

Maximizing EU Funding for the Implementation of Green and Sustainable Initiatives in Cultural and Creative Cities

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Abstract. *The path toward a green economy presents substantial challenges to cities and regions and will call for major investment and a creative approach. European Union (EU) funding has emerged as a central source of support for realizing this transition, especially through initiatives that combine culture, creativity, and sustainability. The paper analyzes the worth of EU funding for encouraging the green transition of cultural and creative cities, with a specific focus on the European Regional Development Fund (ERDF) Operational Program Berlin 2014–2020. Berlin is a successful cultural and creative capital, and a shining best practice for how the EU funds can contribute to turning green, innovative, and sustainable urban development into a reality. A new examination of EU funding sources, namely the Green Deal, the Just Transition Fund and Creative Europe, makes the case for the need to balance cultural and environmental goals. Quantitative analysis has been employed in the research via linear regression models for the purpose of quantifying the impact of ERDF spending on markers such as high-tech jobs, science and technology human resources, GDP, and greenhouse gas emissions. According to the findings, EU funding plays a significant role in fostering economic growth alongside sustainability in creative cities. Moreover, the findings indicate that Berlin's integration of creative into green policy has been successful, albeit with continuing challenges related to the implementation and assessment of cultural policy. This paper contributes to the literature by illuminating the means through which EU funds are best optimized for sustainable urban development in the culture industry, with policy recommendations for cities attempting to balance creativity with environmental stewardship.*

Keywords: European Union Funds, OP Berlin ERDF, green economy, cultural-creative cities, sustainable development.

Introduction

The effects of environmental deterioration such as climate change, water scarcity or pollution are already a reality in most countries, and the development of economic activities can no longer be achieved on previously used methods, but the prioritization of renewable energy and recycling must be considered. The green transition is a necessity that requires funding sources, but it can also represent an opportunity. To stimulate green investments, the EU has introduced various funding programs, the most important of which are Next Generation EU, the ERDF, and Horizon 2020 (Wang & Lo, 2021). Such financial tools are indispensable for providing necessary conditions for the member states to adopt green policies and innovative technologies. Such mechanisms will not only help to facilitate more equal transitions across all the economies of the EU but also very different across the regions due to disparities in economic structures, resources, and regional needs. The Just Transition Fund is considered among the main tools in the initial efforts to help carbon-intensive regions make the necessary transitions (Filipovic et al., 2022).

After financial investments, the potential contribution of cultural and creative industries in the support of environmental transitions is well acknowledged in literature. One such initiative, the "Greening the Creative Europe Program" from the EU, has confirmed the potential that cultural and creative sectors have in attaining sustainability goals while fostering economic innovation (European Commission, 2023). The role of culture and creativity in fostering an innovation-led process that influences and changes urban development attitudes, thus supporting sustainability practice, is increasingly acknowledged.

Over the last few decades, cultural policies have been somewhat more and more, in nature, aligned with policies in the environment and the economy. The EU Green Deal presents a scaffold that positions culture within sustainability policies, considering its inspirational ability to change behavior and increase the adoption of green practices (European Union, 2018). While it can be said that the creative sector contributes to economic growth and urban innovation, direct evaluation of its influence on a green economy transition is quite difficult based on a lack of such type of empirical evidence and difficulty in measuring systemic benefits.

Hence, Berlin has very good evidence for the potential integration of creativity, cultural industries, and sustainability. The ERDF Operational Programme 2014-2020 was implemented in this cultural innovation center to improve the labor market by creating jobs in science, research and technology. It also includes ecological compatibility, thus implementing it in the field of professional cultural infrastructure development. Both initiatives appear more consistent with the interdependence between sustainability, economic development, and creative industries. This paper will try to discuss the influence that EU funding has on stimulating the transition to the green economy within the cities of cultural and creative nature, to be more specific, Berlin. Will be used to spot the production and creative potential in forming sustainable urban development.

The study will be based on empirical evidence, and we will apply a simple linear regression analysis to investigate the relationship between the European financing project and the most important benchmarks of economic and environmental change.

The research hypothesis is that EU funds are the main contributors to the promotion of green economy transitions in creative cities by fostering innovation as well as employment and sustainability. The paper's concern in evaluating the effectiveness of projects funded by ERDF in Berlin is to substantiate empirically how creative industries contribute to attaining environmental goals. The results are expected to shed light on how such financing strategies may be upscaled to other European cities involved in a sustainability drive.

This paper is structured around the following elements: a review of the literature on EU funding for green economy and the involvement of cultural and creative cities in the transition to sustainability. The methodology is the section where the research framework is presented, as well as the methods used, namely the Cultural and Creative Cities Index and linear regression to analyze the impact of EU funding. The results and discussion section commands the empiric exposition on the effectiveness of projects funded by the EU in Berlin. A conclusion will then be made, summarizing said insights, their policy implications, and directions for future research on integrating creative industries into sustainability framework.

Literature review

European Union support to promote the green economy

In the modern world, the economic growth process is, and traditionally has been, a process connected with environmental degradation. This results from reliance on activities that generate a substantial level of greenhouse gas emissions (Rutkowska & Sulich, 2021).

The effects of environmental deterioration such as climate change, water scarcity or pollution are already a reality in most countries, and the development of economic activities can no longer be achieved on previously used methods, but the prioritization of renewable energy and recycling must be considered. In this context, the *concept of green economy* represents a vision of a sustainable economy in which both the environment and the economy are in balance. (Liu & Zhang, 2016)

In this context, the transition to a green economy represents a challenge for cities and regions that will require major investments, but also a creative approach. Thus, European Union funds can represent a solution for a more efficient transition, in principle through new projects that combine sustainability, culture and creativity. The European Union (EU) has allocated substantial funds to support green investments, especially in the aftermath of the 2008 financial crisis, and has adopted various strategies in this regard such as the Green Deal (GD) as the new growth path, aiming for Europe to become the first climate neutral continent by 2050. (Zoboli & Speck, 2017)

In their paper, Bongart & Torres (2022) emphasize that without strong financing, GD goals could not be realized. The *Sustainable Investment Plan* is the investment pillar of GD, that will enable the transition to a green and climate neutral economy. To increase green investments in the EU, the introduction of different funding programs has taken place, the most notable of which are Next Generation EU, the European Regional Development Fund (ERDF), and Horizon 2020 (Wang & Lo, 2021). Such financial tools are indispensable for providing necessary conditions for the member states to adopt green policies and innovative technologies.

However, the EU faces regional differences that have many causes such as different living standards, resources, needs, and socio-economic characteristics of its member states. Thus, the Just Transition Fund (JTF) was created to help the transition in the most affected regions especially those that whose economies rely on coal mines and energy consuming industries (Filipovic & all, 2022).

After analyzing previous studies, we can conclude that investments in green projects supported by EU funds generate significant economic growth and create new jobs. It is also emphasized that the implementation of specific green economy policies improves sustainable development in the EU, while contributing to the strategic objectives of the General Directive (DG).

However, it should be considered that the impact of EU funds varies, and transition economies need to propose and implement appropriate economic policies to maximize their benefits. (Bogovic & Grdic, 2020)

Therefore, more research should focus on assessing the effectiveness of the implemented policies, as well as their social and economic implications.

The role of cultural-creative cities in the transition to the green economy

Another factor that can support the transition to a green economy and environmental responsibility are cultural and creative activities. In 2021 the initiative "*Greening the Creative Europe program*" was launched to help the EU on the one hand to reach its climate change goals and on the other hand to support efforts to green the Creative Europe program. (European Commission, 2023)

In a summary of *Agenda 21 for Culture in 2020* it is referred to that the cultural and creative sector should not be left behind and can contribute to positive changes in attitudes and practices towards a more economically sustainable future. The EU GD has the capacity to offer solutions that would result in benefits in arts, culture, education, to operate in a greener and more sustainable way.

Over the last two decades, culture and creativity have gained a significant role in national and international institutional discourse. Beyond their intrinsic value and direct economic contribution, cultural and creative industries are recognized as sources of innovation (Innocenti et al., 2019) and drivers of social influence, contributing to well-being (Grossi et al., 2019; Reyes-Martínez et al., 2021) and inclusion. (Moulaert et al., 2013) This evidence highlights and justifies both the political interest in the creative economy at all levels (European Union, 2018) and the potential of a culture-based policy.

On the other hand, the literature recognizes the ambiguity of the concept, the lack of specific and detailed data needed to analyze the phenomenon, the systemic nature of the benefits generated and, consequently, the challenge to hold individual organizations accountable and assess the effectiveness of policies (Sacco et al., 2017).

The *creative city concept* has had a significant impact on the promotion of various cultural policies implemented in recent years. Harnessing the synergy between culture and creativity has proven effective in empowering communities, attracting talent (Sacco et al., 2013), fostering inclusion, supporting local cultural industries and driving innovation in the wider economy. Culture is thus deeply interconnected with various models of sustainable development, taking into account the interests of future generations.

Creative cities have emerged as catalysts for sustainable economic development and urban regeneration in Europe. Cultural and creative industries contribute to economic transformation, encouraging innovation and strengthening local identity. These industries can generate new investment opportunities and have spillover effects on the wider economy (Krstinic Nizic et al., 2019).

Methodology

The hypothesis of this paper is that EU funds can be used to implement projects facilitating the transition to a green economy in cultural-creative cities. In this sense, we focused on the Berlin Operational Programme of the European Regional Development Fund 2014-2020 (*OP Berlin ERDF 2014-2020*), which has as specific objectives increasing the number of jobs related to science, research, production, and scientific services; the rehabilitation of cultural buildings to meet ecological standards; and the increase in productivity based on sustainable methods.

The choice of this programme is justified by the role of the European Regional Development Fund (ERDF) in addressing climate change through EU cohesion policy. Berlin was selected by us because it is a creative-cultural city that has successfully combined research, culture and creativity.

Achieving the programme objectives in this city-region could have a positive impact by improving the connection between technology, innovation and the creative industries.

To test the hypothesis of this study, we conducted quantitative research. Similar to other authors who have obtained results in sustainability research, such as Bongardt & Torres (2022), or in innovation research, such as Cristache et al. (2022), we applied simple linear regression.

According to Alhakamy et al. (2023), regression is one of the most widely used statistical methods for analyzing relationships between two or more variables. This method can be applied to various factors and can determine the influence of an independent variable on a dependent variable.

Linear regression is used to quantify the direct effect of EU funding on key indicators. Its main advantage is the high degree of sensitivity to any changes it registers.

To assess the effects of the OP Berlin ERDF 2014-2020, we conducted simple linear regressions, where the independent variable is the European funds allocated through OP Berlin ERDF, while the dependent variables act as proxies for the program's main objectives, which include *Innovation, Research and Technological Development, and Environmental Externalities*, as presented in Table 1.

Table 1. Variables chosen for economic models

The variables	Description	The type of the variables	Data Source*
Total OP Berlin ERDF expenditure	Total OP Berlin FEDR expenditure, expressed (in million EURO).	Independent	European Commission
Employment in high-tech sectors in Berlin	Proxy variable for innovation, indicating economic expansion based on innovation and knowledge.	Dependent	Eurostat
Human resources in science and technology in Berlin	Proxy variable for new jobs in science and technology, reflecting workforce capacity improvements in research-intensive sectors.	Dependent	Eurostat
Gross domestic product (million PPS) in Berlin	Proxy variable for productivity of the economy. Indicator of innovation and economic growth.	Dependent	Eurostat
Total greenhouse gas (GHG) emissions in Berlin	Proxy variable for sustainability. Often used as an indicator to assess the effectiveness of measures aimed at mitigating environmental impacts and promoting sustainability.	Dependent	European Commission

Source: Authors' own research. *Eurostat: <https://ec.europa.eu/eurostat/web/regions/database> (accessed in February 2025), European Commission: OP Berlin ERDF 2014-2020, https://ec.europa.eu/regional_policy/in-your-country/programmes/2014-2020/de/2014de16rfop003_en, EDGAR_GHG_NUTS2_v2.0. GHG emissions at subnational level, https://edgar.jrc.ec.europa.eu/dataset_ghg80_nuts2 (accessed in February 2025)

Data availability constraints usually make it impossible to use difference-in-differences or propensity score matching as they require a control group or policy shift, which are ruled out because of the broad coverage of the program and its continuous funding commitment. However, we acknowledge that there are some problems that may arise due to reverse causality, namely if GDP growth itself attracts more EU funds than the funding that drives economic growth.

Previous studies show that the benefits of infrastructure and development investments usually accumulate over time. To mitigate this issue, we have taken into account the lagged values of EU funding.

Furthermore, the only drawback is the small number of observations (only 9), which may limit the confidence in the results. However, building models based on a larger data set was not possible due to data availability constraints.

To perform the econometric analysis, we used the program *EViews 12*. The analysis covers the period 2015 – 2023, as although OP Berlin ERDF was initially designed for a seven-year period (2014-2020), its actual implementation extended until 2023, following the n+3 rule of the EU.

To analyze the impact of the program on the dependent variables, we used a linear regression model, expressed by the following equation:

$$Y = a + \beta X + \varepsilon \quad (1)$$

In this model, Y represents one of the dependent variables analyzed, as presented in the table above. The independent variable, X represents the European funds allocated through the Berlin ERDF OP. The constant term, a reflects the baseline level of the dependent variable in the absence of European funding, while calculating the extent to which these funds influence the dependent variable.

The error term, ε takes into account additional factors affecting the dependent variable that are not directly included in the model. Each dependent variable is analyzed individually to assess the impact that European funds have had on economic and environmental performance in Berlin.

The regression coefficients are estimated using the ordinary least squares (OLS) method, and for statistical validation of the model, the analysis also includes:

- R^2 , which indicates the proportion of the variability of the dependent variable explained by European funds. Its value ranges from 0 to 1, and the higher it is, the more statistically relevant the model becomes.
- The F-statistic, statistic represents the overall significance of the model.
- P-values for the regression coefficients, used to evaluate whether European funds have a significant effect on each analyzed indicator. These values should not exceed 0.05.

Furthermore, for the city of Berlin we calculated the Cultural and Creative Cities Index to evaluate its cultural and creative performance.

"Building on the success of the first (2017) and second (2019) editions, the Joint Research Centre of the European Commission published the third edition of the Cultural and Creative Cities Monitor in 2023. This analytical tool provides a harmonized database on cultural and creative indicators at the urban level, underscoring their significance in fostering economic growth and social well-being. Furthermore, it serves as a valuable resource for policymakers by enabling inter-city comparisons, the identification of competitive advantages, and the assessment of policy impacts through the integration of both qualitative and quantitative data.

The Cultural and Creative Cities Index (C3) is a comprehensive analytical instrument designed to assess the cultural and creative performance of 190 cities across 30 European countries. It is based on quantitative data drawn from 29 indicators, which are grouped into nine core dimensions. These dimensions are further aggregated into three overarching components, namely:

- cultural vibration;
- creative economy;
- and favorable environment.

Table 2 illustrates the three components of the Cultural and Creative Cities Index (C3)

Table 2: Cultural and Creative Cities Index (C3) components

C3 Index – Cultural and Creative Cities Index								
1. Cultural Vibrancy		2.Creative Economy			3. Enabling Environment			
D1.1 Cultural Venues & Facilities	D1.2 Cultural Participation & Attractiveness	D2.1 Creative & Knowledge-based Jobs	D2.2 Intellectual Property & Innovation	2.3 New Jobs in creative Sectors	D3.1 Human Capital & Education	D3.2 Openness, Tolerance & Trust	D3.3 Local & International Connections	D3.4 Quality of Governance

Source: designed by authors based on the information from the “*Cultural and Creative Cities Monitor*”, 2023

To provide a meaningful interpretation and facilitate the comparison of similar cities, they have been grouped into five clusters based on population size, as shown in Table 2. This classification enables relevant analyses by allowing the evaluation of cities with similar characteristics. For a more detailed analysis, the 190 cities were divided into different clusters, regarding the number of inhabitants, as illustrated in table 3:

Table 3: Classification of cities according to the number of inhabitants

Cluster name	Population (inhabitants)
Cluster S	50 000 – 100 000
Cluster M	100 000 – 250 000
Cluster L	250 000 – 500 000
Cluster XL	500 000 – 1 000 000
Cluster XXL	> 1 000 000

Source: designed by authors based on the information from the “*Cultural and Creative Cities Monitor*”, 2023.

Results and discussions

Before performing the linear regression, we created scatter plots, as it is essential for the relationship between the dependent and independent variables to be approximately linear. These plots allowed us to identify the connection between the variables and detect potential statistical issues.

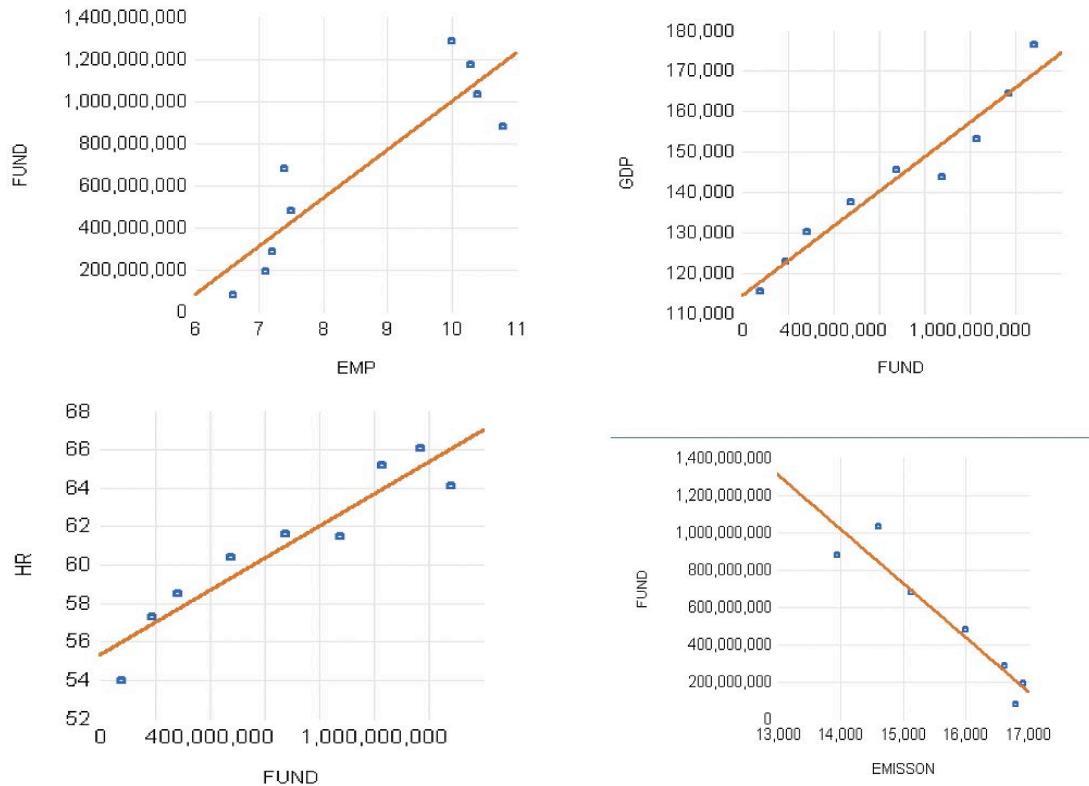


Figure 1. Scatter plots for each variable

Source: Authors' own data processing in Eviews 12.

As can be seen in Figure 1, the graphs suggest that linear regression is appropriate, as there is an almost linear relationship between the independent variable OP Berlin ERDF expenditure (referred to as fund in the graph) and the dependent variables: Human resources in science and technology (HR), GDP, and GHG emissions. In the case of employment in high-tech sectors (EMP), there are minor deviations, but overall, the regression line shows a good fit.

Furthermore, based on the graphs, OP Berlin ERDF expenditures have a strong positive relationship with Employment in high-tech sectors, Human resources in science and technology, and GDP, while it shows a negative relationship with GHG emissions.

Table 2 presents the simple linear regressions performed for the period 2015–2023 at the level of the Berlin city-region.

Table 2. Results of regression analysis

Gross domestic product (million PPS)	Regression statistics: $R^2 = 0.9427$; Adjusted $R^2 = 0.9345$; F-statistic= 115.175; Prob (F-statistic)= 0.00001; Durbin-Watson:1.2173			
Variables	Coefficient	Std. Error	T-Statistic	Prob.
C	114429.4	3169.009	36.10884	0.000
OP Berlin FEDRexpenditure	4.288	3.999	10.731	0.000

Emissions of total greenhouse gases	Regression statistics: $R^2= 0.8985$; Adjusted $R^2= 0.8782$; F-statistic= 44.2950; Prob (F-statistic) = 0.00115; Durbin-Watson:2.2398			
Variables	Coefficient	Std. Error	T-Statistic	Prob.
C	17326.79	286.2093	60.53886	0.000
OP Berlin FEDRexpenditure	-3.100	4.666	-6.655	0.001
Employment in high-tech sectors	Regression statistics: $R^2= 0.7996$; Adjusted $R^2= 0.7710$; F-statistic= 27.9469; Prob (F-statistic) = 0.00114; Durbin-Watson:2.0655			
Variables	Coefficient	Std. Error	T-Statistic	Prob.
C	6.2347	0.5233	11.9121	0.000
OP Berlin FEDRexpenditure	3.488	6.599	5.286	0.001
Human resources in science and technology	Regression statistics: $R^2= 0.8859$; Adjusted $R^2= 0.8696$; F-statistic= 54.3775; Prob (F-statistic) = 0.00015; Durbin-Watson: 1.7020			
Variables	Coefficient	Std. Error	T-Statistic	Prob.
C	55.3286	0.8986	61.5706	0.000
OP Berlin FEDRexpenditure	8.355	1.133	7.374	0.002

Source: Authors' own data processing in Eviews 12.

From a statistical perspective, the simple linear regression models are well-specified, with an R^2 value close to 1 and an Adjusted R^2 indicating that almost all variability is explained by the model. Moreover, all p-value coefficients are statistically significant, and the Durbin-Watson test value is close to 2, suggesting that there is no strong autocorrelation between errors.

According to statistical data, the funded programmes had the strongest impact on GDP, highlighting their indirect contribution to Berlin's economic growth through the funded projects. For example, Berlin has two ERDF-supported venture capital funds that invest in innovative companies in the fields of technology and creative industries for around three to seven years. This is one of the reasons why the city has become a hub for startups.

In addition, there is a strong correlation between the funds attracted and variables in terms of job creation in high-tech sectors, the impact being positive but more moderate compared to GDP growth and employment in science and technology. Regarding greenhouse gas emissions, there is a negative correlation, suggesting that the ERDF-supported programmes under the Berlin OP have contributed to a more sustainable economic model in the region.

Our findings are also supported by the European Commission reports, which indicate that the largest share of the OP Berlin ERDF budget was allocated to research, innovation and the low-carbon economy. One of the most important projects financed by the programme was the replacement of traditional lamps in the public areas of the Konzerthaus with modern LED lighting technology. This initiative brought both environmental and cultural benefits, successfully integrating culture and the creative industries into European initiatives.

The use of the ERDF to co-finance venture capital funds has also facilitated the mobilisation of additional funds, increasing the availability of venture capital for startups and contributing to the achievement of Berlin's innovation policy objectives.

Berlin is a lively and ever-evolving metropolis, widely recognized for its pivotal position as a cultural and artistic epicenter both in Europe and globally. The city harmoniously fuses its historical legacy with modern innovation and multiculturalism, standing out as a key location for visual arts, music, design, theater, and cinema. Its rich and varied cultural landscape offers a welcoming environment for creativity, experimentation, and emerging artistic forms.

The figure below shows how the C3 indicator and its components have evolved across the three dimensions in each of the three editions of the Cultural and Creative Cities Monitor.

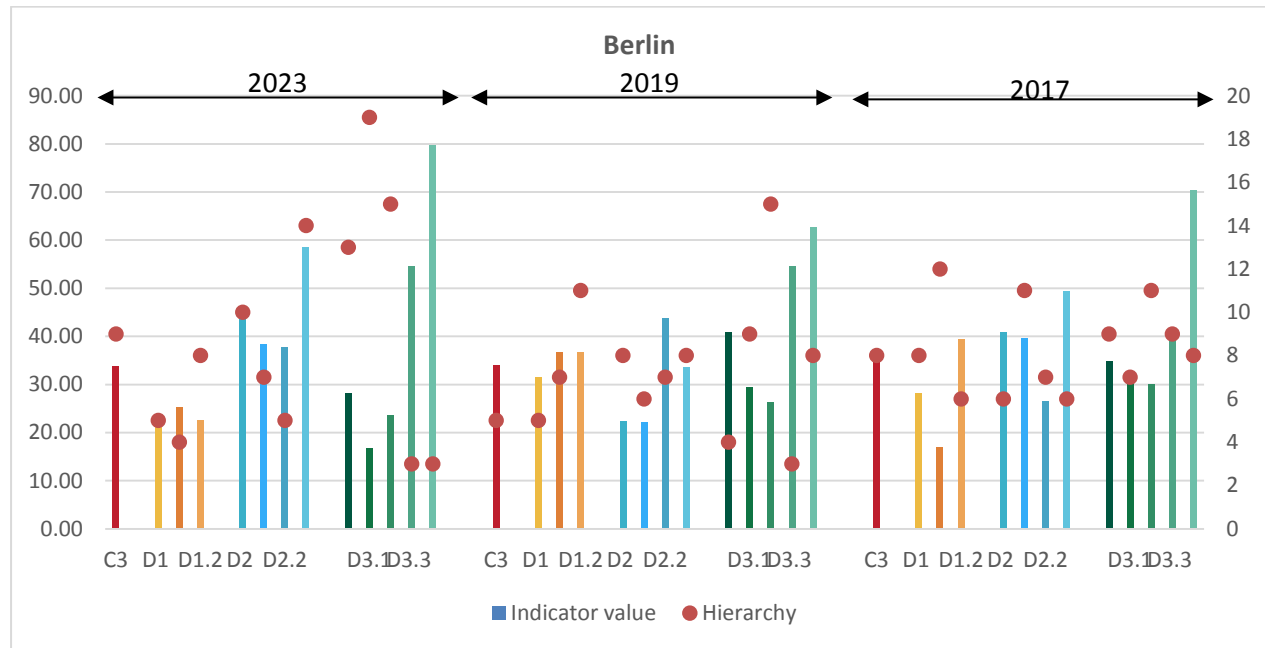


Figure 2. Scatter Plots for each variable

Source: Data collection based on the three editions of the Cultural and Creative Cities Monitor.

From the perspective of the C3 index, a slight decrease in value is observed, leading to a drop from 8th place to 9th place within the XXL cluster. Regarding the component dimensions, in the Cultural Vibrancy dimension, a decrease in value is noted; however, in terms of ranking within the cluster, Berlin saw a slight improvement, moving from 8th place to 5th place. As for the Creative Economy dimension, despite an increase in value from 40.81 to 46.30, the city experienced a hierarchical drop, moving from 6th place to 8th place within the cluster. In the Enabling Environment dimension, Berlin saw a decline in its cluster ranking, dropping from 9th place to 13th place.

Conclusion

Over the years, EU funded projects increasingly become concerned with how such financial investment, such as from the European Regional Development Fund (ERDF), is being used to generate cultural economic growth and sustainability in cities with strong creative and cultural profiles. Berlin is a case in point, a paradigm of what the convergence of environmental policy and creative policy can bring about, to make things flourish all over again in the city.

The internal signals of the EU underline the importance of EU funds in the creation of green policy, innovation and social practice in the field of culture and creative industries. For all practical

reasons, it is pointed out that cities trying to achieve economic growth need to be taught how to grow sustainably and use an approach that doesn't hurt the environment.

Berlin's working example with its creative sector is of great value to other European cities that have similar challenges. It shows the potential of the creative industry to drive deep social and environmental change. This investigation argues convincingly about the relationships between creativity, green changes, and the transformations of cities which justify that active investment into these areas would serve as a powerful driver for both economic and environmental growth. Applying a creative problem-solving approach, such research has the potential to be of immense benefit to creative industries that wish to situate their practice within wider sustainability objectives, not least at a time when Europe's cities are experiencing contemporary challenges.

The research presents the question of how the financing of the EU can support similar initiatives in other disciplines or in other regions and it opens possibilities to transport the successful ones in Berlin to other cities.

Nevertheless, there are limitations in this study. The main problem with the Berlin case study is that it is context specific only. What works in Berlin may not work elsewhere when the situation, the players, the cultural dynamics or the policy objectives are radically different.

Future research could extend this to cross-city comparison between several different EU regions, highlighting the effect (or not) of EU grant money and looking at more widely how urban sustainability works in differing environments. Furthermore, the research approach of prioritizing quantitative examination through linear regression models may have over-simplified too much intercorrelation between an individual society's creative and ecological policies. Qualitative data from individuals who are engaged in projects such as policymakers, citizens, or stakeholders, would offer a better overview of the challenges, success stories, and context of EU-funded art projects.

Finally, the time frame of the current research is confined to a specific historical period, the era of the ERDF Operational Programme (2014–2020), that limits the analysis of perhaps more contemporary alterations of the European funding instruments or changing policy priorities.

As the EU's funding programs are being continuously updated, there remains much for future research to explain to what degree newer structures of funding are reflective of urban sustainability and innovation outcomes in the future.

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