A QUANTITATIVE ASSESSMENT OF SOCIAL CIRCULARITY IN EU SUSTAINABLE TOURISM DEVELOPMENT

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ABSTRACT
This study proposes a quantitative multi-criteria framework to measure the social pillar of circular tourism, bridging the analytical gap between environmental resource efficiency and socio-economic equity. By aligning the Global Sustainable Tourism Criteria (GSTC) with the 5R principles (reduce, recycle, repair, rethink and reuse), the Composite Social Circularity Index (CSCI) was constructed using Eurostat NUTS 2 data across 242 European regions over the 2018–2024 horizon. The methodology applies the entropy weighting method to synthesise complex indicators, such as circular workforce training, sharing economy participation and specialised repair employment. The empirical results reveal a significant circular divide within the EU-27. While a prominent northern-Alpine corridor excels in high-tech rethink strategies, peripheral regions remain caught in structural linear traps. However, a unique social repair buffer was identified in the Mediterranean region, where traditional SME-led repair cultures provide organic labour market resilience. The paper provides a standardised tool for policymakers to monitor the just transition, advocating for social conditionality parameters to ensure that circularity benefits both the environment and the regional labour force.
KEY WORDS: *GSTC, social pillar of sustainability, circular economy, sustainable tourism development.*

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Introduction

Relevance of the research topic. The global circular transition requires reconfiguring macro-economic variables, labour markets and socio-economic systems. While ecological dimensions are well-modelled, social elements remain under-theorised. In the EU, where tourism generates approximately 10% of GDP, circularity drives regional cohesion, wage stabilisation and social equity (Pernice, 2025). This social circularity prioritises human capital, craftsmanship and community well-being, alongside material efficiency (Valencia et al., 2023; European Social Circular Economy Platform, 2017). With circular models projected to unlock $4.5 trillion globally by 2030 (Lacy, Rutqvist, 2015), quantifying these socio-economic yields is imperative, depending on a just labour transition and high-value circular skills across the EU-27 (Strippoli et al., 2024).

The circular model extends beyond micro-waste management, offering a structural framework to optimise regional labour intensity and inclusive growth in tourism areas. As the EU targets climate neutrality by 2050, demand for specialised circular competencies is shifting regional labour towards advanced maintenance, remanufacturing and digitised resource networks (European Parliament, 2021; Knudsen et al., 2024). This shift requires rethinking business structures through targeted digitalisation to enhance labour inclusion, transparency and equitable value distribution. Integrating Global Sustainable Tourism Criteria further ensures growth, and preserves community integrity, the cultural heritage and gender equity (GSTC, n.d.). Given

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the expansion of green employment across EU regions (Rashid, 2026), a standardised empirical methodology is critical for effective place-based policy design.

Despite the growing literature on circular economy indicators, a critical consensus on the social pillar's definition, measurement and spatial distribution remains absent, due to two major research gaps. Firstly, frameworks over-index on technocentric, environmental metrics, treating human labour as a static input rather than a dynamic capital; consequently, the impact on job stability goes unnoticed. Secondly, sustainable tourism evaluations are either overly localised, or aggregated at the national level (NUTS 1), masking intra-national inequalities and vital localised structures, such as small-scale repair economies, essential for sub-national resilience.

The scientific problem addressed in the study concerns the persistent lack of a standardised, quantitative, multi-criteria methodology capable of measuring and spatially analysing how regional choices between higher-tier circular strategies (rethink) and lower-tier localised strategies (repair) impact labour market stability, human capital evolution and spatial socio-economic disparities at the sub-national level.

The purpose of the study: to develop a multi-criteria Composite Social Circularity Index (CSCI), and apply it to a quantitative spatial assessment of 242 EU NUTS 2 regions, evaluating how the operationalisation of the 5R principles shapes sub-national employment dynamics, the evolution of workforce skills, and spatial equity across sustainable tourism systems.

Research tasks: 1. To construct an integrated theoretical framework that maps the 5R principles directly on to the social pillar of sustainable development, moving past purely environmental indicators. 2. To quantitatively build and weight the Composite Social Circularity Index, using objective economic criteria. 3. To empirically evaluate and rank the social circularity configurations of EU NUTS 2 regions using standardised data over a multi-year horizon. 4. To execute an Explanatory Spatial Data Analysis to map the geographical distribution of CSCI scores, identifying regional performance clusters, spatial traps and cross-border spillover effects to inform place-based EU cohesion policies.

The value of the research to the scientific field is threefold: 1) it operationalises the social dimension of the circular economy by shifting the focus from physical material metrics to labour-market and human equity indicators; 2) it provides an objective, data-driven multi-criteria indexing tool (CSCI) that eliminates subjective expert weighting biases; and 3) it uncovers sub-national macro-regional anomalies, and demonstrates empirically how traditional informal or small-scale repair economies provide distinct structural resilience to regional economies facing green transition shocks.

Research methods: systematic literature review, content analysis, and quantitative econometric modelling (including Multi-Criteria Composite Indexing and Explanatory Spatial Data Analysis).

1. The theoretical framework: social circularity in tourism

The systemic transition to a circular economy requires measuring success through social equity and resilience, rather than just material flows. This section establishes a theoretical framework for social circularity, arguing that tourism's transformative power lies in making human capital the primary engine of sub-national socio-economic stability.

1.1. Defining social circularity: beyond environmental metrics

The academic discourse on the circular economy has long been dominated by a technocentric focus on material loops and carbon outputs, overlooking human capital and community resilience (Lacy, Rutqvist, 2015; Garcilazo-Lopez et al., 2026). In tourism, circularity should be redefined as a holistic socio-economic transformation, rather than mere waste management (Moroz, Labanauskaitė, 2026).

Social circularity prioritises the well-being, equity and professional evolution of local workforce and resident communities (Manniche et al., 2021; Strippoli et al., 2024). Beyond minimising waste, a circular destination reinvests economic value in local human capital (Manniche et al., 2021). Success is measured

by employment quality, externalised impact mitigation, and inclusive digital growth. By integrating GSTC standards, social circularity establishes the human element as the central engine of systemic tourism resilience across the EU.

1.2. The macroeconomic impact of circularity on regional labour markets

The transition to circular tourism acts as a macroeconomic catalyst across EU NUTS 2 regions, replacing vulnerable seasonal models with diversified labour structures, localised repair loops and territorial unity.

Unlike linear models, circular configurations are labour-intensive, requiring specialised maintenance, digital management, and community service design that counteracts jobless automation (Rashid, 2026). This aligns with the European Green Deal's Just Transition Mechanism, by preventing rural depopulation and stabilising regional tax bases against mass travel cycles.

Furthermore, the digital rethink principle increases worker productivity and wages, compressing traditional hospitality wage gaps and driving upward social mobility (Polukhina et al., 2025). Finally, circular tourism creates positive systemic multipliers, spilling over into local agriculture via short-loop sourcing and manufacturing via upcycling (Manniche et al., 2021). The NUTS 2 scale captures these dynamics, ensuring equitable wealth distribution across the EU.

1.3. Methodological structure for literature synthesis

To establish a conceptual baseline, a systematic literature review was conducted across Scopus and Web of Science (2015–2026) using the Boolean string: ('social circularity' OR 'circular economy') AND ('tourism' OR 'hospitality') AND ('regional labour' OR 'human capital' OR 'spatial equity'). After removing duplicates, a multi-stage screening filter was applied: inclusion required peer-reviewed articles linking circularity to socio-economic variables at the sub-national/NUTS level, while exclusions omitted editorials, purely technical engineering studies without human capital variables, and non-reproducible local case studies. The retained foundational studies informed the 5R social-circular measurement matrix.

1.4. The structural social-circular tourism model

Rather than viewing the 5R principles as isolated environmental actions, this model frames circularity as socio-economic feedback loops that directly alter regional labour markets and territorial equity through two operational pathways.

Table 1. The structural social-circular tourism model

Operational pathway	Associated 5R pillars	Core economic mechanism	Primary socio-economic outcome
Localised structural preservation vector	Repair, reuse, recycle	Retention of sticky regional capital; formalisation of green-collar positions	Mitigation of seasonal volatility; establishment of an economic floor for low and medium skilled labour
High-tier endogenous restructuring vector	Rethink, reduce	Human capital upskilling; digital transformation; mitigation of negative externalities	Upward social mobility; compression of regional wage gaps; enhanced resident quality of life

The lower-tier components act as an institutional safety net. Conventional linear systems suffer from capital flight via imported goods and centralised maintenance (Manniche et al., 2021). Grounding repair and reuse in institutional economics reveals that maintaining infrastructure requires a stable workforce. Consequently, maintenance and repair employment (NACE Rev. Sector S95) serves as 'sticky regional capital' that cannot be easily outsourced (Velden, 2021). These SME networks provide non-seasonal employment, insulating local households from tourism demand shocks.

This is supported by the recycle dimension, which formalises waste management into regulated green-collar careers with standard contracts and health protections, improving conditions for vulnerable workers (Buyukyazici, Quatraro, 2025). In contrast, the rethink dimension drives economic transformation via Human Capital Theory. Conventional tourism relies on low-skill, high-turnover roles that reinforce wage gaps (Polukhina et al., 2025), turning operators into specialised circular managers. This higher marginal productivity justifies higher wages and drives upward social mobility. Finally, the reduce dimension targets negative social externalities. Minimising waste per tourist night serves as a proxy for resident quality of life, demonstrating infrastructure efficiency that protects public spaces from over-tourism and ensures long-term social sustainability.

2. Methodology and data construction

To quantify the social dimensions of the circular transition, this chapter develops an empirical framework bridging granular regional data with high-level policy objectives, moving beyond traditional econometric modelling, to capture labour market resilience and community integration across the EU (Jančová et al., 2024).

2.1. Selection of NUTS 2 regions: the case for spatial resolution

The study encompasses EU-27 NUTS 2 regions from 2018 to 2024, capturing the pre-pandemic baseline, the 2020 shocks, and the recovery phase where circular principles integrated into the EU's Transition Pathway for Tourism. NUTS 2 represents the methodological optimum, balancing functional labour markets with local impact visibility.

To ensure statistical reliability, a purposive sampling filter is applied to the 242 NUTS 2 regions based on:

1. Tourism intensity as a minimum threshold of tourist nights to ensure tourism is a significant macroeconomic driver (Eurostat, 2026a).
2. Data completeness is chosen as regions must possess at least 80% of the required social indicators to build a solid Composite Social Circularity Index (CSCI) (Garcilazo-Lopez et al., 2026).

2.2. Data identification: mapping the 5Rs to the social pillar

The CSCI translates the 5R loop into measurable variables using the EU Labour Force Survey and Structural Business Statistics:

1. Repair is tracked via employment in NACE Rev.2 sector S95 (Eurostat, 2026d). High repair job density in tourism hubs indicates investment in local technical skills rather than a disposable economy (Interreg Europe, 2022; Strietska-Ilina, Tessaring, 2005).
2. Reduce is measured as the ratio of municipal waste generation to total tourist nights (Eurostat, 2026a, b). Lower waste intensity per guest acts as a proxy for resident quality of life and protection from mass travel externalities (Manniche et al., 2021).
3. Recycle is tracked via employment in NACE Rev.2 sector E38 (Eurostat, 2024b). Growth in E38 signals a shift to stable green-collar jobs and long-term skills development (Buyukyazici, Quatraro, 2025; Yildirim, Vasilev, 2024).

4. Rethink is measured by lifelong learning and vocational training participation rates within NACE Rev. 2 Sector I (Eurostat, 2026c), tracking workforce adaptability in digital and circular business models (Möller et. al., 2025; Hossain et al., 2025).
5. Reuse is captured via digital inclusion metrics measuring individuals using websites or apps to arrange accommodation from private individuals (Eurostat, 2024a). This measures tourism value chain democratisation and community engagement (Eurostat, 2026d).

Table 2. The 5R social-circular measurement framework

5R principle	Framework link	Eurostat dataset	Indicator operational description
Repair	Local sourcing & asset longevity	sbs_sc_ovw (NACE S95)	Employment in NACE S95 (repair of personal/household goods) as % of active workforce
Reuse	Inclusive digital entrepreneurship	$isoc_ci_ce_i$	Peer-to-peer platform usage, % of individuals arranging private lodging
Reduce	Social externality mitigation	env_wasmun / $tour_occ_ninat$	Volume of municipal waste generated (kg) per registered tourist night
Recycle	Skills development & job quality	$sbs_na_1a_se_r2$	Employment in NACE E38 (waste & materials recovery) as % of regional employment
Rethink	Human capital & digitalization	$trng_lfse_02$	Workforce training and lifelong learning in NACE Sector I (tourism), %

2.3. Construction of the composite social circularity index (CSCI)

The composite social circularity index (CSCI) is developed as a multi-criteria decision-making (MCDM) tool designed to aggregate the five heterogeneous indicators identified in Section 2.2. To ensure the index is robust, transparent and replicable, a three-step mathematical procedure is applied.

Data normalisation (min-max scaling)

Since the selected indicators are measured in different units, ranging from percentages (training rates) to per-capita ratios (waste generation), min-max normalization is employed (OECD, 2008). This transforms all variables into a dimensionless range of (0.1), ensuring no single variable disproportionately skews the results due to its scale (OECD, 2008).

For benefit indicators (where higher values represent superior social performance, e.g. repair, reuse, rethink, recycle), the normalisation formula is:

$$\mathrm{Iij} = \frac{\mathrm{Xij} - \mathrm{MIN(Xj)}}{\mathrm{MAX(Xj)} - \mathrm{MIN(Xj)}}$$

For cost indicators (where lower values are preferable, e.g. waste intensity), the normalisation formula is:

$$\mathrm{Iij} = \frac{\mathrm{MAX\ (Xj)} - \mathrm{Xij}}{\mathrm{MAX(Xj)} - \mathrm{MIN(Xj)}}$$

Weighting procedure (entropy weighting method)

To avoid the subjectivity of equal weighting, this study applies the entropy weighting method (EWM) (Zhu et al., 2020). This objective approach assigns higher weights to indicators that exhibit greater dispersion across the NUTS 2 regions, signalling higher informational value. These steps are executed as follows:

1. Calculate the entropy (e_j) of each indicator to measure its uncerainty.
2. Determine the informational redundancy (d_j) where $d_j = 1 - e_j$, representing the useful information provided by the variable.
3. Calculate final weights (w_j) by normalising the redundancy across all indicators. This ensures that if digital training varies significantly across the EU, while waste generation is relatively uniform, the index will place a higher statistical priority on the training metric.

Index aggregation and final score

The final CSCI for each NUTS 2 region (i) is calculated using a weighted linear aggregation:

$$CSCIi = \sum_{j=1}^{n} wj \cdot Iij$$

The resulting score provides a standardised value between 0 (lowest social circularity) and 1 (highest social circularity) (Zhu et al., 2020). This definitive ranking allows the study to quantify the social performance of the circular transition, enabling researchers to correlate circularity with broader regional GDP growth and social resilience.

Spatial autocorrelation and econometric modelling

To evaluate how social circularity is distributed geographically across the EU-27, this study employs explanatory spatial data analysis (ESDA) (Guo, 2017). This approach is essential for identifying whether social circularity in tourism is a purely localised phenomenon, or if circular clusters exist due to cross-border policy integration and regional labour mobility.

Global Moran's I: measuring EU-wide clustering

The first step involves calculating the Global Moran's I (ArcGIS Pro 3.6, 2005) statistic to determine the overall spatial dependency of the circularity scores.

If $I > 0$, it indicates that NUTS 2 regions with high social circularity are geographically clustered (creating, for example, the Nordic model or distinct Mediterranean blocs). The statistic measures the correlation of a region's CSCI score with the weighted average of its neighbours' scores, using a first-order queen contiguity matrix (W_{ij}).

Local indicators of spatial association (LISA)

To identify specific hot spots and cold spots, the LISA (Local Moran's I) technique (Kosfeld et al., 2017) is applied. This allows the study to categorise NUTS 2 regions into four distinct spatial quadrants:

1. High-high (hot spots): high-performing regions surrounded by high-performing neighbours, indicating a resilient circular ecosystem.
2. Low-low (cold spots): regions where both the target and its neighbours underperform, signalling a need for urgent EU cohesion intervention.
3. High-low/low-high (outliers) are islands of circularity or laggard regions within successful clusters, which help identify the impact of specific national versus regional policies.

Spatial lag and spatial error models (SLM/SEM)

Finally, to understand the macro-economic drivers of these scores, spatial econometric modelling (LeSage, 2008) is applied. This determines if a region's social circularity is driven by its own internal investment (e.g. local vocational training), or by spatial spillovers from neighbouring tourism hubs. This distinction is critical for EU policymakers: it reveals whether circularity can be exported across regional borders, or if it requires hyper-local structural reform.

3. Results: the social geography of circular tourism in the EU

The empirical analysis of 242 NUTS 2 regions reveals deep and territorial disparities and distinct regional specialisations in social circularity. Mapping the Composite Social Circularity Index (CSCI) highlights emerging transitional circular corridors alongside spatial traps hindering a just transition in the European periphery.

Descriptive statistic of social circularity indicators

An analysis of the 2018–2024 dataset reveals significant heterogeneity in how regions operationalise the social pillar of circularity. Table 3 presents the summary statistics for the five core indicators before normalisation (Eurostat, 2024a).

Table 3. Descriptive statistics of raw social indicators (NUTS 2 level)

Indicator (the 5Rs)	Mean	Std. Dev.	Min (region)	Max (region)	Unit
Repair (sbs_sc_ovw)	4.2	1.8	0.8 (EL)	12.4 (IT)	Jobs per 1,000 tourist arrivals
Reuse ($isoc_ci_ce_i$)	18.4%	9.2%	4.0% (BG)	42.0% (FR)	% of total adult population
Reduce (env_wasmun)	1.42	0.65	0.35 (AT)	3.80 (ES)	Kg per tourist night
Recycle ($sbs_na_1a_se_r2$)	2.1%	0.7%	0.5% (RO)	4.8% (DE)	% of total regional employment
Rethink ($trng_lfse_02$)	11.2%	5.4%	2.1% (PL)	31.5% (DK)	% workforce (NACE Rev.2 Sector I)

Initial macro-economic observation

The baseline data indicates a sharp north-south-east divide:

1. Rethink (lifelong learning) in northern European regions (Denmark and Sweden) show training rates triple the EU average, ensuring a high-adaptability workforce. Conversely, Mediterranean and East European regions face localised skills obsolescence risks (Möller et al., 2025; European Union, 2022).
2. Repair (small-scale activities) in Mediterranean regions (Italy, Greece) exhibit the highest NACE S95 job densities, maintaining a highly resilient traditional repair culture, despite lagging in high-tech (Interreg Europe, 2022).
3. Reduce (tourism pressure) and high-density mass tourism hubs (e.g. Islas Baleares, Spain) face severe pressure. A standard deviation of 0.65 in waste volume per tourist night confirms that circular infrastructure has not decoupled from absolute arrival volumes (Manniche et al., 2021).

Distributional characteristics

Skewness and kurtosis analysis indicate a non-normal CSCI distribution with positive statistical outliers exceeding 0.85. This asymmetric profile necessitates spatial auto-correlation techniques (Moran's I) (Kosfeld, Eckey, 2007) to determine if regional leaders generate positive spatial spillovers or remain isolated islands.

Identifying regional leaders and laggards

Divided into four performance quartiles (OECD, 2008), the 242 NUTS 2 regions demonstrate varying responses to the social mandate.

Circular vanguard (CSCI > 0.75), led by capital regions such as Hovedstaden and Stockholm: these territories use advanced vocational training rates and digital fluency to foster high wage equity and integrated circular policies (European Union, 2022).

The repair-driven tier (CSCI between 0.50 and 0.74), typified by Toscana and Lisboa: these SME-led hubs excel in technical and repair skills, though global scores are constrained by seasonal waste intensity and a lack of formal digital strategies (Manniche et al., 2021).

The transitioning tier (CSCI between 0.25 and 0.49), including industrial regions such as Mazowieckie (Poland): these areas benefit from professionalised municipal recycling, though high-value digital training remains underdeveloped.

The laggard regions (CSCI < 0.25) such as Severozapaden in Bulgaria: they act as socio-economic cold spots where circularity is largely excluded from development logic, demanding targeted transition funding (Jančová et al., 2024).

Table 4. Ranking of NUTS 2 regions by CSCI score (sample boundary layout)

Rank	Region (NUTS 2)	Member state	CSCI score	Primary 'R' operational driver
1	Hovedstaden	Denmark	0.89	Rethink / reuse systems
2	Stockholm	Sweden	0.86	Rethink / digital capital
3	Oberbayern	Germany	0.82	Recycle / professional skills
4	Ile-de-France	France	0.79	Reuse / digital platforms
5	Utrecht	Netherlands	0.78	Reduce / infrastructure Efficiency
…	…	…	…	…
240	Sud-Muntenia	Romania	0.18	Weak 5R structural integration
241	Jadranska Hrvatsa	Croatia	0.16	High seasonal waste intensity
242	Severozapaden	Bulgaria	0.12	Low training / weak repair base

Mapping hot spots of social circularity in the EU-27

To identify geographical configurations of the CSCI, local indicators of spatial association (LISA) were applied. The Global Moran's I of 0.42 () demonstrates a statistically significant, moderate-to-strong positive spatial autocorrelation, confirming that social circularity is highly clustered rather than randomly distributed (Kosfeld, Eckey, 2007; Guo, 2017).

High-high hotspots (the Nordic-central corridor) stretch continuously from the Nordic countries through Benelux into southern Germany and Austria (such as Oberbayern). This spatial pattern proves the geographical spillover effect of regional human capital, where mobile workforces and advanced reuse and rethink models cross internal borders to form a resilient, transnational circular labour market (European Union, 2022; Knudsen et al., 2024; Buyukyazici, Quatraro, 2025).

Conversely, low-low cold spots (the Balkan peninsula and the Baltic periphery) suffer from severe spatial trap dynamics, where low institutional investment in circular repair and rethink infrastructures is mirrored in its contiguous neighbours, reinforcing linear stagnation (Kosfeld et al., 2017). These regions remain locked in low-value-added service models, failing to achieve absolute resource decoupling (Rashid, 2026; Moroz, Labanauskaitė, 2026), risking permanent linear backwaters without targeted EU Cohesion Policy (Jančová et al., 2024).

High-low spatial outliers (Madrid and Attica), high-performing urban hubs surrounded by lower-performing, linear rural neighbours. Concentrating rethink and reuse activities via advanced digital transformation and sharing economy tech (Hossain et al.; Möller et al., 2025), these metropolitan cores lack spatial spillover to rural hinterlands. Without bridging this urban-rural divide, these outliers risk becoming isolated sustainability pockets failing to support national supply chain cohesion (LeSage, 2008; Polukhina et al., 2025).

4. Discussion

The spatial distribution of the CSCI reveals a profound paradox, suggesting the circular economy may be exacerbating a circular divide between the EU's core and its periphery.

A high Moran's I coefficient (0.42) confirms that social circularity is becoming a club enjoyed by regions with high pre-existing digital literacy and institutional quality (Kosfeld, Eckey, 2007). While northern clusters effectively decouple growth from environmental degradation through rethink and reduce models, low-low cold spots in Eastern and southern Europe remain caught in a structural linear trap, where tourism remains synonymous with high waste generation and low-skilled, seasonal labour (Jančová et al., 2024; Rashid, 2026).

However, Mediterranean regions demonstrate a unique social repair buffer. Their resilience in traditional, SME-led repair networks (NACE Rev.2 Division 95) and localised sourcing provides an organic safety net, highlighting that a one-size-fits-all transition over-prioritising high-tech solutions may displace organic practices sustaining southern tourism economies.

Digitalisation: a catalyst for equity or exclusion?

Digitalisation acts as the primary mediator of the 5R framework with a dual-natured impact:

1. AI-driven hospitality management platforms transform seasonal staff into skilled circular resource managers, increasing marginal labour productivity and reducing precarity (Möller et al., 2025). Conversely, in peripheral regions lacking baseline digital infrastructure, rapid automation risks the algorithmic exclusion of ageing, less-digitised workforces (Polukhina et al., 2025).
2. Blockchain-based social labelling ensures supply chain transparency. Providing immutable records of fair wages and local raw material sourcing empowers the localised reuse economy, keeping economic value within the host community, rather than letting it leak to global digital intermediaries (Hossain et al., 2025).

Territorialised policy: bridging the gap

To prevent a permanent socio-economic rift, EU policy should shift from a generalised Green Deal template to a highly territorialised social circular strategy:

1. ESIF funding for regional tourism should be contingent on documented improvements in circular workforce training (rethink), and the integration of localised SME repair networks, ensuring that inbound capital builds long-term human capital, rather than just physical, high-tech infrastructure.
2. Subsidising specialised micro-credentials in AI-driven resource management for hospitality workers (NACE Rev. 2 Sector I) in low-low clusters will proactively prevent structural labour displacement and ease transition anxieties (Knudsen et al., 2024).
3. Regional incentives should foster integrated networks that link high-tech urban rethink hubs with rural repair and reuse zones to resolve the intense friction seen in high-low spatial outliers such as Madrid and Attica, using regional tourism supply chains as an active vehicle for internal territorial cohesion (European Union, 2022).

Conclusion

The shift towards a circular tourism economy in the EU is an evolutionary process centred on people. Systemic success is measured through the CSCI, a multi-dimensional metric reflecting how regional labour markets, digital literacy and community well-being co-evolve.

Circularity benefits have not diffused. The northern-Alpine corridor has moved beyond basic waste management into high-value rethink strategies (Jančová et al., 2024; Rashid, 2026). Conversely, southern Europe relies on a vital Mediterranean social repair buffer, dense networks of traditional services that provide an organic socio-economic safety net.

Methodologically, the research aligns the 5R principles with Global Sustainable Tourism Council criteria within the CSCI, ensuring that transitions are evaluated through social justice, gender equity and community engagement (Moroz, Labanauskaitė, 2026; GSTC, n.d.).

To prevent an economic rift, EU policy must be territorial: 1) make regional infrastructure grants contingent on workforce upskilling and SME integration; 2) provide digital micro-credentials to hospitality workers in lagging clusters to prevent technological exclusion (Knudsen et al., 2024).

Limitations and future research: Eurostat and OECD indicators can under-represent informal sharing and small-scale guesthouse practices. Future studies should deploy spatial econometric regression models, investigate the European Quality of Government Index as a moderator, and conduct localised longitudinal case studies on urban-rural divides.

Ultimately, circularity transforms disposable seasonal roles into stable careers, ensuring the EU's 2050 transition is both ecologically resilient and socially equitable.

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ES DARNAUS TURIZMO PLĖTROS SOCIALINIO ŽIEDIŠKUMO KIEKYBINIS ĮVERTINIMAS

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Santrauka

Tyrime pritaikyta daugiaaspektė kiekybinė socialinio žiedinės ekonomikos ramsčio ES turizmo sektoriuje vertinimo metodika. Teorinis pagrindas apima Pasaulinės darnaus turizmo tarybos (GSTC) kriterijus ir „5R“ principus. Subjektyvumui eliminuoti taikytas entropijos svorių metodas (EWM) ir sudarytas Sudėtinis socialinio žiediškumo indeksas (CSCI), integruojantis darbo rinkos stabilumo, profesinio perkvalifikavimo, skaitmeninės įtraukties bei regioninės sanglaudos rodiklius NUTS 2 lygmeniu.

Erdvinė autokoreliacijos analizė (ESDA) atskleidė struktūriškai netolygią, statistiškai reikšmingą makroregioninę CSCI rodiklių koncentraciją (*Global Moran's I* = 0,42, $p < 0,01$). Vietinių erdvinės asociacijos rodiklių (LISA) analizė leido identifikuoti integruotą aukštų rodiklių (angl. *High-High*) erdvinį klasterį – Šiaurės ir Alpių regionų koridorių (Daniją, Švediją, Austriją), pasižymintį pažangiais darbuotojų kvalifikacijos kėlimo ir skaitmeninės adaptacijos procesais. Priešingai, ES rytinės ir pietinės periferijos regionuose nustatyti žemų rodiklių (angl. *Low-Low*) klasteriai išryškina struktūrinius linijinio modelio spąstus, kur turizmo plėtra sukelia didelį sezoninių atliekų intensyvumą bei generuoja žemos kvalifikacijos, prekarizuotas darbo vietas.

Empirinio tyrimo rezultatai atskleidė reikšmingą struktūrinį fenomeną – Vidužemio jūros regionuose funkcionuojantį socialinį-ekonominį amortizatorių. Jį generuoja didelė smulkių ir vidutinių įmonių (SVĮ) koncentracija techninės priežiūros bei taisymo paslaugų sektoriuje (NACE Rev. 2 S95). Šis decentralizuotas tinklas užtikrina endogeninį vietos darbo rinkos atsparumą, kurio trūksta kapitalui imliems Šiaurės Europos modeliams. Vertinant skaitmenizacijos ir dirbtinio intelekto poveikį, nustatyta dvejopa rizika: nors technologinė transformacija gali optimizuoti išteklių valdymą ir sukurti stabilias „žaliųjų apykaklių“ profesijas, netolygi infrastruktūra gali lemti vyresnio amžiaus darbuotojų technologinę atskirtį.

Tyrime daroma išvada, kad universalios ES strategijos neužtikrina efektyvaus perėjimo prie žiedinės ekonomikos skirtinguose regionuose. Siūloma diegti teritorinę socialinio žiediškumo strategiją: ES paramą turizmui susieti su investicijomis į darbuotojų perkvalifikavimą ir subsidijuoti vyresnio amžiaus darbuotojų skaitmeninį raštingumą. Suformuotas CSCI indeksas leistų politikos formuotojams operatyviai valdyti Teisingosios pertvarkos procesus bei didinti turizmo socioekonominį teisingumą.

RAKTINIAI ŽODŽIAI: *GSTC kriterijai, socialinis darnumo ramstis, žiedinė ekonomika, darnaus turizmo plėtra.*

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