278**
A2.3	**Self-expression values**	**Average from 2nd to 4th wave of the World Values Survey (1990–2000)**	**Inglehart and Welzel (2004)**

Table 1: Creativity and Design Scoreboard indicators and dimensions (continued)

	Indicators	Time period	Data source
A3	OPENNESS & TOLERANCE		
A3.1	Share of foreign tertiary students	Average for 2002–06	Eurostat
A3.2	Share of foreigners in employment of population aged 25 to 64	Average for 2003–07	Eurostat
A3.3	Share of cultural employment in total employment for employees with a completed tertiary education	2005	Eurostat
A3.4	Degree of urbanisation of population aged 25 to 64 (share of population living in densely-populated areas, i.e. at least 500 inhabitants/ km^2)	Average for 2003–07	Eurostat
A3.5	Openness to other countries, share of population very interested in arts and culture in own other European countries	2007	Eurobarometer 278
A3.6	Brain drain (reversed) (your country's talented people: 1 = normally leave to pursue opportunities in other countries, 7 = almost always remain in the country)	2006/07	Global Competitiveness Report 2007/08
B CREATIVITY & DESIGN			
B1	CREATIVE SECTOR		
B1.1	Share of creative occupations (ISCO classes 1 and 2) of population aged 25 to 64	Average for 2003–07	Eurostat
B1.2	Share of knowledge workers in S&T (HRSTC — Core of Human Resources in Science and Technology)	Average for 2002–06	Eurostat
B1.3	Value added share of creative and cultural industries		KEA (2006)
B2	CREATIVITY IN R & D		
B2.1	National patent applications per million population	Average 2004–06	WIPO (patents)/Eurostat (population)
B2.2	Scientific publications per million population	Average 2004–06	Thomson Reuters Web of Science & CWTS (Leiden University)/Eurostat (population)
B2.3	Trademark applications by residents per million population	Average 2004–06	WIPO (trademarks)/Eurostat (population)

Table 1: Creativity and Design Scoreboard indicators and dimensions (continued)

	Indicators	Time period	Data source
B2.4	Capacity for innovation (companies obtain technology: 1 = exclusively from licensing or imitating foreign companies, 7 = by conducting formal research and pioneering their own new products and processes)	2006/07	Global Competitiveness Report 2007/08
B3	DESIGN ACTIVITIES		
B3.1	Importance of design staff for innovation (In the last two years, has your company's design staff been a major source of ideas for the innovative activities of your company?)	2007	Innobarometer 2007
B3.2	Number of designers per million population	2006	BEDA — Bureau of European Design Association/Eurostat (population)
B3.3	Community design applications per million population	Average 2004–06	OHIM/Eurostat
B3.4	Production process sophistication (production processes use: 1 = labour-intensive methods or previous generations of process technology, 7 = the world's best and most efficient process technology)	2006/07	Global Competitiveness Report 2007/08
B3.5	Uniqueness of product design (product designs are: 1 = copied or licensed from abroad, 7 = developed locally)	2000/01	Global Competitiveness Report 2001-02
B4	COMPETITIVENESS IN DESIGN		
B4.1	Exports design related services as a percentage of services exports	Average 2003–05	UNCTAD (Global databank on world trade in creative products)
B4.2	Exports design as a percentage of merchandise exports	Average 2003–05	UNCTAD (global databank on world trade in creative products)
B4.3	Value chain breadth (exporting companies in your country: 1 = are primarily involved in resource extraction or production, 7 = not only produce but also perform product design, marketing sales, logistics and after sales services)	2006/07	Global Competitiveness Report 2007/08
B4.4	Extent of branding (companies that sell internationally: 1 = sell into commodity markets or to other companies that handle marketing, 7 = have well-developed international brands and sales organisations)	2003/04	Global Competitiveness Report 2004–05

Sources:

BEDA, the Bureau of European Design Association, works as a permanent liaison between the professional societies of designers, the promotional, educational, research, social and design management organisations and networks within the European countries and the authorities of the European Union.

CWTS (Centre for Science and Technology Studies at Leiden University, the Netherlands) is a knowledge company dedicated to bibliometric and related information products.

The ELIA, European League of Institutes of the Arts is an independent network organisation of major arts education institutions and universities representing all subject disciplines, with a membership of over 350 arts institutions in 47 countries, representing more than 250 000 art students.

Eurobarometer 243 — Europeans and their Languages. This survey was requested by Directorate-General for Education and Culture and coordinated by Directorate-General Communication, European Commission, 2006.

Eurobarometer 278 — European Cultural Values. This survey was requested by Directorate-General for Education and Culture and coordinated by Directorate-General Communication, European Commission, 2007.

Eurostat — Statistical Office of the European Communities, whose main task is to provide the European Union with statistics at European level that enable comparisons between countries and regions.

The Global Competitiveness Report is published by the World Economic Forum on a yearly basis assessing the comparative strengths and weaknesses of national economies. Its present coverage extends to 134 major and emerging economies.

Inglehart, R. and Welzel, C. (2004), 'What Insights can Multi-Country Surveys Provide about People and Societies?' Comparative Politics Newsletter, American Political Science Association.

The Innobarometer analyses specific aspects of innovation through a survey of 3 500 randomly selected companies in the EU. The Innobarometer is part of the INNO Metrics network funded by the Directorate-General for Enterprise and Industry.

KEA is a Brussels-based strategic consultancy specialised in creative industries, cultural, entertainment, media and sport sectors.

OHIM (Office of Harmonisation for the Internal Market) is the European Union agency responsible for registering trademarks and designs that are valid in all 27 countries of the EU.

Thomson Reuters Web of Science is the world's leading source of intelligent information for businesses and professionals, in the financial, legal, tax and accounting, scientific, healthcare and media markets.

UNCTAD (United Nations Conference on Trade and Development) promotes the integration of developing countries into the world economy and undertakes research, policy analysis and data collection and provides technical assistance to the specific requirements of developing countries.

WIPO — The World Intellectual Property Organisation is a specialised agency of the United Nations, involved in the development of an international intellectual property (IP) system.

A1 Creative education

The education system is generally seen as having a major impact on the creativeness of individuals and on the creative climate. This concerns all levels and fields of education, although available statistical data is biased in favour of measuring creativity in artistic and cultural fields. The following indicators are used to capture performance in Creative education:

- **A1.1 Number of art schools per million population**

There is growing evidence that the arts produce tangible social and economic benefits (Creative Community Index, 2006). Education in arts in particular is assumed to have a positive impact on the creativity of people. Here we use the number of art schools per million population as an indicator of the presence of such schools where a higher number of art schools is assumed to improve the creative potential of a country's population. The data on the number of art schools were taken from the website of the European League of Institutes of the Arts (ELIA) and do not necessarily cover all art schools in each country.

- **A1.2 Quality of educational system**

The quality of the educational system is believed to be positively linked to creativity, by meeting the needs of a competitive economy. Moreover, educated consumers are more likely to be comfortable with new ideas, demand sophisticated and novel products and services, and consider different options. The data on quality of educational system were taken from 'The Global Competitiveness Report 2007–08' published by the World Economic Forum. The indicator reflect answers to the question 'The educational system in your country (1 = does not meet the needs of a competitive economy, 7 = meets the needs of a competitive economy)'.

- **A1.3 Public expenditure on education per capita**

Education is assumed to develop peoples' skills and abilities, for all types and levels of education. We use public expenditure on education per capita as an additional indicator for the quality of the educational system, assuming that higher spending results in better education. Data were taken from Eurostat's pocketbook on Cultural statistics (Eurostat, 2007).

- **A1.4 Share of tertiary students by field of education related to culture**

The fields of education related to culture include Humanities, Arts, Journalism and information, Architecture and building [3]. Educators have observed that students develop creative thinking through arts and transfer this capacity to other subjects. Whenever arts are a strong element in the school environment, students tend to achieve higher grades. Moreover dropout rates and absenteeism are lower (Galligan, 2001). Education in arts also helps building specific skills such as goal setting, flexible thinking, tolerance, cooperation, teamwork, creative problem-solving, self-confidence and motivation, all of them valuable in the business field (Business Week, 1996). Data were taken from Eurostat's pocketbook on Cultural statistics (Eurostat, 2007).

- **A1.5 Extent of staff training**

The extent to which companies invest in their personnel is an indicator of the intensity of on the job training and reflects the relevance of lifelong education. Data on extent of staff training were taken from 'The Global Competitiveness Report 2007–08' published by the World Economic Forum. The indicator reflect answers to the question 'The general approach of companies in your country to human resources is (1 = to invest little in training and employee development, 7 = to invest heavily to attract, train and retain employees)'.

A2 Self-expression

Self-expression is seen as an individual person's drive to act creatively. More individual creativity will have a positive effect on the generation of ideas relevant for the process of innovation. Self-expression is measured by proxy indicators on language skills, artistic activities and self-expression values.

- **A2.1 Language skills**

The indicator is defined as the share of population being able to have a conversation in at least one other language besides their mother tongue. It is assumed that being able to speak more than one's own language will benefit the exchange of ideas. The willingness of people to invest time and effort in learning more languages reflects their willingness for self-expression. Arundel (2004) in the TrendChart report on

[3] Owing to the lack of a robust definition of culture (or to an over-abundance of definitions), the Eurostat pocketbook relies on the pragmatic definition generally agreed upon during the earlier work by the European Leadership Group (LEG). First, it was decided to restrict the field to activities recognised as cultural by every Member State. Second, the field to culture was broken down into about 60 activities, cross-relating eight 'domains' (artistic and monumental heritage, archives, libraries, books and press, visual arts, architecture, performing arts and audio-visual/multimedia).

National Innovation Systems used this indicator to measure the receptiveness to use new ideas. Data were obtained for the Special Eurobarometer 243 on 'Europeans and their Languages'.

- **A2.2 Share of population involved in artistic activities**

Cultural capital [4] activities can be found in different forms of art and performance, attitude to innovation in everyday life, work context and in social activities. According to the Creative Community Index Survey (2005), respondents who worked in jobs requiring creative skills attended more cultural outings when compared to those in less creative jobs. Moreover, creativity was associated with 'the capacity to generate original ideas'. In these sense, participation in cultural activities is linked to the generation of new ideas. We use the share of population involved in artistic activities as a proxy to measure cultural capital and involvement in creative activities. The data were taken from the Eurobarometer 278 on 'European Cultural Values'.

- **A2.3 Self-expression values** [5]

The indicator on self-expression values was developed by Inglehart and Welzel (2004). The indicator uses data from the second to fourth round of the World Values Survey (1990–2000) and reflects the percentages of people who (i) emphasise freedom and participation, (ii) tolerate sexual liberty, (iii) sign petitions, (iv) trust other people and report high life satisfaction.

A3 Openness & Tolerance

Tolerance relates to the level of acceptance in a society in terms of racism, discrimination and intolerance. Mobility of human capital is related to social conditions that are conducive to cultural exchange, exchange of skills and knowledge as well as international exposure. Creative environments attract talented and ambitious people, who bring new ideas and different world views (Stolarick et al., 2005). Cultural diversity provides sources of creative expression that are captured by the creative industries

[4] The Creative Community Index (2006) used the term cultural capital to refer to more specific activities and qualities related to culture, art and creativity in everyday life. Cultural capital is related to the degree in which people in community value creative activities that are not directly related to economic returns.

[5] Indicator A2.3 — Self-expression values significantly correlates with indicator A2.2 — Share of population involved in artistic activities — (0.626), which in turn significantly correlates with indicator A2.1 — Language skills (0.476), and are consequently grouped together. Indicator A2.3 — Self-expression values do not significantly correlate with any indicator in Group A3, except with indicators A3.1 — Foreign Students (0.565) and Brain drain (reversed) (0.821). Indicator A2.3 — Self-expression values has a low correlation with indicator A3.5 — Cultural openness (0.270), most likely because while 'Self-expression values' refers to a broader level of acceptance, Culture openness only refers to other European arts and cultures.

(Bell and Stolarick, 2008; Florida, 2002). The following indicators are used to capture performance in Openness & Tolerance:

- **A3.1 Share of foreign tertiary students**

Following the 2003 TrendChart report on National Innovation Systems (Arundel, 2004), 'these students increase local diversity, respond to tolerance, and introduce new ideas'. It is to be noted that this indicator is biased towards the presence of universities or other higher education institutes. There are also cultural and language biases having an effect on the relative attractiveness of a country (or region within that country) for attracting foreign students. Data were taken from Eurostat's educational statistics.

- **A3.2 Share of foreigners in employment of population aged 25 to 64**

A large share of foreign employees is used as a proxy for the tolerance of the domestic population towards non-nationals. It would be better to have indicator focusing on skilled employees, but such data are not available in the public domain. Data were taken from Eurostat's Labour Force Survey.

- **A3.3 Share of cultural employment in total employment for employees with a completed tertiary education**

Cultural employment is defined as both employment in cultural occupations in the whole economy and any employment in cultural economic activities. We focus on the share of cultural employment for the higher educated only as these are expected be involved in the most creative jobs. Data have been obtained from Eurostat (EU Labour Force Survey, 2005).

- **A3.4 Degree of urbanisation of population aged 25 to 64**

Urban environments are thought to be conducive to creativity through their greater levels of diversity, 'attractivity' to talent, and proximity of individuals (Sacco and Segre, 2006). The authors highlighted that urban concentrations display a high number of high education and research institutes, facilitating start-ups activities and more complex relationships between producers and consumers in what they called 'flexible networks'. Firms look for a talented workforce, with talented workers preferring to reside in places where there is a vibrant cultural life (Eger, 2003). Arts and culture are fundamental for attracting a talented workforce. Larger cities offer a more developed and diverse recreational, cultural and educational infrastructure, facilitating the exchange of ideas between individuals (and professionals). Larger cities have been found to more innovative than smaller cities (Carlino, 2001; Therrien, 2003). We use the share of population living in densely populated areas, i.e. at least 500 inhabitants/km^2, as a proxy for the degree of urbanisation.

- **A3.5 Openness to other countries**

Openness to other countries is measured as the share of the population that respond to be very interested in other European countries arts and culture. Being interested in other cultures is likely to increase the exchange of ideas and improves the creative climate. Data were obtained from the Eurobarometer 278 on 'European Cultural Values'.

- **A3.6 Brain drain (reversed)**

The development and demand for innovative products can be impacted by the ability of talented graduates to work, stay and consume in their countries after they complete their education. While in the past it was considered that offering companies tax and other incentives was a necessary condition for influencing business location decisions, today the requirements are much different. According to Florida (2002), 'traditional economic development and growth strategies had been driven by 'demand-side' strategy: attract jobs to get the people. Today's economy requires a 'supply-side' strategy: places must offer a balance between technology, talent and tolerance to sustain long-term growth and prosperity.' This can partly be measured by a reverse indicator for 'brain drain', which is an indicator of the level of domestic opportunities for talented graduates. The inflow of talented people from abroad is assumed to have a positive effect on a country's creativity and the relative size of this inflow indirectly reflects that country's openness or attractiveness to foreign skilled workers. Data on brain drain (reversed) were taken from 'The Global Competitiveness Report 2007–08' published by the World Economic Forum. The indicator reflect answers to the question 'Your country's talented people (1 = normally leave to pursue opportunities in other countries, 7 = almost always remain in the country)'.

B1 Creative sector

The Creative Community Index (2006) defines the creative sector as the mix of non-profit arts and for-profit creative industries, such as technology development, arts and entertainment, design, film-making and architecture that exhibit high rates of per employee value-added input to the goods and services they produce. The creative sector is also characterised by high-paying jobs. Moreover, the development, production, marketing and sales of technology products involves more and more people trained in artistic skills. The following indicators are used to capture the degree of activity/dynamism of the creative sector.

- **B1.1 Share of creative occupations (ISCO Classes 1 and 2) of population aged 25 to 64**

This indicator reflects the indicator used by Florida (2002) for the share of population in creative occupations. In the NIS 2003 report (Arundel, 2004) a

similar indicator was used to capture the receptiveness to new ideas but then also ISCO Class 3 (technical and associate professionals) was included. ISCO Class 1 includes legislators, senior officials and managers and ISCO Class 2 includes professionals. The NIS 2003 report referred to this indicator as coming 'closest to measuring social creativity at the national level'. Data were taken from Eurostat's Labour Force Survey.

- **B1.2 Share of knowledge workers in Science and Technology (HRSTC — Core of Human Resources in Science and Technology)**

Knowledge workers are central to any knowledge economy. Being university trained and being employed in an S&T occupation, knowledge workers not only add directly to enhancing the pool of creative ideas, but they also indirectly spur the diffusion of existing ideas and technologies. Data on knowledge workers were obtained from Eurostat and reflects average between years 2002 to 2006. Data were taken from Eurostat's Labour Force Survey.

- **B1.3 Value added share of creative and cultural industries**

A direct measure of the relative importance of the creative industries is their value added share in the economy. Data were obtained from KEA (2006) (Table 3: Contribution of the European cultural & creative sector to the European and national economies). The definition by KEA of the cultural and creative sector overlaps with Hartley's definition (Hartley, 2008) as described in Box 1, although Hartley also incorporates creative inputs (not only outputs), in particular in the services sector and the most recent developments in terms of user created activities and open networks.

B2 Creativity in R & D

According to Howkins (2005), 'the enforcement of IPR regimes, covering copyrights, patents, trademarks and licensing are fundamental not only to attract FDI (foreign direct investments) but also to create incentives for businesses to adopt new methods of production, and new knowledge.' Intellectual property (IP) is considered a fundamental factor in the creative economy, regulating how people share ideas, and how ideas are rewarded and accessed. The following indicators are used to capture performance in creativity in R & D:

- **B2.1 Patent applications per million population**

Patent applications are one measure of ongoing ability to innovate and to create. Patents reflect the initial discovery and registration of innovative ideas (Creative Community Index, 2006). The capacity of firms to develop new products will

determine their competitive advantage. The number of patents is one indicator of the rate of new product innovation. Patent applications are also a measure of the number of ideas resulting from R & D activities. In the European Innovation Scoreboard EPO patent applications are used as an innovation indicator, but application barriers for EPO patents are higher than for national patent applications. Instead of EPO patents we thus use resident patent filings from WIPO — World Intellectual Property Organisation.

- **B.2.2 Scientific publications per million population**

This indicator measures the number of scientific research publications as measured in the Thomson Reuters Web of Science database. Publications can be used as a measure of the creativity of university (but also enterprise) researchers. Being published implies that papers have been accepted after a peer review process. The actual number of 'academic ideas' that are published is only a (small) share of all submitted papers.

- **B2.3 Trademark applications per million population**

A trademark is a distinctive sign, which identifies certain goods or services as those produced or provided by a specific person or enterprise. Trademarks are an important innovation indicator, especially for the service sector (Frietsch, 2005). The EIS uses data on Community trademarks, but application barriers for Community trademarks are higher than for national trademark applications. We thus use data on direct resident trademark applications from WIPO.

- **B2.4 Capacity for innovation**

The data on capacity for innovation was taken from 'The Global Competitiveness Report 2007–08' published by the World Economic Forum. The indicator reflects answers to the question how companies obtain technology (1 = exclusively from licensing or imitating foreign companies, 7 = by conducting formal research and pioneering their own new products and more intense and creative R & D activities).

B3 Design activities

Design is an important factor driving competitiveness and innovation, both at the micro and macro level (Bitard and Basset, 2008). The following indicators are used to capture performance:

- **B3.1 Importance of design staff for innovation**

The Innobarometer 2007 asks companies if in the two years prior to the survey the company's design staff has been a major source of ideas for the innovative

activities of that company[6]. This indicator can be used as a direct proxy for the importance of design activities for innovation.

- **B3.2 Number of designers per million population**

According to Vinodrai (2005), designers develop and use their skills in a variety of employers (firms and economic sectors). Designers are able to transfer knowledge across via labour mobility, benefiting firms in general.
The number of designers was obtained from the European Design Report supplement, based on the World Development Indicators database, World Bank in 2006. The total number of designers in Europe in 2006 amounted to 447 000, generating a turnover of more than EUR 36 billion (European Design Report, 2006).

- **B3.3 Community design applications per million population**

Design applications reflect the activities relating to 'the outward appearance of a product or part of it resulting from the lines, contours, colours, shape, texture, materials and/or its ornamentation'[7]. For Community designs the same argument to higher application barriers holds as for EPO patents and Community trademarks, but as national design applications from WIPO are not available from 2003 onwards, we have chosen to use Community design data.

- **B3.4 Production process sophistication**

NZIER (2003) defines design as a process applied along the value added chain. It contributes to minimising production input costs, through more efficient production systems and it helps to maximise revenues, by providing a tool to create a product that satisfies customers' requirements. According to Walsh et al. (1988), the use of design affects not only qualitative factors, such as product's performance, reliability, appearance, safety, and ease of but also cost factors, through its impact on how easy the product is to manufacture and its life cycle cost to the user.
Production process sophistication is used as a proxy to measure the relative importance of design in the production system in terms of efficiency. Data on production process sophistication were taken from 'The Global Competitiveness Report 2007–08' published by the World Economic Forum. The indicator reflects answers to the question: 'In your country, production processes use (1 = labour-intensive methods or previous generations of process technology, 7 = the world's best and most efficient process technology)'.

[6] i.e. Question 7 in the Innobarometer 2007: 'In the last two years, have any of the following been a major source of ideas for the innovative activities of your company? (a) Your company's production engineers or technicians: Yes/No/(No such unit/department)/Do not know; (b) Your company's marketing department: Yes/No/(No such unit/department)/Do not know; (c) Your company's design staff: Yes/No/(No such unit/department)/Do not know; (d) Your company's management: Yes/No/(No such unit/department)/Do not know; (e) Your company's research department: Yes/No/(No such unit/department)/Do not know'.

[7] Definition taken from the website of the Office of Harmonisation for the Internal Market (OHIM): http://oami.europa.eu/ows/rw/pages/RCD/design.en.do

- **B3.5 Uniqueness of product design**

The data on uniqueness of product design were taken from 'The Global Competitiveness Report 2001–02' published by the World Economic Forum. The indicator reflect answers to the question 'Product designs are: (1 = copied or licensed from abroad, 7 = developed locally). Unique product designs are assumed to be a proxy for the success of design activities.

B4 Competitiveness in design

Various studies (Roy et al., 1998; Potter et al., 1991; Walsh et al., 1988; Hertenstein et al., 2005) clearly indicate that there is a relationship between investment in design and innovation and business performance. As summarised by Hertenstein et al. (2005), 'results provide strong evidence that good design boost firms' operating performance and growth, which is rewarded by stock market premiums'. The following indicators are used to capture performance:

- **B4.1 Design related services as a percentage of services export**

Following the definition by UNCTAD (cf. Table 5.1 in United Nations, 2008) design-related services comprise the following three subcategories:

- Advertising and market research and public opinion polling services (Advertising): (EBOPS 278, level 3) 'Advertising and market research services transacted between residents and non-residents cover the design, creation, and marketing of advertisements by advertising agencies; media placement, including the purchase and sale of advertising space; exhibition services provided by services fairs; the promotion of products abroad; market research; and public opinion polling abroad on various issues'.
- Architectural, engineering and other technical services (Architectural) (EBOPS 280, level 3): Architectural, engineering and other technical services cover resident and non-resident transactions related to architectural design of urban and other development projects; planning and project design and supervision of dams, bridges, airports, turnkey projects, etc.; surveying, cartography, product testing and certification, and technical inspection services'.
- Research and development services (R & D) (EBOPS 279, level 3): Research and development services cover those services that are transacted between residents and non-residents and associated with basic research, applied research, and experimental development of new product and processes. In principle, such activities in the sciences, social sciences and humanities are covered; included is the development of operating systems that represent technological advances'.

The three subcategories of creative services data and services exports were obtained from UNCTAD's 'Global databank on world trade in creative products' and consisted of the average data for 2003 to 2005.

- **B4.2 Exports design as a percentage of merchandise exports**

Data is based on the 1996 version of the Harmonised System (HS 1996) for creative goods. The classification of 'creative goods' and, in specific, design was based on the Unesco Framework for Cultural Statistics. Design is defined as comprising fashion (code 49); interior (code 50); toys (code 17); jewellery (code 12) and graphic (code 11). Both design data and merchandise exports were obtained from UNCTAD's 'Global databank on world trade in creative products' and consisted of the average data for 2003 to 2005.

- **B4.3 Value chain breadth**

Related to Business sophistication, data on value chain breadth were taken from 'The Global Competitiveness Report 2007–08' published by the World Economic Forum. The indicator reflect answers to the question 'Exporting companies in your country (1 = are primarily involved in resource extraction or production, 7 = not only produce but also perform product design, marketing sales, logistics, and after-sales services)'.

- **B4.4 Extent of branding**

The data on extent of branding were taken from 'The Global Competitiveness Report 2004–05' published by the World Economic Forum. The indicator reflect answers to the question 'Companies in your country that sell internationally (1 = sell into commodity markets or to other companies that handle marketing, 7 = have well-developed international brands and sales organisations)'.

Do creativity and design drive innovation performance?

Correlation results at indicator level

Innovativeness is measured using the composite indicator scores from the EIS 2008 for each of its innovation dimensions and overall performance as captured by the Summary Innovation Index (SII). The EIS 2008 distinguishes seven different dimensions[8]. The first two dimensions — the Enablers — capture the main drivers of innovation that are external to the firm:

- Human resources capture the availability of high-skilled and educated people with performance being the summary of five different indicators.
- Finance and support capture the availability of finance for innovation projects and the support of governments for innovation activities with performance being the summary of five different indicators.

The next three dimensions — Firm activities — capture innovation efforts that firms undertake recognising the fundamental importance of firms' activities in the innovation process:

- Firm investments cover a range of different investments firms make in order to generate innovations with performance being the summary of three different indicators.
- Linkages & entrepreneurship capture entrepreneurial efforts and collaboration efforts among innovating firms and also with the public sector with performance being the summary of four different indicators.
- Throughputs capture the Intellectual Property Rights (IPR) generated as a throughput in the innovation process and Technology Balance of Payments flows with performance being the summary of four different indicators.
- The final two dimensions — Outputs — capture the outputs of firm activities as:
- Innovators capture the number of firms that have introduced innovations onto the market or within their organisations, covering technological and non-technological innovations with performance being the summary of three different indicators.

[8] For more details, refer to both the EIS 2008 report and the accompanying EIS 2008 Methodology Report, available at http://www.proinno-europe.eu/metrics

- Economic effects capture the economic success of innovation in employment, exports and sales due to innovation activities with performance being the summary of six different indicators.

The correlation results between the creativity and design indicators and the EIS innovation dimensions and SII reveal that several of the indicators are strongly correlated with innovation (refer to Annex 6 for detailed results).

- Most correlation coefficients for the indicators capturing Creative education are significant. The coefficients are significant and high for the EIS dimension Human resources, a result which can be explained by the fact that this EIS dimension also includes education related indicators. Public expenditure on education and the extent of staff training correlate best with innovation performance.
- Except for language skills the indicators capturing Self-expression correlate well with the EIS dimensions. In particular a high degree of Self-expression values relates well with Throughputs and the Summary Innovation Index.
- The indicators capturing Openness & Tolerance correlate less well with the EIS dimensions, with the exception of the Share of foreign students and Brain drain. The indicators correlate best with the EIS dimension Throughputs. These results are in contradiction to the importance assigned to Tolerance by, inter alia, Florida and Tinagli (2004) which can be partly explained by the use of different indicators to measure Tolerance [9].
- The Creative sector indicators correlate well with Enablers and Firm activities, but less well with Outputs. This would suggest that creativity is more important for creating favourable input and throughput conditions but less so for the actual successful marketing of the outputs of the innovation process.
- The indicators capturing Creativity in R & D correlate well with the EIS innovation dimensions, a result which can be explained by the fact that two of these indicators are included in the EIS dimension Throughputs (patents and trademarks, albeit at international rather than domestic levels) and that those scientific publications including at least one private and one public partner are included in the EIS dimension Linkages & entrepreneurship.
- Design activities correlates well with the EIS innovation dimensions, except for the indicator on the importance of design staff for innovation. Thus although more designers, more design applications, a more sophisticated production

[9] Florida and Tinagli (2004) use data from the World Values Survey measuring to what degree a country reflects traditional as opposed to modern or secular values.

process and a more unique product design seem to have a positive effect of the degree of innovativeness, the relative importance of design staff decreases with countries' increasing innovation performance. This can be explained by the fact that in more innovative countries relatively more firms innovate by performing R & D and, and as R & D and design can be complementary (see Tether 2006) such firms may be less likely to report design staff as a major source of ideas for innovation [10]. Another explanation could be that although design staff is important in the innovation process they are perceived to be the source of ideas for innovations (consistent with the definition used in this report that design 'shapes' ideas).

- The indicators measuring Competitiveness in design correlate well with the EIS innovation dimensions, in particular the Value chain breadth and the Extent of branding. However, exports of product design correlate negatively with five of the seven innovation dimensions. This may be because this indicator measures the volume of such exports (fashion, interior, toys, jewellery and graphic) and not necessarily their quality or, indeed, whether the design activities that lead to the exports took place in that country. Therefore, this measure of exports of product design is only a weak indicator of a country's success in either innovation or economic terms [11].

[10] cf. footnote 5 showing the question from the Innobarometer 2007 on the major sources of ideas for a firm's innovative activities.

[11] Another explanation is that, according to the Creative Economy Report (UN, 2008), it is problematic to measure trade in the creative economy, considering that available information sources have been developed to capture physical and financial flows, which are not always clear in the case of the creative economy. According to the report 'much of the value in the creative economy has been a result of trade in physical products that are of relatively low value as materials but that contains real value in intellectual property'. While conventional trade measures focus on the flow of material goods, by either registering their price or weight, in the case of the creative economy, it is impossible to separate the intellectual property value or even to recognise it. Moreover, digitisation is facilitating the transfer and trade in intellectual property online, which is not monitored. For these reasons, trade in the creative economy is relatively invisible. Moreover, with rapid technological change, the relationships between goods and value are constantly changing. Traditional measures used in the evaluation of economic activity, such as output or turnover, may not be appropriate for the creative economy, since a significant proportion of this economy does not register in trade or economic statistics as the activity may take place in the informal economy. Based on the difficulties to properly measure trade in the creative economy, the indicator exports on product design may not reflect a country's success in either innovation or in economic terms, contributing to the explanation on why it correlates negatively with five out of seven of the EIS innovation dimensions.

Relative performance in Creative climate and Creativity and design

The indicators discussed in Section 3 are used to measure average performance by using composite scores. The methodology for calculating these composite indicators is explained in Annex 1. Annex 2 shows the data for all indicators. Annex 3 shows the normalised data as calculated using the methodology as explained in Annex 1. The results for each country are shown in Annex 5.

Sweden is the best performing country in Creative climate, closely followed by Denmark (Figure 3). Bulgaria, Poland and Romania show the least good performance. Figure 3 also shows that the relative importance of the different Creative climate dimensions differs among the EU Member States. Performance in Creative education is a relative strength [12] in Ireland and Finland and a relative weakness in Latvia. Self-expression is a relative strength in Latvia, Lithuania and Slovakia and a relative weakness in Ireland, Greece, Cyprus, Hungary and Portugal. Openness & tolerance is a relative strength in Bulgaria, Greece and Hungary and a relative weakness in Slovakia and Finland.

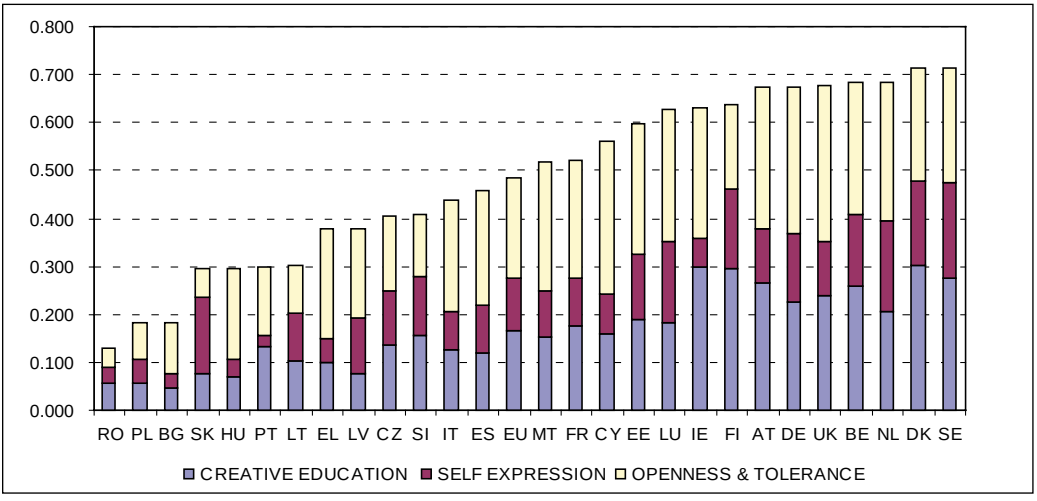

Figure 3: Countries' relative performance in Creative climate

Denmark is the best performing country in Creativity & design, followed by Sweden (Figure 4). Bulgaria and Romania show the least good performance. Figure 4 also shows that the relative importance of the different Creativity & design dimensions

[12] Relative strengths (weaknesses) are defined as those dimensions with an overall share in explaining the Creative climate composite indicator being 33 % above or 33 % below the share of the EU-27.

differs among the EU Member States. Performance in the Creative sector is a relative strength in Bulgaria, Estonia and Lithuania and a relative weakness in Italy, Malta, Austria, Portugal and Romania. Creativity in R & D is a relative strength in Bulgaria, the Czech Republic, Malta and Austria and a relative weakness in Lithuania. Design activities are a relative strength in Luxembourg and a relative weakness in Bulgaria, Estonia, Hungary, Lithuania, Poland and Romania. Competitiveness in design is a relative strength in Latvia, Lithuania, Hungary, Poland, Romania and Slovakia and a relative weakness in Ireland and Luxembourg.

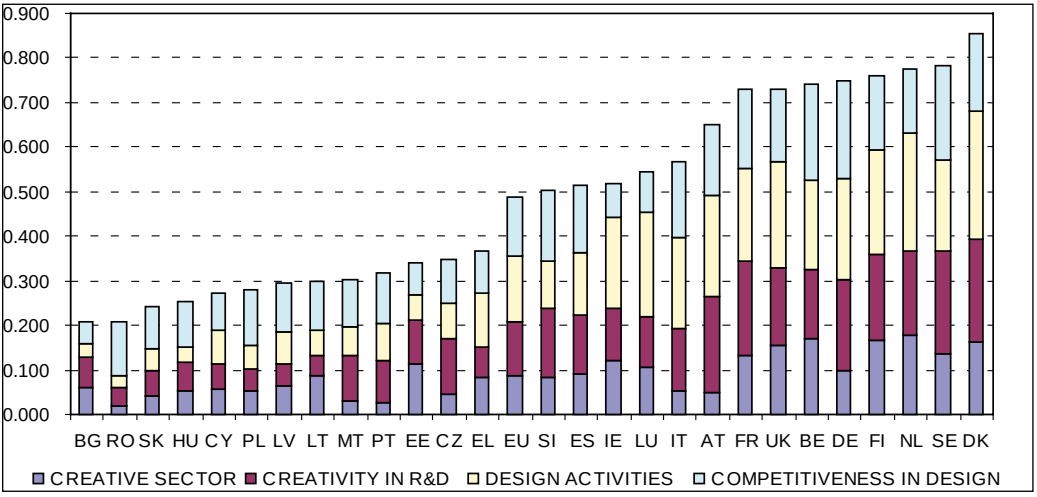

Figure 4: Countries' relative performance in Creativity & design

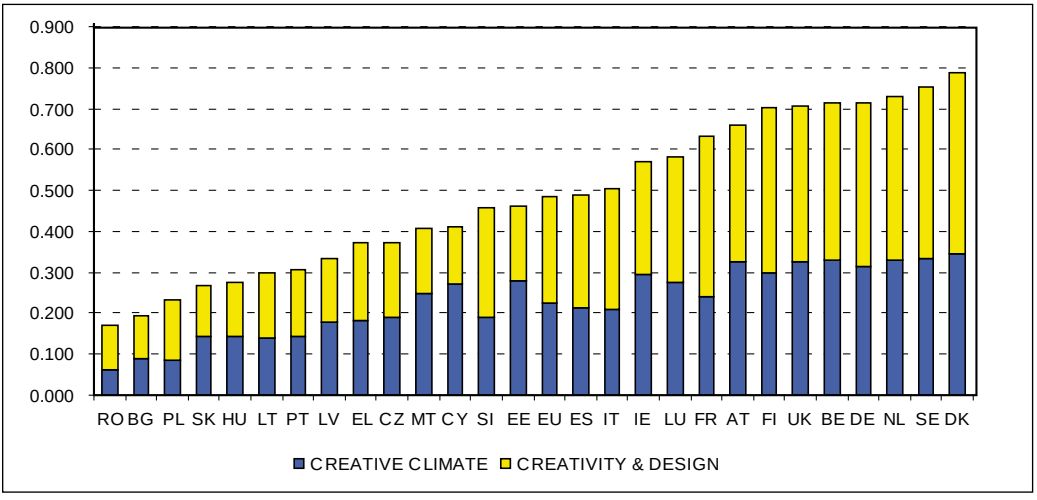

Figure 5: Countries' overall performance: the DCI Index

Figure 5 shows the overall performance in the seven dimensions capturing the Creative climate and Creativity & design. Belgium, Denmark, Germany, the Netherlands, Sweden, Finland and the UK are in the group of best performers. Ireland, France, Luxembourg and Austria are in the group of second-best performers. The Czech Republic, Estonia, Greece, Spain Italy, Cyprus, Malta, and Slovenia show a moderate performance and Bulgaria, Latvia, Lithuania, Hungary, Poland, Portugal, Romania and Slovakia show weakest performance.

Creativity, design and innovation performance

Our 'flow-chart model' predicts that the dimensions capturing the Creative climate should have a positive impact on Creativity and design. Simple correlation results between the different creativity and design dimensions and the EIS innovation dimensions support this prediction with almost all correlation results being significant [13]. The results show a strong correlation between Creativity and design and Innovation performance as measured by the EIS innovation dimensions.

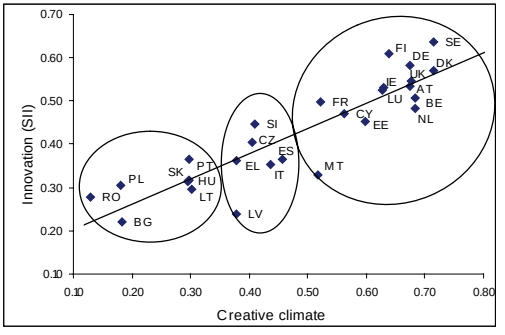

Figure 6: Creative climate and Innovation

However, these strong correlation results might be the result of what is known as spurious correlation, where two indicators appear to be strongly correlated not because they actually are, but because each of them is correlated with an unobserved third indicator. We therefore repeat the correlation analysis but this time we control for differences in per capita GDP, as many of the composite indicators correlate positively with per capita GDP.

The correlation results controlling for differences in per capita GDP confirm that the Creative climate dimensions Creative training and Self-expression have a favourable effect on Creativity and design activities. But Openness & tolerance no longer seems to have a positive effect on these dimensions, nor on innovation performance as measured by the EIS dimensions. The results also confirm the strong correlation between Creativity and design and Innovation performance as measured by the EIS innovation dimensions for Enablers and Firm activities. For Outputs we only find a significant correlation between Creativity in R & D and Economic effects (refer to Annex 8 for detailed results).

[13] These correlations are not shown in this report but are available upon request.

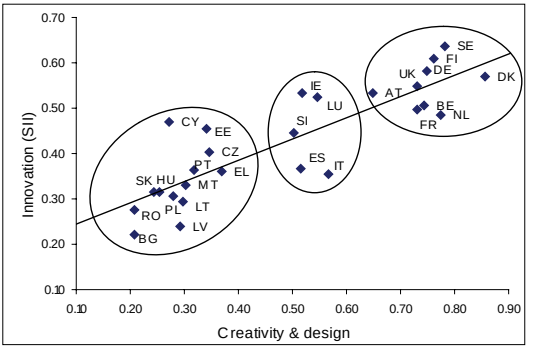

Figure 7: Creativity & design and Innovation

Figures 6 and 7 visualise the relation between performance in Creative climate and Creativity & design and Innovation performance. Countries showing a stronger performance in Creative climate also show a better innovation performance. However, as Figure 6 clearly shows, one could distinguish three different groups of countries, and within each group the link between Creative climate and Innovation is less clear. Countries showing a stronger performance in Creativity & design also show a better innovation performance. However, as shown in Figure 7, one could distinguish three different groups of countries, and within two of these groups the link between Creativity & design and Innovation is less clear. In particular within the dimensions Creative sector and Creativity in R & D the relation with innovation is strong as shown in Figure 8.

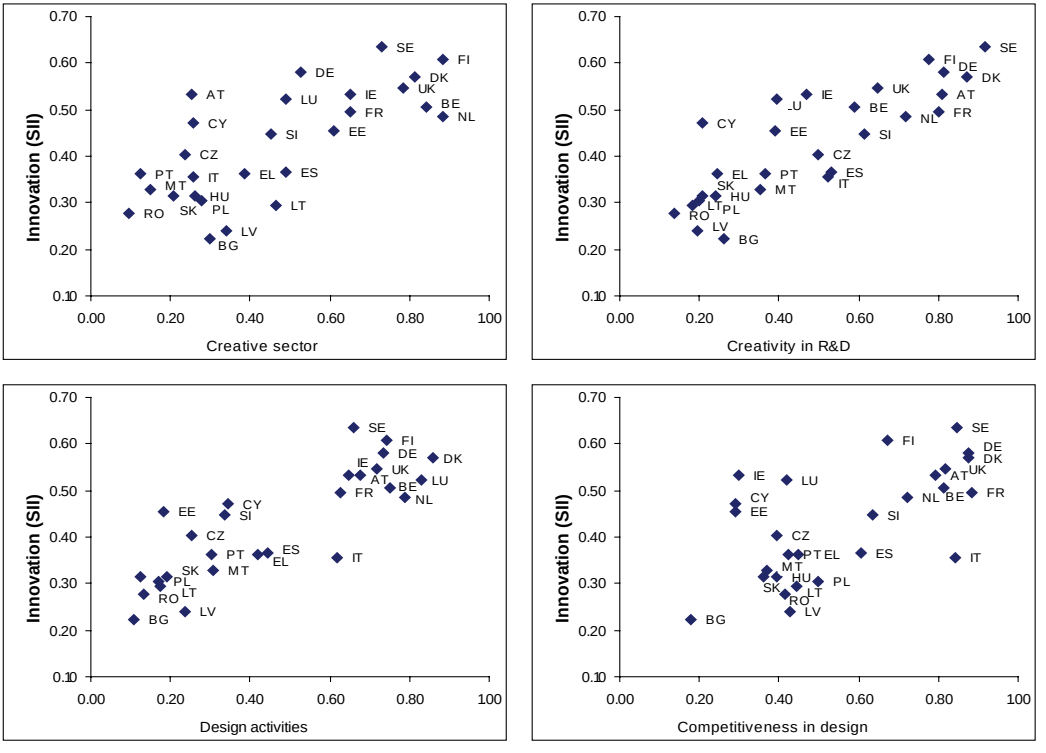

Figure 8: Creativity & design dimensions and Innovation

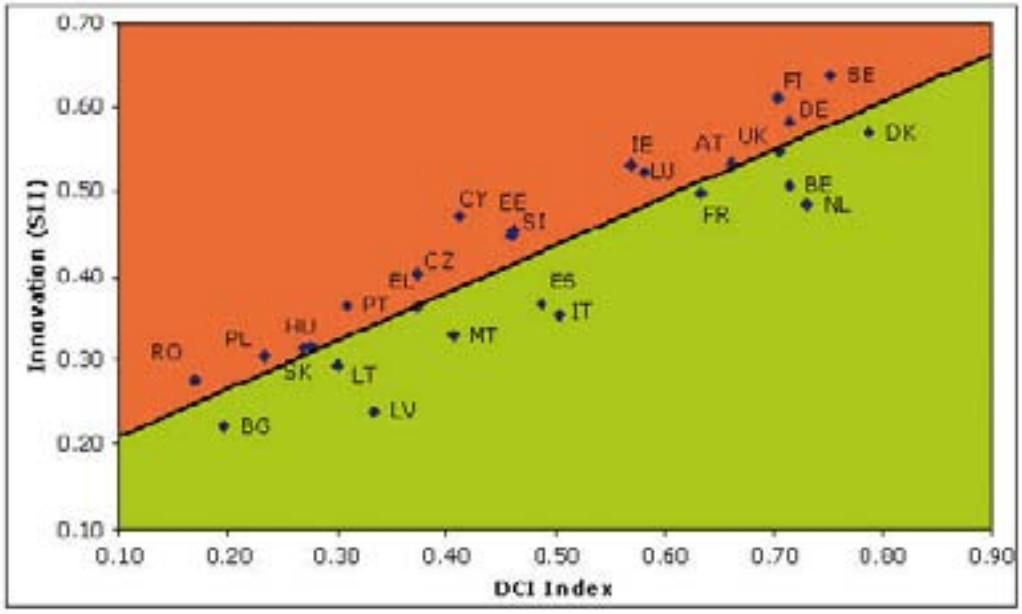

Figure 9: DCI Index and Innovation performance

Overall performance in creativity and design as measured by the DCI index is positively correlated to overall innovation performance as measured by the SII (Figure 9). Figure 9 also provides some evidence about differences in relative strength in creativity and design among the Member States. The countries located in the green coloured area show a relative strength in creativity and design as opposed to the countries located in the orange coloured area. In particular Belgium, Bulgaria, Spain, Italy, Latvia, Malta, and the Netherlands perform relatively well in creativity and design given their innovation performance. Countries performing relatively less well include Ireland, Cyprus, Finland and Sweden.

Conclusions and recommendations

Creativity and design are important features of a well-developed knowledge economy both having a positive impact on countries' innovation performance. However, given the current lack of quantitative indicators it is not possible to directly measure the degree of creativity and design. We, therefore, have had to rely on a range of so-called proxy indicators indirectly measuring countries' performance in creativity and design. For benchmarking countries a scoreboard approach has been used similar to that used in the European Innovation Scoreboard (EIS).

A flow-chart model has been developed linking the Creative climate (measured by three distinct dimensions or groups of indicators) to Creativity and design (measured by four distinct dimensions) to Innovation (measured by the composite indicator scores from the EIS 2008).

The statistical results show that there are strong relations between creativity, design and innovation. The best performing countries in creativity and design are the same countries — the innovation leaders and innovation followers — that show superior innovation performance in the EIS. Countries with a good creative climate tend to have higher levels of R & D and design activities and also strong overall innovation performance. These findings point to the need to consider design and other non-R & D activities as part of the broader approach to innovation policy as well as to the strong links between creativity and innovation. Creative education is the dimension which shows the strongest relation to innovation. This seems to suggest that policies aimed at improving levels of educational attainment and policies aimed at improving creative thinking in education will, after a number of years, have a positive effect on a society's innovative performance.

But the Scoreboard approach used in this report is seriously hampered by a lack of adequate indicators. For truly understanding the linkages between creativity, design and innovation new data are needed to construct more precise and direct indicators. Measuring creativity will be difficult, as creativity is a multidimensional phenomenon that can comprise technological (invention), economic (entrepreneurship) and artistic/cultural creativity. Each of these would require a different set of indicators for which the data could be collected by special surveys focusing on some key attributes of creativity.

Similar problems may be expected for measuring design, as different definitions for design are being used. The role of design should be better captured in the Community Innovation Survey (CIS), as the current CIS does not include a question on the role of design in product or process innovation. The CIS does include a question on if firms have made significant changes to product design as part of their marketing innovation, but this question does not fully capture the importance of design.

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Annex 1: Methodology for calculating the DCI composite indicators

For each of the seven dimensions average performance will be summarised by calculating a composite indicator as explained in the following steps:

Step 1: Identifying outliers

Positive (negative) outliers are identified as those values which are higher (smaller) than the mean value plus (minus) two times the standard deviation [14]. These outliers are not included in determining the maximum and minimum scores in the normalisation process (cf. Step 3).

Step 2: Transforming data

Most of the indicators are fractional indicators with values between 0 and 100 %. Some indicators are unbound indicators, where values are not limited to an upper threshold (e.g. the Intellectual property indicators, Publications and Art schools). These indicators can be highly volatile over time and have skewed data distributions (where most countries show low performance levels and a few countries show exceptionally high performance levels). For most indicators we use three to six-year average values and all indicators where initial skewness (after having adjusted for outliers) is below – 0.50 or above 0.50 are transformed using a power root transformation such that skewness after the transformation is between – 0.50 and 0.50.

Step 3: Determining maximum and minimum values

The maximum (minimum) score is the highest (lowest) value found within the group of EU-27 countries excluding the outliers identified in Step 1.

Step 4: Calculating rescaled values

Rescaled values are calculated by first subtracting the minimum value and then dividing by the difference between the maximum and minimum value. The maximum rescaled value is thus equal to 1 and the minimum rescaled value is equal to 0. For positive and negative outliers, these rescaled values are limited to the upper value of 1 respectively lower value of 0.

Step 5: Calculating composite indicators

For each dimension a composite indicator is calculated as the unweighted average of the rescaled scores for all indicators within the respective dimension.

Step 6: Calculating EU average

[14] This approach follows the well-adopted Chauvenet's Criterion in statistical theory.

For the EU average we use the unweighted average of all EU-27 Member States.

Annex 2: Data Creativity and Design Scoreboard indicators

	A1.1	A1.2	A1.3	A1.4	A1. 5	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A3.5	A3.6
BE	1.24	5.7	7.34	16.38	5.4	74.0	78.0	52.0	10.38	7.58	8.60	53.6	17.0	4.5
BG	0.52	3.4	1.36	12.06	2.8	59.0	21.0	24.0	3.59	0.27	0.10	44.3	9.0	2.1
CZ	0.68	4.4	3.15	14.42	4.5	61.0	73.0	42.0	4.86	1.03	1.30	27.7	8.0	3.8
DK	0.74	5.8	10.56	19.56	5.9	88.0	79.0	59.0	8.03	3.19	3.90	33.8	14.0	4.7
DE	0.23	4.9	5.31	21.05	5.5	67.0	77.0	55.0	10.86	8.34	7.70	49.3	14.0	4.6
EE	2.97	4.3	2.79	17.18	4.7	89.0	87.0	29.0	1.87	18.13	3.50	47.1	15.0	3.8
IE	2.40	5.6	6.23	22.15	5.2	34.0	39.0	51.0	5.42	6.31	7.50	36.0	25.0	5.4
EL	0.36	3.3	3.37	16.25	3.9	57.0	46.0	—	2.41	6.34	2.80	67.7	15.0	3.5
ES	0.23	3.8	4.27	17.22	4.0	44.0	80.0	43.0	2.14	10.40	8.50	51.7	15.0	4.3
FR	0.49	4.8	6.42	—	5.0	51.0	59.0	47.0	11.12	4.91	4.70	46.9	13.0	3.9
IT	0.17	3.4	5.09	24.87	3.5	41.0	51.0	49.0	2.02	5.79	—	45.2	18.0	3.3
CY	1.32	4.9	6.03	12.02	3.6	78.0	53.0	—	26.93	13.35	7.90	58.3	13.0	3.7
LV	0.43	4.1	2.34	10.80	4.0	95.0	57.0	32.0	2.02	1.01	—	47.3	18.0	3.3
LT	0.59	4.1	2.58	12.16	4.3	92.0	44.0	33.0	0.47	0.75	—	43.0	4.0	3.1
LU	0.00	4.2	9.41	—	5.1	99.0	84.0	—	—	45.21	35.50	31.4	22.0	4.3
HU	0.30	3.6	3.36	12.90	3.6	42.0	48.0	25.0	3.19	0.71	0.40	32.8	19.0	3.5
MT	0.00	4.8	3.33	20.45	4.2	92.0	51.0	—	5.71	2.70	3.10	84.7	20.0	3.7
NL	0.86	5.2	6.59	11.92	5.5	91.0	78.0	66.0	4.63	3.53	4.30	64.7	13.0	5.0
AT	0.73	5.2	6.99	20.60	5.6	62.0	66.0	48.0	14.56	9.59	10.20	36.4	14.0	4.9
PL	0.10	4.0	2.67	11.30	3.7	57.0	38.0	29.0	0.44	0.16	0.40	42.6	8.0	3.0
PT	0.76	3.5	4.18	18.50	3.9	42.0	27.0	31.5	3.43	3.18	3.40	45.2	10.0	3.9
RO	0.18	3.7	1.07	14.33	3.5	47.0	42.0	22.0	1.58	0.16	—	—	11.0	2.4
SI	2.00	4.1	5.04	12.07	4.4	91.0	68.0	32.5	1.06	0.42	—	18.4	9.0	4.0
SK	0.37	3.7	2.31	11.74	4.2	97.0	83.0	40.0	0.98	0.19	—	22.0	6.0	3.0
FI	3.43	6.0	7.19	18.45	5.3	69.0	82.0	63.0	2.64	1.44	1.30	28.7	11.0	5.2
SE	1.11	5.2	8.80	17.35	5.8	90.0	93.0	64.0	8.56	4.36	4.10	22.6	15.0	4.7
UK	0.93	4.6	6.24	21.43	5.2	38.0	74.0	57.0	14.53	6.03	—	66.9	13.0	4.9

	B1.1	B1.2	B1.3	B2.1	B2.2	B2.3	B2.4	B3.1	B3.2	B3.3	B3.4	B3.5	B4.1	B4.2	B4.3	B4.4
BE	32.63	22.86	2.60	49	1288	764	5.1	42.0	—	117	5.9	0.100	0.020	5.7	5.5	0.100
BG	19.93	17.70	1.20	33	223	878	2.9	21.0	—	1	2.9	0.010	0.020	3.2	2.6	0.010
CZ	17.85	11.32	2.30	60	596	918	4.3	13.9	314	34	4.7	0.010	0.020	4.7	4.1	0.010
DK	25.53	26.70	3.10	310	1723	804	5.5	26.0	2030	182	6.0	—	0.030	6.0	6.0	—
DE	21.66	19.14	2.50	310	940	803	6.1	17.2	970	182	6.3	0.120	0.010	6.2	6.7	0.120
EE	27.54	17.96	2.40	21	585	939	3.7	6.9	468	11	4.4	0.030	0.020	3.8	2.7	0.030
IE	35.64	18.50	1.70	189	1033	369	4.4	40.7	1927	63	5.3	0.010	0.000	5.2	4.8	0.010
EL	25.29	17.36	1.00	44	737	520	3.0	55.5	767	2	4.1	—	0.030	3.9	3.6	
ES	21.16	19.00	2.30	69	743	1248	3.8	24.5	489	97	4.7	0.050	0.040	4.9	4.3	0.050
FR	22.18	19.46	3.40	227	880	1022	5.5	38.8	198	85	5.8	—	0.030	6.0	6.1	—
IT	18.30	11.66	2.30	134	722	674	4.7	34.5	258	168	4.8	—	0.070	5.6	5.6	—

	B1.1	B1.2	B1.3	B2.1	B2.2	B2.3	B2.4	B3.1	B3.2	B3.3	B3.4	B3.5	B4.1	B4.2	B4.3	B4.4
CY	17.45	20.52	0.80	21	411	681	3.0	31.3	—	25	3.9	0.010	0.020	4.0	3.4	0.010
LV	22.57	13.78	1.80	48	144	596	3.3	25.4	209	15	3.9	0.060	0.030	3.7	3.1	0.060
LT	25.68	16.88	1.70	20	287	565	3.6	19.0	117	6	4.2	0.020	0.030	4.7	3.8	0.020
LU	27.79	21.84	0.60	36	432	738	4.7	30.3	1971	182	5.5	—	0.000	5.3	4.9	—
HU	21.33	14.66	1.20	72	492	373	3.7	6.5	248	13	4.2	0.040	0.010	4.4	4.0	0.040
MT	21.72	12.36	0.20	54	163	1020	3.1	26.7	—	11	4.2	0.010	0.040	4.1	3.3	0.010
NL	33.47	23.42	2.70	134	1505	765	5.3	29.8	2817	134	5.8	—	0.010	5.7	6.0	—
AT	19.22	13.16	1.80	275	1126	913	5.4	17.1	1157	182	5.9	—	0.020	6.0	5.6	—
PL	21.85	14.86	1.20	57	376	364	3.7	26.6	157	19	3.7	0.040	0.040	4.3	3.8	0.040
PT	18.18	10.74	1.40	15	548	904	3.9	16.8	625	44	4.2	0.030	0.030	4.3	3.6	0.030
RO	12.84	10.24	1.40	41	119	526	3.1	21.8	—	1	3.4	0.050	0.050	3.5	3.1	0.050
SI	22.54	16.54	2.20	153	1024	754	4.7	18.9	851	34	4.5	0.070	0.030	5.0	4.3	0.070
SK	17.62	11.88	2.00	35	414	525	3.4	14.8	436	15	3.9	0.030	0.020	4.0	3.6	0.030
FI	29.24	24.94	3.10	310	1649	523	5.8	44.5	381	101	6.0	0.060	0.010	5.7	5.9	0.060
SE	26.23	24.44	2.40	285	1923	869	5.9	11.9	1108	126	6.1	0.110	0.010	6.2	6.2	0.110
UK	31.69	18.92	3.00	302	1400	413	5.1	37.1	3081	74	5.4	—	0.020	5.8	6.2	—

Annex 3: Normalised data Creativity and Design Scoreboard indicators

	A1.1	A1.2	A1.3	A1.4	A1. 5	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A3.5	A3.6
EU-27	0.51	0.43	0.46	0.47	0.44	0.53	0.54	0.48	0.46	0.40	0.45	0.51	0.48	0.52
BE	0.72	0.89	0.75	0.49	0.79	0.62	0.77	0.68	0.81	0.64	0.84	0.71	0.69	0.70
BG	0.46	0.04	0.03	0.11	0.00	0.38	0.00	0.05	0.39	0.02	0.00	0.53	0.19	0.00
CZ	0.53	0.41	0.25	0.32	0.42	0.42	0.70	0.45	0.49	0.11	0.12	0.19	0.13	0.47
DK	0.55	0.93	1.00	0.77	1.00	0.83	0.79	0.84	0.69	0.32	0.38	0.31	0.50	0.77
DE	0.31	0.59	0.51	0.90	0.83	0.51	0.76	0.75	0.84	0.69	0.75	0.63	0.50	0.73
EE	1.00	0.37	0.21	0.56	0.50	0.85	0.91	0.16	0.22	1.00	0.34	0.58	0.56	0.47
IE	1.00	0.85	0.62	1.00	0.71	0.00	0.18	0.66	0.53	0.55	0.73	0.36	1.00	1.00
EL	0.39	0.00	0.28	0.48	0.17	0.35	0.29	—	0.28	0.56	0.27	1.00	0.56	0.37
ES	0.31	0.19	0.38	0.57	0.21	0.15	0.80	0.48	0.25	0.82	0.83	0.68	0.56	0.63
FR	0.45	0.56	0.64	—	0.63	0.26	0.48	0.57	0.85	0.45	0.46	0.58	0.44	0.50
IT	0.27	0.04	0.48	1.00	0.00	0.11	0.36	0.61	0.24	0.52	—	0.54	0.75	0.30
CY	0.74	0.59	0.59	0.11	0.04	0.68	0.39	—	1.00	1.00	0.77	0.81	0.44	0.43
LV	0.43	0.30	0.15	0.00	0.21	0.94	0.45	0.23	0.24	0.11	—	0.59	0.75	0.30
LT	0.49	0.30	0.18	0.12	0.33	0.89	0.26	0.25	0.01	0.08	—	0.50	0.00	0.23
LU	0.00	0.33	1.00	—	0.67	1.00	0.86	—	—	1.00	1.00	0.26	1.00	0.63
HU	0.35	0.11	0.27	0.19	0.04	0.12	0.32	0.07	0.36	0.08	0.03	0.29	0.81	0.37
MT	0.00	0.56	0.27	0.85	0.29	0.89	0.36	—	0.55	0.28	0.30	1.00	0.88	0.43
NL	0.60	0.70	0.66	0.10	0.83	0.88	0.77	1.00	0.47	0.34	0.42	0.94	0.44	0.87
AT	0.55	0.70	0.71	0.86	0.88	0.43	0.59	0.59	1.00	0.77	1.00	0.37	0.50	0.83
PL	0.21	0.26	0.19	0.04	0.08	0.35	0.17	0.16	0.00	0.00	0.03	0.49	0.13	0.20
PT	0.56	0.07	0.37	0.68	0.17	0.12	0.00	0.22	0.38	0.32	0.33	0.54	0.25	0.50
RO	0.28	0.15	0.00	0.31	0.00	0.20	0.23	0.00	0.19	0.00	—	—	0.31	0.00
SI	0.91	0.30	0.48	0.11	0.38	0.88	0.62	0.24	0.12	0.04	—	0.00	0.19	0.53
SK	0.39	0.15	0.15	0.08	0.29	0.97	0.85	0.41	0.11	0.00	—	0.07	0.00	0.20

	A1.1	A1.2	A1.3	A1.4	A1. 5	A2.1	A2.2	A2.3	A3.1	A3.2	A3.3	A3.4	A3.5	A3.6
FI	1.00	1.00	0.73	0.67	0.75	0.54	0.83	0.93	0.31	0.16	0.12	0.21	0.31	0.93
SE	0.68	0.70	0.93	0.58	0.96	0.86	1.00	0.95	0.72	0.41	0.40	0.09	0.56	0.77
UK	0.62	0.48	0.62	0.94	0.71	0.06	0.71	0.80	1.00	0.53	—	0.98	0.44	0.83

	B1.1	B1.2	B1.3	B2.1	B2.2	B2.3	B2.4	B3.1	B3.2	B3.3	B3.4	B3.5	B4.1	B4.2	B4.3	B4.4
EU-27	0.41	0.49	0.48	0.48	0.46	0.53	0.44	0.50	0.42	0.44	0.49	0.51	0.37	0.71	0.56	0.48
BE	0.95	0.86	0.71	0.28	0.77	0.61	0.69	0.93	—	0.71	0.86	0.50	1.00	0.71	0.83	0.71
BG	0.18	0.51	0.21	0.18	0.09	0.78	0.00	0.38	—	0.01	0.00	0.04	0.00	0.71	0.00	0.00
CZ	0.03	0.07	0.61	0.34	0.37	0.84	0.44	0.19	0.15	0.27	0.45	0.21	0.00	0.71	0.50	0.37
DK	0.54	1.00	0.89	1.00	1.00	0.67	0.81	0.51	1.00	1.00	0.90	0.88	—	0.87	0.93	0.83
DE	0.30	0.61	0.68	1.00	0.58	0.67	1.00	0.28	0.52	1.00	1.00	0.88	1.00	0.50	1.00	1.00
EE	0.67	0.53	0.64	0.07	0.36	0.87	0.25	0.01	0.24	0.11	0.34	0.21	0.22	0.71	0.20	0.02
IE	1.00	0.56	0.39	0.76	0.63	0.01	0.47	0.90	0.96	0.44	0.66	0.29	0.00	0.00	0.67	0.54
EL	0.53	0.48	0.14	0.25	0.46	0.24	0.03	1.00	0.41	0.02	0.24	—	—	0.87	0.23	0.24
ES	0.26	0.60	0.61	0.38	0.46	1.00	0.28	0.47	0.26	0.62	0.45	0.42	0.44	1.00	0.57	0.41
FR	0.33	0.63	1.00	0.84	0.54	1.00	0.81	0.85	0.06	0.56	0.83	0.83	—	0.87	0.93	0.85
IT	0.06	0.10	0.61	0.62	0.45	0.47	0.56	0.74	0.11	0.94	0.48	0.83	—	1.00	0.80	0.73
CY	0.00	0.70	0.07	0.08	0.24	0.48	0.03	0.65	—	0.21	0.17	—	0.00	0.71	0.27	0.20
LV	0.36	0.24	0.43	0.28	0.02	0.35	0.13	0.50	0.07	0.14	0.17	0.29	0.56	0.87	0.17	0.12
LT	0.55	0.45	0.39	0.06	0.15	0.31	0.22	0.33	0.00	0.06	0.28	0.21	0.11	0.87	0.50	0.29
LU	0.68	0.79	0.00	0.19	0.25	0.57	0.56	0.63	0.97	1.00	0.72	—	—	0.00	0.70	0.56
HU	0.27	0.30	0.21	0.40	0.30	0.01	0.25	0.00	0.10	0.13	0.28	—	0.33	0.50	0.40	0.34
MT	0.30	0.14	0.00	0.31	0.04	1.00	0.06	0.53	—	0.11	0.28	—	0.00	1.00	0.30	0.17
NL	1.00	0.90	0.75	0.62	0.89	0.61	0.75	0.61	1.00	0.79	0.83	0.71	—	0.50	0.83	0.83
AT	0.13	0.20	0.43	0.94	0.68	0.84	0.78	0.28	0.61	1.00	0.86	0.63	—	0.71	0.93	0.73
PL	0.31	0.31	0.21	0.33	0.21	0.00	0.25	0.53	0.03	0.17	0.10	0.00	0.33	1.00	0.37	0.29
PT	0.05	0.03	0.29	0.00	0.33	0.82	0.31	0.27	0.34	0.34	0.28	—	0.22	0.87	0.37	0.24
RO	0.00	0.00	0.29	0.23	0.00	0.25	0.06	0.40	—	0.00	0.00	—	0.44	1.00	0.10	0.12
SI	0.35	0.43	0.57	0.67	0.63	0.59	0.56	0.33	0.46	0.27	0.38	0.25	0.67	0.87	0.60	0.41
SK	0.01	0.11	0.50	0.19	0.24	0.24	0.16	0.22	0.22	0.14	0.17	—	0.22	0.71	0.27	0.24
FI	0.76	1.00	0.89	1.00	0.96	0.24	0.91	1.00	0.19	0.64	0.90	1.00	0.56	0.50	0.83	0.80
SE	0.59	0.97	0.64	0.96	1.00	0.77	0.94	0.14	0.59	0.76	0.93	0.88	1.00	0.50	1.00	0.88
UK	0.90	0.59	0.86	0.99	0.83	0.08	0.69	0.81	1.00	0.50	0.69	0.58	—	0.71	0.87	0.88

Normalised data for EU-27 have been calculated as the unweighted average of the normalised data for the EU-27 Member States.

Annex 4: Pearson correlations (2-tailed) with EIS dimensions

	ENABLERS		FIRM ACTIVITIES			OUTPUTS		
	Human resources	Finance and support	Firm investments	Linkages & entrepreneurship	Throughputs	Innovators	Economic effects	Summary Innovation Index
A CREATIVE CLIMATE								
A1 CREATIVE EDUCATION								
A1.1 Number of art schools	0.582***	0.405**	0.524***	0.501***				0.473**
A1.2 Quality of educational system	0.626***	0.640***	0.659***	0.719***	0.711***		0.380*	0.788***
A1.3 Public expenditure on education	0.579***	0.788***	0.551***	0.711***	0.902***	0.470**	0.402**	0.865***
A1.4 Share of tertiary students in cultural education		0.441**			0.651***	0.346*	0.495**	0.508***
A1.5 Extent of staff training	0.658***	0.711***	0.676***	0.770***	0.764***	0.387**	0.487***	0.875***
A2 SELF-EXPRESSION								
A2.1 Language skills								
A2.2 Share of population involved in artistic activities	0.397**	0.583***	0.663***	0.549***	0.474**		0.478**	0.647***
A2.3 Self-expression values	0.631***	0.781***	0.604***	0.717***	0.866***	0.354*	0.538***	0.834***
A3 OPENNESS & TOLERANCE								
A3.1 Share of foreign tertiary students		0.452**	0.423**	0.590***	0.442**	0.459**		0.519***
A3.2 Share of foreigners in employment					0.483**	0.418**		0.331*
A3.3 Share of cultural employment of tertiary educated					0.593***			
A3.4 Degree of urbanisation	–0.346*							
A3.5 Openness to other countries					0.544***			
A3.6 Brain drain (reversed)	0.602***	0.799***	0.577***	0.743***	0.817***	0.441**	0.502***	0.875***

B CREATIVITY & DESIGN								
B1 CREATIVE SECTOR								
B1.1 Share of creative occupations	0.641 ***	0.587 ***		0.460 **	0.501 ***			0.533 ***
B1.2 Share of knowledge workers	0.676 ***	0.737 ***	0.456 **	0.620 ***	0.614 ***			0.703 ***
B1.3 Value added share of creative industries	0.644 ***	0.529 ***	0.523 ***	0.533 ***				0.533 ***
B2 CREATIVITY IN R & D								
B2.1 Patent applications	0.660 ***	0.637 ***	0.667 ***	0.617 ***	0.656 ***		0.457 **	0.770 ***
B2.2 Scientific publications	0.745 ***	0.776 ***	0.650 ***	0.769 ***	0.655 ***	0.336 *	0.408 **	0.842 ***
B2.3 Trademark applications								
B2.4 Capacity for innovation	0.648 ***	0.682 ***	0.698 ***	0.669 ***	0.744 ***	0.398 **	0.518 ***	0.849 ***
B3 DESIGN ACTIVITIES								
B3.1 Importance of design staff for innovation								
B3.2 Number of designers	0.400 *	0.613 ***		0.562 ***	0.638 ***			0.566 ***
B3.3 Community design applications		0.574 ***	0.451 **	0.530 ***	0.848 ***	0.396 **	0.469 **	0.695 ***
B3.4 Production process sophistication	0.590 ***	0.745 ***	0.643 ***	0.740 ***	0.833 ***	0.451 **	0.592 ***	0.899 ***
B3.5 Uniqueness of product design		0.686 ***	0.572 **	0.601 ***	0.759 ***	0.404 *	0.560 **	0.729 ***
B4 COMPETITIVENESS IN DESIGN								
B4.1 Exports design related services		0.415 *	0.461 **	0.476 **	0.401 *		0.397 *	0.545 **
B4.2 Exports product design	– 0.425 **	– 0.365 *	– 0.442 **	– 0.449 **	– 0.437 **			– 0.523 ***
B4.3 Value chain breadth	0.600 ***	0.705 ***	0.566 ***	0.654 ***	0.782 ***	0.374 *	0.539 ***	0.825 ***
B4.4 Extent of branding	0.587 ***	0.671 ***	0.567 ***	0.635 ***	0.754 ***	0.335 *	0.548 ***	0.803 ***

*** Correlation is significant at the 1 % level.

** Correlation is significant at the 5 % level.

* Correlation is significant at the 10 % level.

Annex 5: Composite indicator scores and rankings

	CREATIVE CLIMATE		Creative education		Self- ex-pression		Openness & Tolerance		CREATIVITY & DESIGN		Creative Sector		Creativity in R & D		Design activities		Competi-tiveness in design		DCI index	
		Rank		Rank		Rank		Rank		Rank		Rank		Rank		Rank		Rank		Rank
EU-27	**0.488**		0.463		0.516		0.485		**0.486**		0.460		0.479		0.472		0.531		**0.485**	
BELGIUM	**0.686**	**4**	0.729	6	0.690	7	0.641	6	**0.749**	**5**	0.842	3	0.588	10	0.752	4	0.812	7	**0.714**	**5**
BULGARIA	**0.174**	**26**	0.129	27	0.143	25	0.250	23	**0.212**	**26**	0.300	17	0.263	19	0.109	27	0.177	27	**0.196**	**26**
CZECH REPUBLIC	**0.423**	**17**	0.385	16	0.522	16	0.363	20	**0.345**	**17**	0.237	23	0.497	13	0.254	19	0.393	21	**0.374**	**18**
DENMARK	**0.740**	**2**	0.850	1	0.820	4	0.549	13	**0.854**	**1**	0.812	4	0.870	2	0.857	1	0.876	2	**0.788**	**1**
GERMANY	**0.671**	**6**	0.629	8	0.672	8	0.712	2	**0.737**	**8**	0.527	10	0.811	3	0.735	6	0.875	3	**0.714**	**4**
ESTONIA	**0.602**	**10**	0.528	11	0.638	9	0.639	7	**0.368**	**16**	0.611	9	0.389	16	0.184	22	0.288	26	**0.462**	**14**
IRELAND	**0.583**	**11**	0.836	2	0.280	22	0.634	8	**0.517**	**12**	0.652	8	0.468	14	0.649	10	0.301	24	**0.570**	**11**
GREECE	**0.359**	**21**	0.262	21	0.321	21	0.495	16	**0.374**	**15**	0.386	15	0.244	20	0.420	14	0.448	14	**0.373**	**19**
SPAIN	**0.454**	**15**	0.330	19	0.478	17	0.553	12	**0.517**	**13**	0.489	12	0.531	11	0.442	13	0.606	12	**0.488**	**13**
FRANCE	**0.513**	**14**	0.569	10	0.438	19	0.532	15	**0.741**	**6**	0.653	7	0.800	5	0.626	11	0.884	1	**0.633**	**9**
ITALY	**0.420**	**18**	0.357	18	0.362	20	0.541	14	**0.561**	**10**	0.256	21	0.525	12	0.620	12	0.844	5	**0.504**	**12**
CYPRUS	**0.547**	**12**	0.416	14	0.535	14	0.691	3	**0.276**	**23**	0.257	20	0.207	23	0.346	15	0.292	25	**0.411**	**16**
LATVIA	**0.397**	**19**	0.217	22	0.540	12	0.434	18	**0.300**	**20**	0.342	16	0.195	25	0.235	20	0.428	16	**0.333**	**20**
LITHUANIA	**0.328**	**22**	0.285	20	0.467	18	0.232	24	**0.317**	**18**	0.466	13	0.182	26	0.176	23	0.442	15	**0.300**	**22**
LUXEMBOURG	**0.679**	**5**	0.500	12	0.932	2	0.606	9	**0.534**	**11**	0.490	11	0.395	15	0.831	2	0.420	18	**0.581**	**10**
HUNGARY	**0.270**	**24**	0.193	24	0.170	24	0.446	17	**0.255**	**24**	0.263	19	0.239	21	0.126	26	0.394	20	**0.275**	**23**
MALTA	**0.534**	**13**	0.394	15	0.628	10	0.582	10	**0.294**	**21**	0.148	25	0.353	18	0.306	17	0.368	22	**0.406**	**17**
NETHERLANDS	**0.712**	**3**	0.579	9	0.883	3	0.673	5	**0.777**	**3**	0.882	2	0.717	7	0.788	3	0.721	9	**0.731**	**3**
AUSTRIA	**0.655**	**8**	0.741	5	0.538	13	0.686	4	**0.632**	**9**	0.252	22	0.810	4	0.675	8	0.791	8	**0.661**	**8**
POLAND	**0.187**	**25**	0.157	25	0.227	23	0.179	25	**0.286**	**22**	0.279	18	0.197	24	0.168	24	0.498	13	**0.233**	**25**
PORTUGAL	**0.272**	**23**	0.371	17	0.113	27	0.331	21	**0.305**	**19**	0.125	26	0.367	17	0.304	18	0.425	17	**0.308**	**21**
ROMANIA	**0.130**	**27**	0.147	26	0.142	26	0.100	27	**0.195**	**27**	0.095	27	0.135	27	0.134	25	0.417	19	**0.169**	**27**
SLOVENIA	**0.439**	**16**	0.434	13	0.579	11	0.304	22	**0.510**	**14**	0.452	14	0.613	9	0.337	16	0.637	11	**0.459**	**15**
SLOVAKIA	**0.365**	**20**	0.213	23	0.742	6	0.141	26	**0.241**	**25**	0.208	24	0.208	22	0.190	21	0.360	23	**0.269**	**24**
FINLAND	**0.670**	**7**	0.832	3	0.768	5	0.411	19	**0.770**	**4**	0.886	1	0.778	6	0.744	5	0.673	10	**0.704**	**7**
SWEDEN	**0.755**	**1**	0.769	4	0.939	1	0.558	11	**0.788**	**2**	0.732	6	0.916	1	0.658	9	0.845	4	**0.751**	**2**
UNITED KINGDOM	**0.652**	**9**	0.674	7	0.523	15	0.758	1	**0.741**	**7**	0.783	5	0.645	8	0.717	7	0.817	6	**0.705**	**6**

Annex 6: Partial correlations (controlling for per capita GDP) between Creativity and design dimensions and EIS dimensions

							ENABLERS		FIRM ACTIVITIES			OUTPUTS		
	Creative sector	Creativity in R&D	Design activi-ties	Com-petilive-ness in design	Creative climate	Creativity & design	Human resourc-es	Finance and sup-port	Firm invest ments	Linkages & entrepre neurship	Through-puts	Inno-vators	Eco-nomic effects	Summar V Innova-tion
Creative education	0.666 "	0.767 "	0.736 "	0.500 "	0.849 "	0.762 "	0.658 "	0.684 "	0.673 "	0.775 "	0.739 "			0.887 "
Self-expres-sion	0.433 ""	0.374 *			0.571 "	0.388 *		0.418 ""	0.528 "					0.397 ""
Openness & tolerance		0.351 *	0.424 ""		0.773 "	0.370 *		0.547 "		0.482 ""	0.381 *			0.425 ""
Creative sector		0.564 "	0.642 "	0.457 ""	0.629 "	0.746 "	0.773 "	0.673 "	0.423 ""	0.556 "	0.334 *			0.614 "
Creativity in R&D			0.789 "	0.802 "	0.685 "	0.917 "	0.505 "	0.668 "	0.615 "	0.556 "	0.675 "		0.390 ""	0.783 "
Design activities				0.821 "	0.679 "	0.928 "	0.466 ""	0.560 "	0.425 ""	0.584 "	0.656 "			0.647 "
Competi-tiven ess in design					0.471 ""	0.891 "	0.395 ""	0.463 ""	0.383 ""	0.452 ""	0.426 ""			0.545 "
Creative climate						0.699 "	0.451 ""	0.754 "	0.641 "	0.741 "	0.636 "			0.792 "
Creativity & design							0.601 "	0.671 "	0.537 "	0.610 "	0.609 "			0.745 "
DCI index					0.890	0.948	0.583 "	0.764 """	0.627 """	0.717 """	0.672 """			0.828 "

***** Correlation is significant at the 1 % level.**

**** Correlation is significant at the 5 % level.**

*** Correlation is significant at the 10 % level.**