Cultural and Creative Employment across Italian Regions

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Article

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Abstract: in the following article I analyze the trend of cultural and creative employment in the Italian regions between 2004 and 2022 through the use of ISTAT-BES data. After presenting a static analysis, I also present the results of the clustering analysis aimed at identifying groupings between Italian regions. Subsequently, an econometric model is proposed for estimating the value of cultural and creative employment in the Italian regions. Finally, I compare various machine learning models for predicting the value of cultural and creative employment. The results are critically discussed through an economic policy analysis.

Keywords: Innovation; Innovation and Invention; Management of Technological Innovation and R&D; Technological Change; Intellectual Property and Intellectual Capital

JEL CODE: O3; O31; O32; O33; O34

1. Introduction

Cultural and creative industries significantly contribute to economic growth, innovation, and social cohesion and also employment. The distribution of cultural and creative employment across regions within a country often exhibits significant variation. In Italy understanding this distribution is pivotal for informing policy decisions, fostering inclusive growth, and tackling regional disparities. However, disparities in cultural and creative employment are often stark between regions. Factors such as historical legacies, infrastructural investments, educational resources, and policy frameworks significantly influence these variations. Northern regions, with their stronger economic bases, boast higher concentrations of cultural and creative employment compared to southern regions, where infrastructure and investment may be lacking. By investigating the distribution of cultural and creative employment across Italian regions, this article aims to elucidate the underlying drivers of these disparities. Understanding these factors is essential for devising targeted interventions that can mitigate regional imbalances, foster inclusive growth, and harness the full potential of Italy's cultural and creative sectors. Moreover, exploring the implications of these disparities for regional development and social equity is paramount. Cultural and creative employment not only generates income but also contributes to community cohesion and well-being. Regions with thriving cultural scenes often experience higher levels of social capital and quality of life. Addressing disparities in cultural and creative employment is therefore not just an economic imperative but also a social and cultural one. In conclusion, investigating the distribution of cultural and creative employment across Italian regions is essential for understanding the nuances of regional development and fostering inclusive growth. By identifying the factors driving these disparities and exploring their implications for social equity, policymakers can develop targeted strategies to support the cultural and creative industries and promote more balanced and resilient regional economies.

The article continues as follows: the second section presents a literature review, the third section shows data about the distribution of cultural and creative employment across Italian regions, the

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fourth section shows different methodologies of clusterization, the fifth section present the econometric model, the sixth section contains the prediction obtained with machine learning algorithms, the seventh section shows the policy implications, the eight section concludes.

2. Literature Review

In exploring the intersection of cultural and creative industries with innovation, knowledge management, and social engagement, a selection of scholarly works provides critical insights into contemporary challenges and strategies within these sectors. Santoro, Bresciani, and Papa (2020) delve into how collaboration with cultural and creative industries can enhance innovation performance, emphasizing the significant role of diverse knowledge sources and the capacity for knowledge absorption. This study underscores the importance of strategic collaborations and the effective integration of external knowledge in driving innovation within the cultural and creative sectors. Alacovska (2020) shifts the focus to the ethical dimensions of creative work, proposing a framework that views creative endeavors as forms of socially engaged art marked by compassion and care. This perspective challenges the conventional valorization of passion in creative work by advocating for a more inclusive and empathetic approach to understanding the social impact of creative industries. Building on the theme of care in creative work, Alacovska and Bissonnette (2021) address the precarity of contingent labor in the creative industries, arguing for an ethics of care approach that recognizes and values the vulnerabilities and dependencies inherent in creative work.This contribution is vital in framing discussions around the sustainability and ethical dimensions of employment in creative fields. Bacchini et al. (2021) explore the evolution of Italy's framework for measuring well-being, providing a crucial context for understanding how cultural and creative sectors contribute to broader societal well-being and quality of life. This research highlights the importance of integrating cultural and creative industries into national well-being indicators, recognizing their contribution beyond economic metrics. Lastly, Bandinelli (2020) examines how neoliberal dynamics within culture industries shape the production of subjectivity, particularly through the lens of coworking spaces as sites of neoliberal labor practices. This analysis adds a critical dimension to understanding the socio-economic forces at play in shaping the experiences and identities of workers within the cultural and creative sectors.

Bandinelli (2020) delves into the intricacies of subjectivity production within neoliberal culture industries, with a focus on coworking spaces. Cerquetti (2023) highlights the imperative of skill-building in the digital era for cultural and creative sectors, examining current needs, trends, and challenges. Chang and Hung (2021) contribute insights into the tourist experience within cultural and creative industries parks, developing a scale to measure visitor engagement. Comunian and England (2020) shed light on the exposed precarity within the creative economy exacerbated by the COVID-19 pandemic. Conticelli et al. (2020) investigate the adaptation of the "Creative City" approach from urban to rural contexts, probing the dynamics of cultural development in non-urban settings. Finally, Duffy et al. (2021) delve into the complexities of creative labor on social media platforms, uncovering the nested precarities faced by individuals navigating digital spaces.

Eikhof's (2020) exploration of the impact of the COVID-19 pandemic on workforce diversity and inclusion within the cultural economy provides crucial insights into addressing challenges stemming from external crises. Giovinazzi et al.'s (2021) focus on assessing earthquake impacts on historic areas and monitoring their resilience through GIS tools highlights the intersection of technology and heritage preservation. Goya's (2022) examination of Marshallian and Jacobian externalities within creative industries sheds light on the complex interplay of knowledge spillovers and innovation in shaping economic development. Gustafsson and Lazzaro's (2021) investigation into the innovative responses of cultural and creative industries to societal challenges underscores their role in fostering sustainability and social inclusion. Lastly, Kovalenko's (2022) master's thesis delves into the influence of institutional work on shaping the boundaries and practices within the creative economy, offering valuable insights into the dynamics of institutional change in a specific geographical context.

Leogrande's works delve into the spatial dynamics of knowledge workers and patenting activities across different Italian regions, shedding light on regional disparities in innovation capacity

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and economic development. Lomm's doctoral dissertation explores the professional identity formation of international alumni, emphasizing the role of digital and creative environments in fostering connectivity and career trajectories. Luckman's article delves into questions of inclusion and recognition within the craft sector, interrogating whose contributions are valued and acknowledged, thereby contributing to discussions on diversity and equity within creative industries. Mackenzie and McKinlay's study on "hope labor" in cultural work delves into the emotional and aspirational investments individuals make in pursuit of uncertain career opportunities, highlighting the psychological dimensions of work and the need for strategies to promote well-being and resilience in the creative sector.

These references collectively contribute to a nuanced understanding of the intricate interplay. Martínez Rodríguez's (2023) exploration of cultural indicators sheds light on how culture influences human well-being and sustainable development, offering insights crucial for policymaking. McCutcheon and Cunningham (2023) provide valuable insights into Australia's creative economy, drawing from Census 2021 data to analyze its economic significance and regional variations. Mecocci, Maghssudipour, and Bellandi's (2022) study on the relationship between cultural and creative production and human capital development in European regions underscores the importance of investments in these sectors for fostering innovation and economic growth. Mešková et al.'s exploration of creative potential in cities and its exploitation for sustainable development likely offers strategies for leveraging cultural and creative assets in urban planning and regeneration initiatives. Lastly, Phillipov, Luckman, and Loyer's (2023) analysis of media discourses surrounding artisanal food and craft in Australia provides insights into consumer perceptions and market dynamics, highlighting the social significance attributed to artisanal practices. Together, these studies offer a comprehensive framework for understanding and harnessing the potential of culture and creativity in driving sustainable development and economic prosperity.

The referenced works cover a diverse range of topics within the cultural and creative industries. Pilege (2023) proposes a Career Guidance Model tailored for the digital transformation within these sectors, addressing the evolving landscape and skills required. Raevskikh, Pinto, and Baeker (2021) contribute to understanding cultural activities in Abu Dhabi, offering a foundational report that likely informs policy and development initiatives. Richards and Pacella (2022) explore the resilience of creativity within the film festival sector amidst the challenges posed by the COVID-19 pandemic, shedding light on adaptation strategies and the sector's determination to persist. Sharma et al. (2021) delve into sustainability and innovation dynamics within organizations, emphasizing the importance of green culture and its impact on employee commitment and performance. Siciliano (2020) provides a critical perspective on work dynamics within the culture industries, highlighting the complexities of creative control and labor ambivalence.

Snowball, Tarentaal, and Sapsed (2022) delve into the intersection of innovation and diversity within digital cultural and creative industries, shedding light on evolving dynamics in these sectors. Song et al. (2021) examine the multifaceted impacts of spatial planning, well-being, and behavioral shifts catalyzed by the COVID-19 pandemic, emphasizing the need for sustainable approaches in urban development. Stoffberg (2023) focuses on empowering Cape Flats youth to navigate environmental challenges by harnessing their personal potential, offering insights into community resilience strategies. Teixeira and Silva-Domínguez (2020) contribute a comparative study of internships in creative and cultural industries management master programs in Spain and Portugal, providing valuable insights into educational practices fostering industry readiness and professional development.

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3. Rankings and Regional Inequalities

Istat calculates the level of cultural and creative employment. The variable is defined as the percentage of employed in professions or sectors of cultural activity and creatives (Isco-08, Nace rev.2) on the total employed (15 years and older).

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Trend of cultural and creative employment in the Italian regions in 2022. The data presented offers an interesting overview of the percentages of employment in the cultural and creative sector in the different Italian regions for the year 2022. The analysis of this data can reveal different aspects of the cultural and creative economy in Italy, as well as the geographical distribution of job opportunities in this sector. The first observation to consider is the geographic variation in cultural and creative employment. Lazio, with Rome at its centre, shows the highest percentage (4.8%), which is understandable considering the richness of the region's historical, cultural and artistic heritage, as well as the presence of numerous cultural institutions, film industries and theaters . This suggests that regions with strong tourist and historical attractions tend to have a higher percentage of employment in this sector. There is also a certain gap between the north and south of the country, with regions such as Lombardy, Tuscany and Veneto having relatively high percentages, while southern regions such as Calabria, Sardinia and Molise have the lowest percentages. This may reflect differences in investment in cultural and creative sectors, as well as tourism infrastructure and education. Regions with a strong tourist and historical appeal tend to show higher percentages. This is evident in regions such as Tuscany, famous for its cities of art and its Renaissance heritage, and Lazio. Tourism can therefore be an important driver of employment in the cultural and creative sector. Differences may also reflect regional policies on culture and creativity. Some regions may have more aggressive or better-funded strategies to promote cultural and creative industries, resulting in a higher share of employment in these sectors. The southern regions present challenges but also potential opportunities for the development of the cultural and creative sector. Investing in these areas could not only increase employment but also help preserve and enhance the rich cultural heritage of the South. For regions with lower percentages, a greater focus on the development of cultural and creative policies could represent a strategic lever for economic growth and employment, as well as contributing to economic diversification (Figure 1).

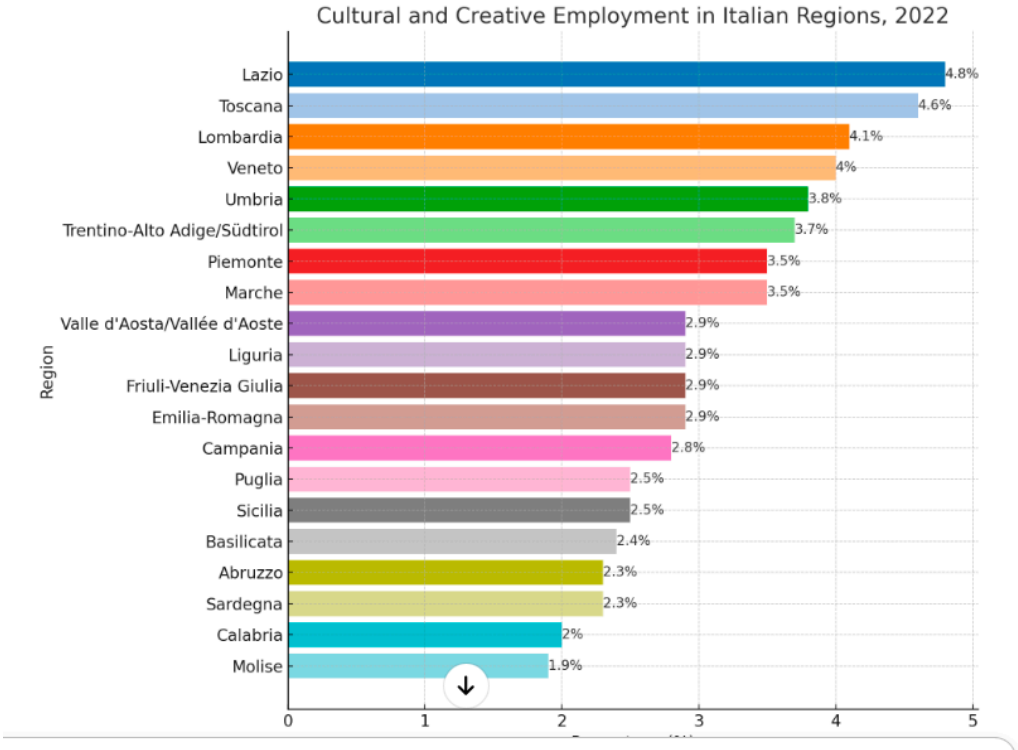

Figure 1. Cultural and creative employment across italian regions in 2022.

Trend of cultural and creative employment between 2018 and 2022. The analysis of data relating to cultural and creative employment in the Italian regions between 2018 and 2022 shows the trend of differentiated dynamics for the various areas of the country. Both positive and negative changes in

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employment can be observed, which are expressed in absolute and percentage terms. Tuscany shows the highest percentage growth (+15%) in cultural and creative employment among all regions, rising from 4% in 2018 to 4.6% in 2022. This could indicate robust development and investment in the cultural and creative sector in this region. On the contrary, Molise recorded the most significant percentage decrease (-45.7%), with a drop in employment from 3.5% to 1.9%. This could suggest economic difficulties in the sector or a redirection of regional policies and investments. Most regions experienced an increase in cultural and creative employment, albeit with relatively modest percentage changes. Despite overall economic challenges that may impact the sector, there is continued interest and resilience in cultural and creative employment. Regions such as Piedmont, Emilia-Romagna and Lombardy show both an absolute and percentage decrease in employment, contrary to the general growth trend in many other regions. In particular, Piedmont and Emilia-Romagna recorded the highest percentage drops after Molise, of -16.7% and -19.4% respectively. There are specific regional factors that negatively impact the cultural and creative sector in these areas. Lazio, despite being one of the regions with the highest percentage of cultural and creative employment, shows a modest increase of +2.1%. The wide variation between regions highlights the importance of local context in determining the health of the cultural and creative sector. Factors such as regional policies, investment in culture and creativity, tourism and the general economy can have significant impacts. While some regions show signs of growth and resilience, others face significant challenges that require attention and intervention to reverse negative trends (Figure 2).

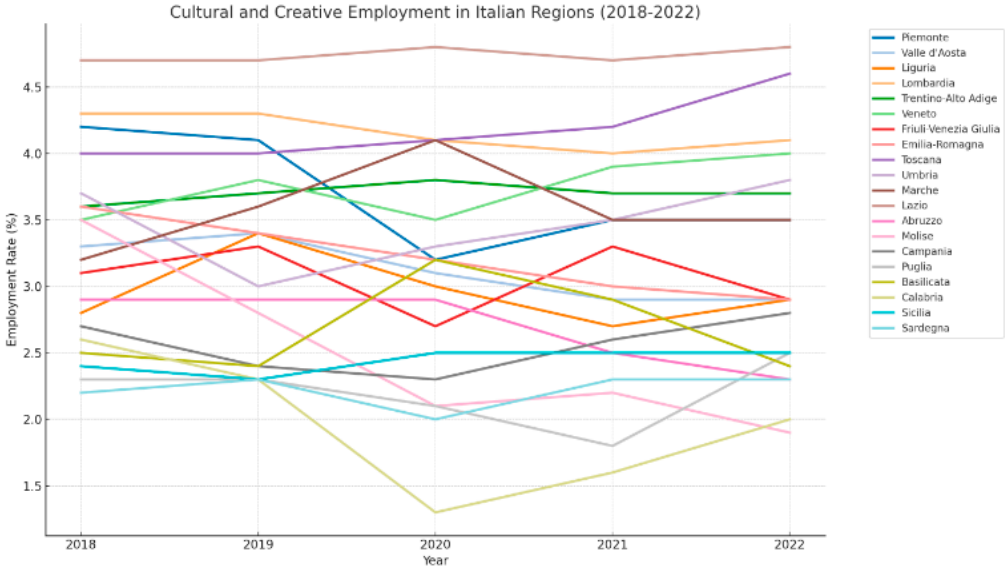

Figure 2. Cultural and Creative Employment in Italian Regions during the period 2018-2022.

Cultural and creative employment in Italian macro-regions. The analysis of data on cultural and creative employment in Italian macro-regions between 2018 and 2022 offers an overview of the sector's performance on a larger scale than detailed regional analysis. The Central macro-region shows significant growth both in absolute terms (+0.30) and percentages (+7.14%), indicating a strengthening of the cultural and creative sector. This could reflect favourable investments and policies in this area, which includes regions with rich cultural and artistic traditions, such as Tuscany and Lazio. The North, both overall and divided into North-West and North-East, records a decrease in employment in the cultural and creative sector. In particular, the North West highlights the greatest decline both in absolute terms (-0.30) and percentages (-7.32%), suggesting that this area may have been more affected by adverse factors that have negatively influenced the sector . The Southern macro-region shows stability (0.00 percentage change) despite the general economic challenges that often characterize these regions. This could indicate a resilience of the cultural and creative sector or

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the effectiveness of specific support measures. The South, excluding the aggregate data of the South, shows a slight decrease both absolute (-0.10) and percentage (-3.85%). This decline, while modest, potentially reflects the ongoing challenges in promoting and supporting the cultural and creative sector in these regions. The Islands (Sicily and Sardinia) recorded an increase (+0.10 absolute change, +4.35% percentage change), indicating an improvement in the cultural and creative sector. This can be seen as a positive signal for cultural tourism and the valorization of local heritage. The trend of cultural and creative employment in the Italian macro-regions underlines the importance of targeted policies and investments at local and regional level. Disparities between different macro-regions suggest that factors such as cultural policy, tourism, and infrastructure play crucial roles in determining the growth or decline of the sector. In conclusion, while some areas of Italy are experiencing growth in the cultural and creative sector, others face significant challenges (Figure 3).

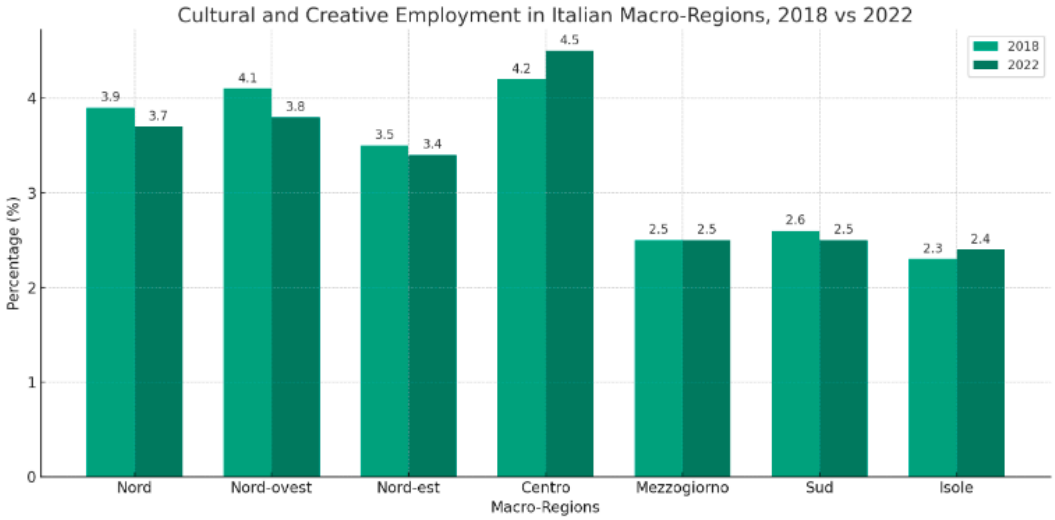

Figure 3. Cultural and Creative Employment in Italian Macro-Regions 2018 vs 2022.

Gap between North and South in terms of cultural and creative employment. The analysis of data relating to cultural and creative employment by region in Italy between 2018 and 2022 can provide indications on the existence of a North-South gap. Southern regions such as Abruzzo, Molise, and Calabria show some of the highest negative percentage changes. In particular, Molise records a drastic decrease of -45.7%, while Abruzzo and Calabria see reductions of -20.7% and -23.1%, respectively. Some regions of the Center and North, such as Tuscany, Veneto, and Trentino-Alto Adige, show significant increases, both in terms of absolute and percentage change. Tuscany and Veneto, for example, record increases in cultural and creative employment of 15% and 14.3%, respectively. While some Northern regions show growth, others, such as Emilia-Romagna and Piedmont, experience significant declines, of -19.4% and -16.7% respectively. This indicates that, despite a positive general trend, there are important exceptions that suggest a more complex situation. It is important to note that starting levels of cultural and creative employment vary considerably between regions. Lazio, for example, starts from a base of 4.7% in 2018, while regions such as Basilicata and Calabria start from lower levels, 2.5% and 2.6% respectively. This can influence the perception of percentage changes, since a similar percentage change has a different impact depending on the starting level. The data indicates that, although some regions in the North experience declines in cultural and creative employment, in general the Centre-North shows a trend towards growth or stability, while the South presents a more varied situation, with some regions in significant decline. This could support the existence of a North-South divide in the cultural and creative sector, especially when considering percentage changes and general trends. In conclusion, while exceptions exist and the situation is complex, the data tends to indicate a gap between the North and the South of Italy in terms of cultural and creative employment, with the South showing a greater propensity for significant negative variations. However, for a complete assessment it would

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be useful to also consider other factors, such as government support, investment in the cultural sector and specific regional policies, which can influence these dynamics (Figure 4).

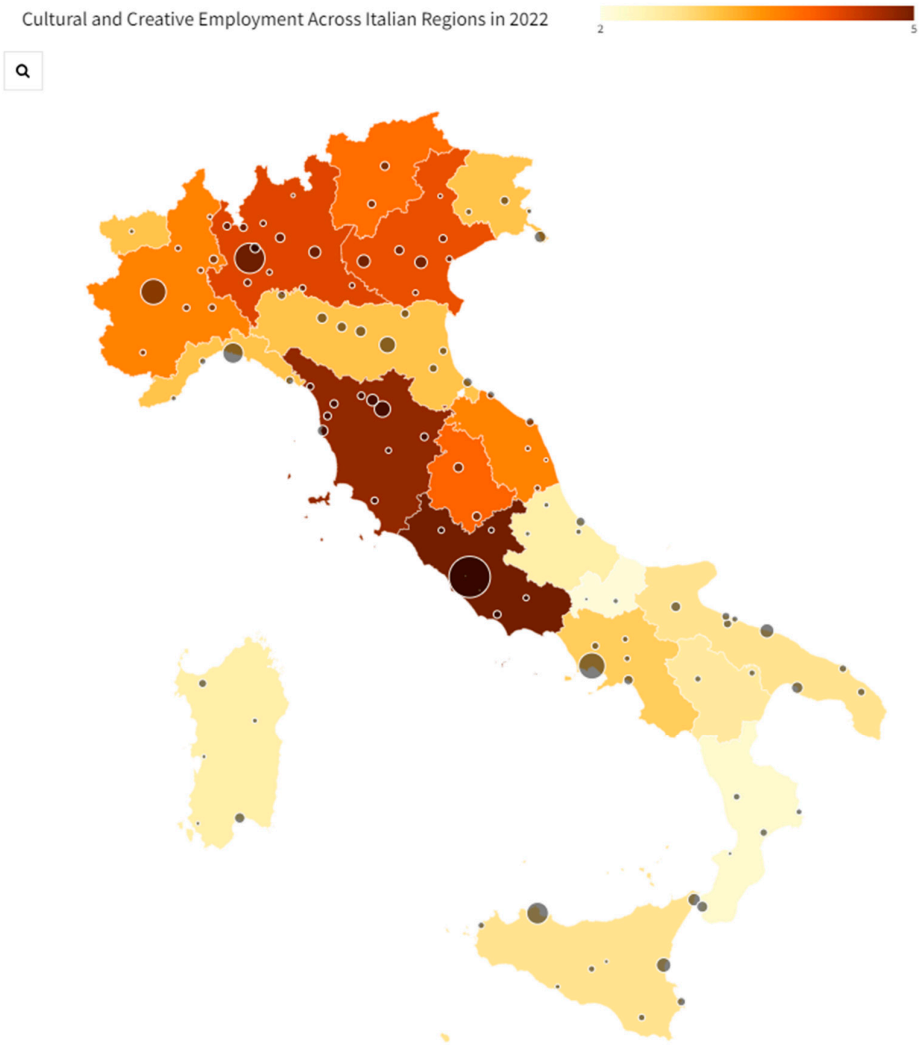

Figure 4. Level of cultural and creative employment in the Italian regions. The map highlights a contrast between the central-Northern regions with high levels of cultural and creative employment and the Southern regions with reduced values of the variable.

The level of cultural and creative employment in the Italian regions has decreased by an average of 4.3% between 2018 and 2022. Regions that experienced a significant reduction include Valle d'Aosta with -12.10%, Piedmont with -16.7%, Emilia Romagna with -19.4%, Abruzzo with -20.7%, Calabria with -23.10%, and Molise with -45.7%. On the other hand, regions that saw a significant increase in the value of cultural and creative employment between 2018 and 2022 are Tuscany with +15.0%, Veneto with +14.30%, Marche with +9.4%, and Puglia with +8.7%. Considering the macro-areas, this value has only grown in Central Italy with +7.14% and in the Islands with +4.35%. Conversely, there have been reductions in the North-East with -2.86%, in the South with -3.85%, in the North with -5.135, and in the North-West with -7.32%. There exists a significant gap between Northern and Southern Italy that can only be bridged with adequate economic policies. Effective strategies should embrace targeted investments in cultural infrastructures, facilitate access to tax incentives to stimulate private investments, and promote educational programs that enhance creative

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skills. It is also crucial to support the digitization of the sector to expand its reach and accessibility, encourage research and innovation to explore new forms of cultural expression, and build collaborative networks that unite various stakeholders in the field. Policies should also include powerful marketing strategies to promote Italian culture globally, ensuring at the same time that these efforts are sustainable and inclusive, making culture accessible to everyone. Finally, an evaluation and monitoring system would allow for measuring the effectiveness of the implemented policies, ensuring a continuous optimization of strategies to support and promote the cultural and creative sector in the Italian regions. Such economic policies would not only valorise the country's cultural and creative heritage but would also contribute to economic growth, innovation, and social well-being at both regional and national levels.

4. Clusterization

In the following part we present a series of clusterings with the aim of identifying the number of clusters that can best represent the analyzed dataset. At the end of the paragraph we will show how for socio-economic and cultural reasons it is preferable to choose a certain value of K rather than another.

K-Means clusterization with Silhouette Coefficient. The optimized clustering with K-Means, using the Silhouette Coefficient to determine the optimal number of clusters. The Silhouette Coefficients for K=2 to K=10 are as follows:

- K=2: Silhouette Coefficient = 0.4966
- K=3: Silhouette Coefficient = 0.4010
- K=4: Silhouette Coefficient = 0.3488
- K=5: Silhouette Coefficient = 0.3129
- K=6: Silhouette Coefficient = 0.2895
- K=7: Silhouette Coefficient = 0.2915
- K=8: Silhouette Coefficient = 0.2791
- K=9: Silhouette Coefficient = 0.2722
- K=10: Silhouette Coefficient = 0.2616

The optimized clustering using the K-Means algorithm, with the determination of the optimal number of clusters through the Silhouette Coefficient, indeed suggests that a bifurcation into 2 clusters provides the most coherent grouping for the dataset concerning cultural and creative employment across Italian regions. A Silhouette Coefficient of 0.4966 for K=2 is relatively high, indicating that the data points within each cluster are closer to each other than to those in different clusters. This level of cohesion and separation is desirable in clustering exercises, as it implies clear distinctions between groups. The composition of these clusters reveals significant insights into the regional dynamics of cultural and creative employment in Italy:

- Cluster 1 (Higher Employment Metrics): comprising Piemonte, Lombardia, Trentino-Alto Adige, Veneto, Toscana, Umbria, Marche, and Lazio, this cluster can be interpreted as representing regions with stronger metrics in cultural and creative employment. These regions are traditionally recognized for their rich cultural heritage, significant tourist influx, and robust creative industries. Lombardia and Lazio, for example, are economic powerhouses of Italy, hosting major cities like Milan and Rome, which are centers for fashion, cinema, and art. The presence of Veneto and Toscana, known for their historic significance and contribution to Italy's cultural and creative sectors, further corroborates the cluster's characterization.
- Cluster 0 (Lower Employment Metrics): this cluster includes Valle d'Aosta, Liguria, Friuli-Venezia Giulia, Emilia-Romagna, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, and Sardegna. While some of these regions also boast considerable cultural heritage, the clustering suggests they might have lower metrics in cultural and creative employment relative to Cluster 1. This could be due to various factors, such as economic challenges, lesser tourist visibility compared to their Cluster 1 counterparts, or different economic focuses. Regions like

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Campania and Sicilia, despite their significant cultural assets, face economic disparities and infrastructural challenges that might affect their creative employment sectors.

The distinction between the clusters highlights not only the geographic and economic diversities of Italy but also the potential disparity in policy support, infrastructure, and investment in the cultural and creative sectors (Figure 5).

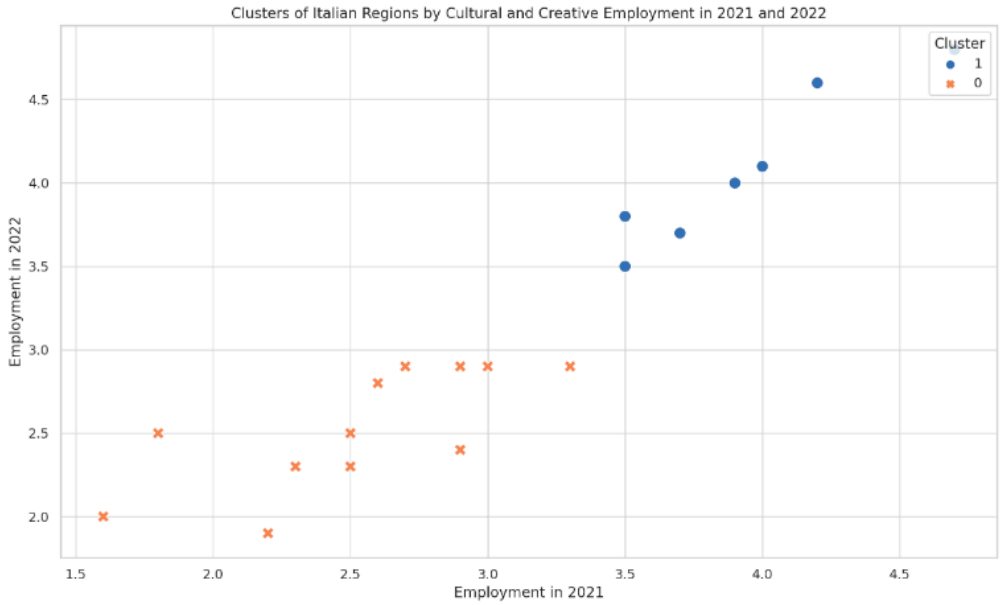

Figure 5. Clusterization with k-Means Algorithm optimized with the Silhouette Coefficient.

It underscores the importance of tailored policy interventions to bolster the creative industries across all regions, especially those in Cluster 0, to harness their full potential for economic development and cultural preservation. Furthermore, this analysis emphasizes the utility of data-driven approaches in policy formulation and resource allocation. By identifying regions with lower employment metrics in the cultural and creative sectors, policymakers can target interventions more effectively, such as investing in creative hubs, enhancing tourism strategies, and supporting local artisans and creators, thereby fostering economic growth and cultural enrichment across Italy.

K-Means clusterization optimized with the Elbow Method. The Elbow Method graph above shows the Within-Cluster Sum of Squares (WCSS) for different numbers of clusters ranging from 1 to 10. We're looking for the "Elbow" point where the rate of decrease in Within-Cluster Sum of Squares-WCSS sharply changes, indicating the optimal number of clusters. From the graph, the elbow point appears to be at 3 or 4 clusters. This suggests that the optimal number of clusters for our k-Means algorithm, given the data on Cultural and Creative Employment across Italian regions from 2018 to 2022, is around 3 or 4. Choosing between 3 and 4 depends on additional context and specific goals of the clustering. If we aim for a more generalized clustering, we might choose 3 to reduce complexity. If we believe a finer granularity could reveal more insights, 4 could be the better choice (Figure 6).

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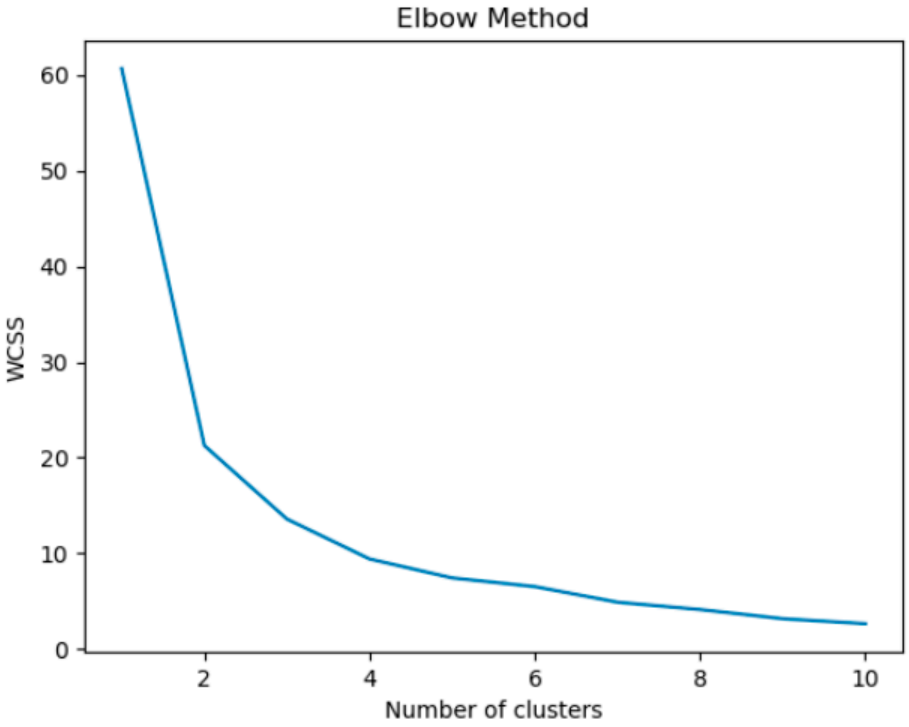

Figure 6. Elbow Method applied to k-Means algorithm.

Applying K-Means clustering with K=4 to the dataset on cultural and creative employment across Italian regions yielded the following clusters:

- Cluster 0: Valle d'Aosta, Liguria, Friuli-Venezia Giulia, Emilia-Romagna, Abruzzo, Basilicata. These regions might represent a group with certain similarities in their cultural and creative employment metrics, possibly mid-range values.
- Cluster 1: Piemonte, Trentino-Alto Adige, Veneto, Umbria, Marche. This cluster groups regions that may share higher metrics in cultural and creative employment compared to Cluster 0.
- Cluster 2: Molise, Campania, Puglia, Calabria, Sicilia, Sardegna. These regions could be characterized by lower metrics in cultural and creative employment, indicating a potential focus area for policy and development efforts to bolster the creative sector.
- Cluster 3: Lombardia, Toscana, Lazio. These regions are distinguished into their own cluster, likely due to their significantly higher metrics in cultural and creative employment. This cluster includes some of the most economically robust and culturally rich regions in Italy, suggesting a strong correlation between economic development and cultural employment opportunities.

This clustering at K=4 offers a nuanced view of Italy's regional disparities and strengths in cultural and creative employment, highlighting potential areas for targeted policy interventions and investments to foster balanced cultural growth and economic development across the country.

The clustering underscores the variability in how different Italian regions engage with and benefit from cultural and creative industries. It suggests a need for diversified policy approaches tailored to the unique strengths and challenges of each cluster. For regions in Clusters 0 and 2, policies might focus on building foundational support for cultural industries, improving access to funding, and enhancing local education and training in creative skills. In Cluster 1, the focus could be on leveraging existing cultural assets to drive broader economic innovation and diversification, encouraging cross-sector collaboration. For Cluster 3, policies might aim at sustaining leadership in the creative industries through advanced research, global networking, and cutting-edge infrastructure investments. This analysis, therefore, not only highlights the cultural and economic diversity across Italian regions but also offers a strategic blueprint for fostering equitable growth in

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Italy's cultural and creative sectors. By recognizing the specific needs and strengths of each cluster, policymakers can craft more effective strategies to enhance Italy's cultural heritage and creative economy.

Mean Shift Clustering. The clusters generated by the Mean Shift clustering algorithm reveal insightful patterns in the distribution of cultural and creative employment across Italian regions, suggesting both geographical and economic factors at play. This argument can be supported by analyzing the composition of the clusters, the characteristics of the regions within each cluster, and the broader implications for Italy's cultural and creative landscape.

- Cluster 0 (Label 0): This cluster groups regions with relatively lower percentages of cultural and creative employment, including Liguria, Abruzzo, Molise, Campania, Puglia, Basilicata, Calabria, Sicilia, and Sardegna. The commonality among these regions could be attributed to several factors. Geographically, many of these regions are located in the South of Italy or are island regions, areas that have historically faced economic challenges, including higher rates of unemployment and lower levels of industrialization compared to the North. This economic disparity could influence the lower presence of cultural and creative employment, as there may be less investment in these sectors and fewer opportunities for cultural and creative professionals.
- Cluster 1 (Label 1): Comprising regions with moderate percentages of cultural and creative employment, this cluster includes Piemonte, Valle d'Aosta, Trentino-Alto Adige, Veneto, Friuli-Venezia Giulia, Emilia-Romagna, Umbria, and Marche. Many of these regions are in the North or Central Italy and are known for their diverse economic bases, which include industry, agriculture, and tourism. The moderate levels of cultural and creative employment in these regions could reflect a balanced economic development, where cultural and creative sectors contribute significantly but are part of a wider economic context.
- Cluster 2 (Label 2): Containing regions with the highest percentages of cultural and creative employment, namely Lombardia, Toscana, and Lazio, this cluster highlights areas with a strong presence of cultural and creative sectors. These regions are not only economic powerhouses of Italy but also rich in cultural heritage and contemporary cultural production. Lombardia and Lazio, housing Milan and Rome respectively, are key financial, media, and cultural centers, offering numerous opportunities in cultural and creative fields. Toscana, with its world-renowned artistic heritage and vibrant contemporary culture, further exemplifies a region where the cultural and creative sectors are integral to the local economy and identity.

The clusters indicate a clear geographical pattern, with the higher percentages of cultural and creative employment concentrated in the Central and Northern regions, particularly in major urban centers. This distribution suggests that cultural and creative employment opportunities are closely linked with broader economic development, urbanization, and access to cultural infrastructure and investment (Figure 7).

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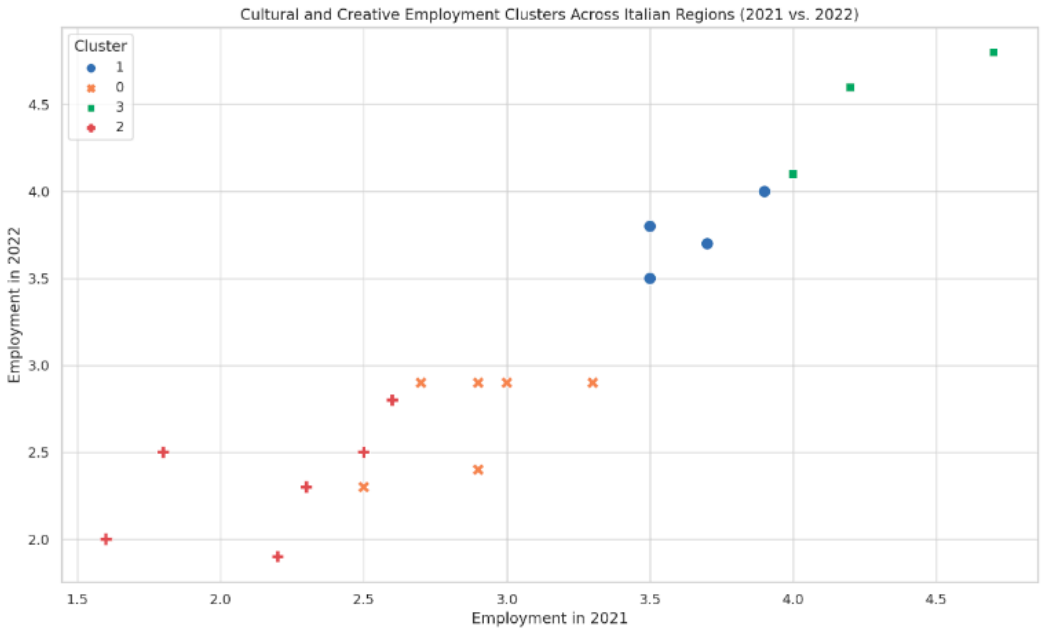

Figure 7. Clusterization with k-Means Algorithm optimized with the Elbow Method.

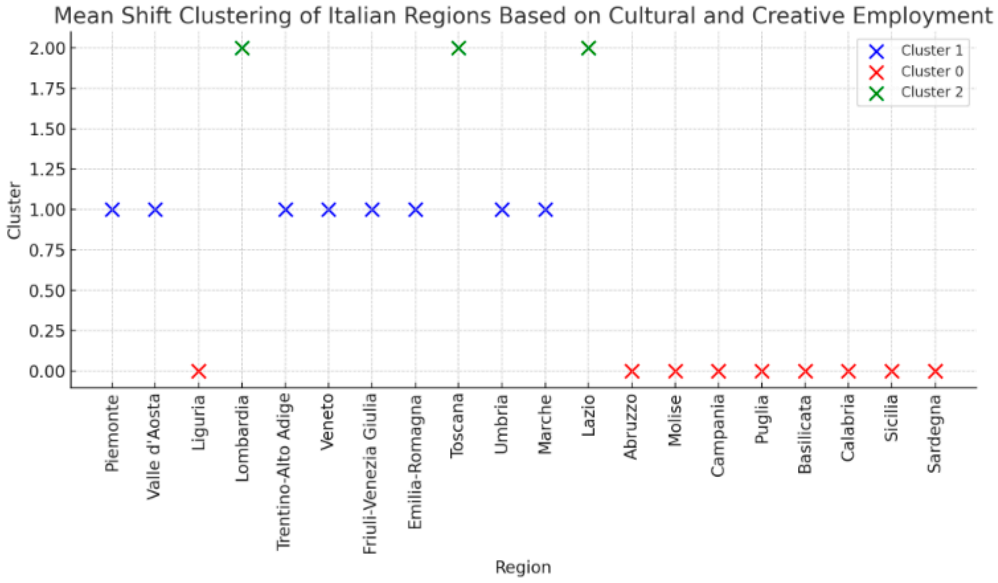

Figure 8. Mean Shift Clustering of Italian Regions Based on Cultural and Creative Employment.

Economically, the clusters underscore the role of the cultural and creative sectors as indicators of regional development and prosperity. Regions in Cluster 2, which have embraced and invested in these sectors, not only bolster their cultural prestige but also stimulate economic growth, innovation, and tourism. The Mean Shift clustering algorithm's output reflects the multifaceted relationship between geography, economy, and cultural and creative employment in Italy. It underscores the need for targeted policy interventions in regions lagging in cultural and creative employment, aimed at fostering economic diversification, cultural investment, and infrastructure development. For Italy as a whole, it highlights the cultural and creative sectors' potential as drivers of sustainable development, innovation, and social cohesion.

Choosing the most fitting method. Considering the various outputs that have been produced by the proposed clustering models we can note that the most efficient model, from my point of view,

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corresponds to mean shift clustering. In fact, through the application of mean shift clustering it is possible to obtain an optimized representation with k=3 which tends to represent a contrast between central-northern regions and southern regions, demonstrating the evident presence of a North-South gap in terms of cultural employment and creative.

5. Econometric Model

In the following analysis we estimated the impact of some variables connected to the technological innovation system on the value of creative and cultural employment in the Italian regions. I used Istat-BES data for the period 2004-2022 for the 20 Italian regions. The econometric models used are the following: Pooled OLS, Panel Data with Random Effects, Panel Data with Fixed Effects and WLS. The results of the econometric estimates can be consulted in the appendix. The following expression has been estimated (Table 1).

Table 1. Variables, Acronyms and Labels.

Variables, Acronym and Labels		
Variables of the Econometric Model	**Acronym**	**Label**
Cultural and creative employment	CCE	A101
Knowledge workers	KW	A100
Mobility of Italian graduates (25-39 years)	MIG	A102
Regular internet users	RIU	A105

$$\boldsymbol{CCE_{it} = \alpha + \beta_1 (KW)_{it} + \beta_2 (MIG)_{it} + \beta_3 (RIU)_{it}}$$

where i=20 and t=[2004;2022].

- *KW:* the positive relationship between cultural and creative employment and the proliferation of knowledge workers in Italian regions is a testament to how these sectors catalyze economic vitality and innovation. Cultural and creative sectors attract and nurture knowledge workers—individuals who thrive on innovation, creativity, and intellectual engagement—by providing environments that value and foster creative thinking. These sectors contribute to a vibrant cultural ecosystem, enhancing the attractiveness of regions as hubs for both living and working. In turn, knowledge workers, with their high skill levels and demand for stimulating, culturally rich environments, stimulate local economies through increased consumption and investment in cultural and creative activities. This synergy not only drives direct economic benefits through job creation in cultural and creative industries but also indirectly supports a broader innovation ecosystem. By fostering an environment that values creativity, diversity, and innovation, regions with strong cultural and creative employment offer fertile ground for knowledge workers to contribute to technological advancements and innovative solutions, further enhancing regional competitiveness and attractiveness.

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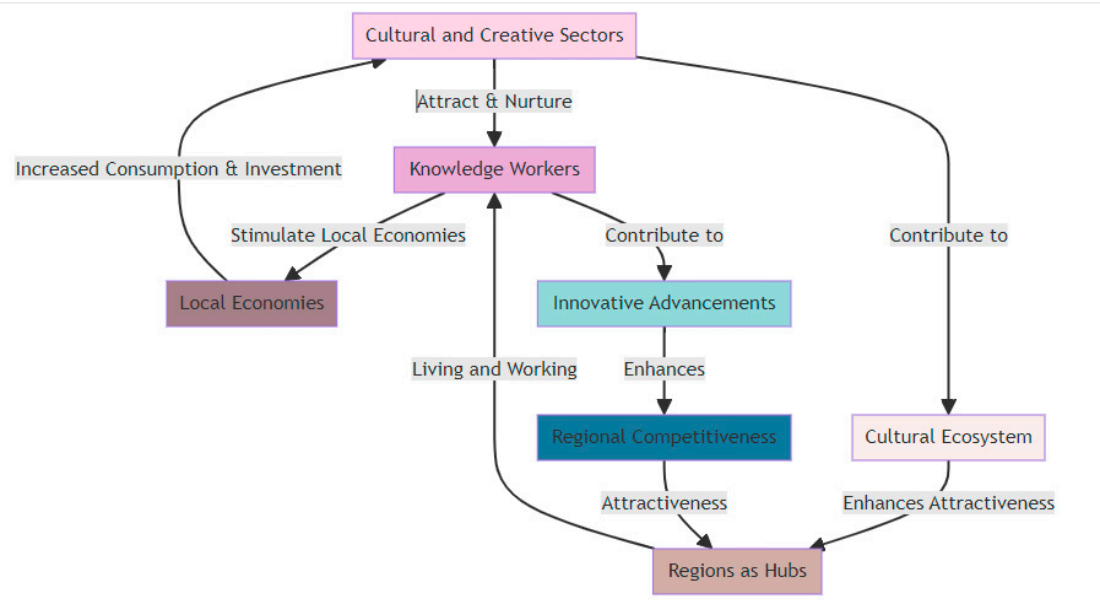

Figure 9. Conceptual Map of the positive relationship between CCE and KW.

- *MIG*: the positive relationship between cultural and creative employment and the mobility of Italian graduates aged 25-39 underscores a dynamic interplay that enhances both regional attractiveness and the national economy. In regions where cultural and creative industries flourish, there is a marked increase in the allure for young graduates, who are often in pursuit of not only employment opportunities but also a vibrant cultural life and creative work environments. This attraction is significant in Italy, a country renowned for its rich cultural heritage and burgeoning creative sectors, which range from fashion and design to film and technology. Graduates in these age groups, often at the beginning of their careers, are particularly drawn to cities and regions that offer a mix of professional opportunities in these industries and a high quality of life, facilitated by access to cultural events, artistic communities, and creative networks. Moreover, the presence of these graduates in turn fuels the growth and diversification of the cultural and creative sectors, creating a virtuous cycle: as more talented individuals move to these regions, their skills and innovation contribute to the expansion and dynamism of the creative economy, which in turn attracts more graduates. This mobility not only supports the growth of cultural and creative employment but also contributes to the broader economic and social fabric of the regions, fostering innovation, enhancing cultural diversity, and stimulating local economies. Therefore, the relationship between cultural and creative employment and the mobility of young Italian graduates is a critical factor in regional development strategies, emphasizing the importance of investing in the creative economy as a means to retain and attract young, highly educated talent, which is essential for sustaining Italy's global competitiveness and cultural vibrancy.

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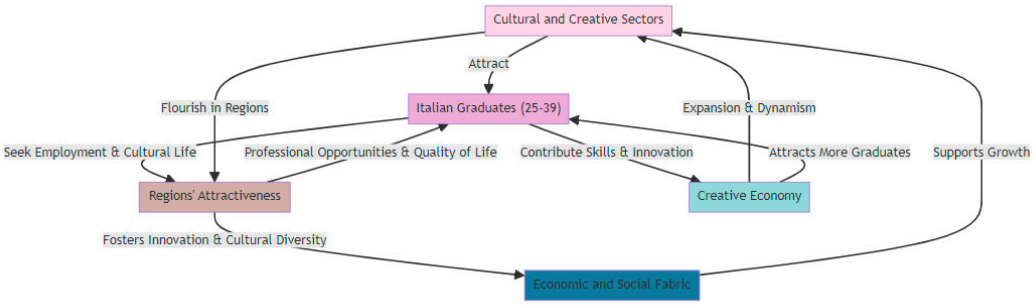

Figure 10. Conceptual Map of the positive relationship between CCE and MIG.

- *RIU:* the positive relationship between cultural and creative employment and the prevalence of regular internet users across Italian regions highlights the transformative role of digital connectivity in the cultural and creative landscapes. In an era where digital platforms have become central to the dissemination and consumption of cultural and creative content, regions with higher rates of regular internet users are likely to experience a corresponding boost in cultural and creative employment opportunities. This synergy is particularly evident in Italy, where the digital transformation of the cultural sector has opened new avenues for employment, from digital marketing for cultural events to online curation and content creation. Regular internet users, by engaging with cultural and creative content, not only contribute to the demand for such content but also participate in its distribution and promotion, thus supporting the ecosystem that sustains cultural employment. Moreover, the internet facilitates the global reach of local cultural and creative products, enhancing the potential for Italian regions to showcase their cultural heritage and contemporary creativity on an international stage. This dynamic not only benefits the cultural and creative sectors directly but also contributes to a broader cultural vibrancy and economic vitality within regions, underscoring the importance of digital literacy and infrastructure as pivotal to sustaining and expanding cultural and creative employment. Thus, the relationship between cultural and creative employment and regular internet usage in Italian regions is a testament to the critical role of digital engagement in supporting and amplifying the cultural economy, creating a mutually reinforcing loop that benefits both the creators and the consumers of cultural content.

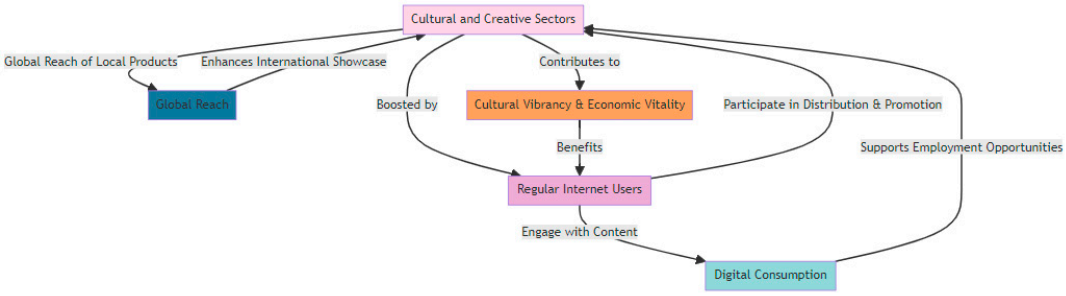

Figure 11. The positive relationship between CCE and RIU. .

6. Machine Learning for Prediction

After applying Linear Regression, Decision Tree, Random Forest, and Gradient Boosting Machine algorithms to the cultural and creative employment data across Italian regions, we analyzed

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the performance of each model using R-squared (R^2), Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE). We can analyse the results in the following Table 2.

Table 2. The table shows the superiority of ensemble methods (Random Forest and Gradient Boosting) over simpler models like Linear Regression and Decision Tree in terms of R-squared (R^2), Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE) for the given dataset.

Model	R^2	MAE	MSE	RMSE
Linear Regression	0.0034	0.408	0.301	0.549
Decision Tree	0.462	0.325	0.163	0.403
Random Forest	0.884	0.145	0.035	0.187
Gradient Boosting	0.807	0.185	0.058	0.241

- Linear Regression shows very low predictive power with an R^2 close to 0, indicating that the model does not effectively capture the variance in the data.
- Decision Tree provides a moderate improvement, especially in terms of R^2, which suggests that it captures some of the variability in the data better than Linear Regression.
- Random Forest significantly outperforms the other models in terms of all metrics, offering the highest R^2 value, which indicates a strong predictive power and a good fit to the data.
- Gradient Boosting also performs well, with an R^2 value that suggests a good fit, though not as strong as Random Forest. It still significantly surpasses the simpler models of Linear Regression and Decision Tree.

The Random Forest model, with the highest R^2 and lowest errors, is the best performing model among those tested. It indicates that ensemble methods, which combine multiple learning algorithms, provide a more robust prediction for this dataset. These models, especially Random Forest and Gradient Boosting, are likely capturing complex, non-linear relationships in the data that a simple model like Linear Regression cannot (Table 3).

Table 3. These predictions illustrate the Random Forest model's effectiveness in approximating the actual employment values across the regions, showcasing its utility for predictive tasks within the cultural and creative sectors.

Predictions with Random Forest Algorithm		
Region	**Actual 2022**	**Predicted 2022**
Piemonte	3.5	3.519
Valle d'Aosta	2.9	2.860
Liguria	2.9	2.828
Lombardia	4.1	4.189
Trentino-Alto Adige	3.7	3.733
Veneto	4.0	3.893
Friuli-Venezia Giulia	2.9	3.017
Emilia-Romagna	2.9	2.920

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Toscana	4.6	4.283
Umbria	3.8	3.481
Marche	3.5	3.540
Lazio	4.8	4.645
Abruzzo	2.3	2.437
Molise	1.9	2.110
Campania	2.8	2.639
Puglia	2.5	2.212
Basilicata	2.4	2.550
Calabria	2.0	2.234
Sicilia	2.5	2.456
Sardegna	2.3	2.272

7. Policy Implications

To bolster employment in cultural and creative jobs across Italian regions, a multidimensional approach to economic policy is warranted. Firstly, investment in cultural infrastructure, such as museums and creative spaces, not only enhances the cultural landscape but also generates employment in construction and operation. Secondly, fostering support for small and medium-sized enterprises (SMEs) through financial incentives and tax breaks can stimulate growth, particularly within sectors reliant on cultural and creative output. Thirdly, prioritizing education and training programs tailored to these industries equips individuals with the necessary skills, reducing unemployment and meeting industry demands. Moreover, promoting cultural tourism capitalizes on Italy's rich heritage, creating jobs in related services like guided tours and artisanal crafts. Encouraging innovation and entrepreneurship, facilitating collaboration between sectors, and promoting cultural exports also play pivotal roles in job creation. Flexible labor policies and region-specific strategies further enhance the environment for cultural and creative job growth, ensuring that each region can capitalize on its unique assets and opportunities. Through these concerted efforts, Italy can cultivate a thriving ecosystem for cultural and creative employment across its diverse regions.

8. Conclusions

In this article I analyzed the trend of cultural and creative employment in the Italian regions. The data used refers to the ISTAT-BES database. The analysis shows significant regional disparities, with the regions of central and northern Italy tending to have higher levels of cultural and creative employment than the southern regions. This value was confirmed by clustering analysis. Subsequently, the econometric analysis conducted showed the presence of a positive relationship between the value of cultural and creative employment, knowledge workers, graduate mobility and regular internet users. Finally, the analysis using machine learning showed the possibility of using the Random Forest algorithm to predict future trends in cultural and creative employment. There is a large regional disparity in terms of cultural and creative employment. It is very likely that economic policies aimed both at the formation of human capital and at the valorisation of the vast Italian artistic and museum heritage could allow a growth in cultural and creative employment with positive effects in terms of human capital, social capital and perceived well-being by the population.

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11. Appendix

WLS, using 380 observations
Included 20 cross-sectional units
Dependent variable: A101
Weights based on per-unit error variances

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	−0.00562472	0.0165883	−0.3391	0.7347	
A100	0.193965	0.00184767	105.0	<0.0001	***
A102	0.0267639	0.00225375	11.88	<0.0001	***
A105	0.00477988	0.00221254	2.160	0.0314	**

Statistics based on the weighted data:

Sum squared resid	371.9551	S.E. of regression	0.994607
R-squared	0.969157	Adjusted R-squared	0.968911
F(3, 376)	3938.217	P-value(F)	1.4e-283
Log-likelihood	−535.1310	Akaike criterion	1078.262
Schwarz criterion	1094.023	Hannan-Quinn	1084.516

Statistics based on the original data:

Mean dependent var	0.827368	S.D. dependent var	1.443423
Sum squared resid	42.64343	S.E. of regression	0.336769

Pooled OLS, using 380 observations
Included 20 cross-sectional units
Time-series length = 19
Dependent variable: A101

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	−0.00309073	0.0204224	−0.1513	0.8798	
A100	0.189152	0.00243805	77.58	<0.0001	***
A102	0.0250755	0.00237803	10.54	<0.0001	***
A105	0.00570373	0.00262955	2.169	0.0307	**

Mean dependent var	0.827368	S.D. dependent var	1.443423
Sum squared resid	42.12756	S.E. of regression	0.334726
R-squared	0.946649	Adjusted R-squared	0.946224
F(3, 376)	2223.904	P-value(F)	7.6e-239
Log-likelihood	−121.2975	Akaike criterion	250.5950
Schwarz criterion	266.3557	Hannan-Quinn	256.8490

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rho	0.799330	Durbin-Watson	0.598972

Fixed-effects, using 380 observations
Included 20 cross-sectional units
Time-series length = 19
Dependent variable: A101

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	−0.00293807	0.0190089	−0.1546	0.8773	
A100	0.188523	0.00229273	82.23	<0.0001	***
A102	0.0221467	0.00236584	9.361	<0.0001	***
A105	0.00477552	0.00247716	1.928	0.0547	*

Mean dependent var	0.827368	S.D. dependent var	1.443423
Sum squared resid	34.60067	S.E. of regression	0.311321
LSDV R-squared	0.956181	Within R-squared	0.955380
LSDV F(22, 357)	354.1016	P-value(F)	2.7e-227
Log-likelihood	−83.90001	Akaike criterion	213.8000
Schwarz criterion	304.4240	Hannan-Quinn	249.7600
rho	0.727189	Durbin-Watson	0.665297

Joint test on named regressors -
Test statistic: F(3, 357) = 2547.99
with p-value = P(F(3, 357) > 2547.99) = 1.28729e-240
Test for differing group intercepts -
Null hypothesis: The groups have a common intercept
Test statistic: F(19, 357) = 4.08738
with p-value = P(F(19, 357) > 4.08738) = 4.42276e-08
Random-effects (GLS), using 380 observations
Using Nerlove's transformation
Included 20 cross-sectional units
Time-series length = 19
Dependent variable: A101

	Coefficient	*Std. Error*	*z*	*p-value*	
const	−0.00300522	0.0385087	−0.07804	0.9378	
A100	0.188662	0.00227398	82.97	<0.0001	***
A102	0.0227523	0.00232089	9.803	<0.0001	***
A105	0.00496465	0.00245633	2.021	0.0433	**

Mean dependent var	0.827368	S.D. dependent var	1.443423
Sum squared resid	42.25557	S.E. of regression	0.334789
Log-likelihood	−121.8740	Akaike criterion	251.7480

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Schwarz criterion	267.5086 Hannan-Quinn	258.0019
rho	0.727189 Durbin-Watson	0.665297

'Between' variance = 0.0214129
'Within' variance = 0.0910544
theta used for quasi-demeaning = 0.572359
Joint test on named regressors -
Asymptotic test statistic: Chi-square(3) = 7748.81
with p-value = 0
Breusch-Pagan test -
Null hypothesis: Variance of the unit-specific error = 0
Asymptotic test statistic: Chi-square(1) = 56.6068
with p-value = 5.32267e-14
Hausman test -
Null hypothesis: GLS estimates are consistent
Asymptotic test statistic: Chi-square(3) = 4.91772
with p-value = 0.177922

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