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Assessing the Impacts of Public Policies Towards Environmental Sustainability in the Centre NUTII of Portugal. The Case of POSEUR (2014-2020)

Avaliação dos Impactos da Política Pública para a Sustentabilidade Ambiental na NUTII Centro de Portugal. O Caso do POSEUR (2014-2020)

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Abstract

The operational programme for Sustainability and Use of Resources (POSEUR 2014-2020) is the most powerful mechanism of EU Cohesion Policy to be implemented in Portugal concerning sustainable environmental development. The programme has a place-based approach that attends to the territorial characteristics of the Portuguese regions. This study focused its analysis on the POSEURS' main impacts on the Portuguese Centre NUT II. With a mixed methodological approach, impact scores were produced for five environmental sustainability dimensions: i) low-emissions economy, ii) adaptation to climate change, iii) risk prevention and management, iv) environmental protection, and v) resource efficiency.

The qualitative and quantitative data was collected through interviews, literature review, the POSEUR project database analysis and regional environmental indicators. The outcome of the analysis showed that technical and execution barriers contributed to the heterogeneity of the results obtained in the five selected dimensions. An overall balance points out the low positive impact scores promoting small regional changes in environmental sustainability. Nonetheless, elaborating spatial plans for the municipalities and regions turned the adaptation to climate change into a highly positive impact dimension.

Keywords: EU Cohesion Policy; POSEUR; TARGET_TIA; Sustainable Development; Centre of Portugal

JEL codes: O10, O12, Q01

Resumo

O Programa Operacional Sustentabilidade e Eficiência no Uso de Recursos (POSEUR 2014-2020) é o mais poderoso mecanismo da Política de Coesão da UE a ser implementado em Portugal no que diz respeito ao desenvolvimento ambiental sustentável, do ponto de vista financeiro. O programa tem uma abordagem local que atende às características territoriais das regiões portuguesas.

Este estudo centrou a sua análise nos principais impactos dos POSEUR na NUT II do centro de Portugal. Com uma abordagem metodológica mista, foram produzidos *scores* de impacto para cinco dimensões de sustentabilidade ambiental: i) economia de baixas emissões, ii) adaptação às mudanças climáticas, iii) prevenção e gestão de riscos, iv) proteção ambiental ev) eficiência de recursos. Os dados qualitativos e quantitativos foram obtidos por meio de entrevistas, revisão da literatura, análise da base de dados do programa POSEUR e indicadores ambientais estatísticos regionais. O resultado da análise mostrou que barreiras técnicas e de execução contribuíram para a heterogeneidade dos resultados obtidos nas cinco dimensões selecionadas. Um balanço geral aponta para scores de impacto positivos, mas reduzidos na promoção das mudanças regionais na sustentabilidade ambiental nas região Centro de Portugal. No entanto, a elaboração de planos de ordenamento dos municípios desta região, tornou a adaptação às alterações climáticas numa dimensão de impacto altamente positivo.

Keywords: EU Cohesion Policy; POSEUR; TARGET_TIA; Sustainable Development; Centre of Portugal

Códigos JEL: O10, O12, Q01

1. INTRODUCTION

European Union (EU) Cohesion policy aims to mitigate the development gap between regions in the EU Member States. In this context, launching the Operational Programme for Sustainability and Efficient Use of Resources (POSEUR 2014-2020) can be regarded as the most important Portuguese policy mechanism for supporting sustainable environmental processes in the Portuguese territory. The POSEUR interventions follow the widespread policy guidelines towards financing a green and digital transformation, as supported by the UN Agenda 2030 (UN, 2016) and the EU Green Deal (EU, 2019). The POSEUR interventions in Portugal aim to promote sustainable development (Keeble, 1988) based on three axes:

1. The support of a transition to a model of the low-carbon economy;
2. The promotion of climate change adaptation strategies, risk prevention and management;
3. Protecting the environment and promoting the efficient use of resources.

EU Cohesion Policy finances regional projects to be implemented where regional and territorial needs are diagnosed. However, it does not always produce the expected positive impacts and the desired outcomes (Darvas et al., 2019). Issues related to the appropriateness of the policies in a given territory (Di Caro & Fratesi, 2022), the constraints of deadlines and public hiring processes (Potluka & Medeiros, 2021), as well as contextual endogenous and exogenous factors (Percoco, 2017), can influence the effectiveness of POSEUR implementation and alike EU Cohesion Policy Operational Programmes.

The case of POSEUR in the Centre NUTII of Portugal is interesting as a case study for understanding the impact of the EU Cohesion Policy at the regional level. The Central area of Portugal is a heterogeneous territory due to its unique morphology and recent demographic changes. The presence of several medium-sized cities in the Portuguese urban system context (Coimbra, Aveiro, Leiria), with universities (Farinha et al., 2020), hospitals and public services, attract daily commuting flows towards these urban areas from peripheral localities. Consequently, these medium-sized cities gradually expand towards the suburban areas, thus applying pressure on the coastal areas and agricultural lands (Pereira & Coelho, 2013; Barros et al., 2018). Moreover, the Centre NUT II shore areas have registered new waves of tourism, interested in leisure activities associated with the growth of water sports in the region (Carneiro et al.,2016). For instance, the towns of Peniche and Nazaré have become mediatic places for surfers worldwide.

Furthermore, the central region has also seen an increasing affluence of tourists to learn more about Portugal's history. Cities such as Batalha, Alcobaça or Coimbra are now looking for solutions to cope with unexpected growth in tourism activities (Guerreiro et al., 2016; Melo et al., 2021). In Aveiro, the stream that crosses the city is also a tourism attraction source, supporting the regional economy. This scenario does not come without environmental costs, including the contamination of Aveiro's stream. Moreover, the desertification process is felt in rural areas of the Centre region

inland due to inadequate spatial planning in managing natural forestry zones that complex the wildfire prevention structures. In this stance, this study aims to better understand how the POSEUR tackled these and other critical environmental sustainability policy areas to promote sustainable changes in the Centre NUT II of Portugal.

This study provides a novel perspective on the main impacts of the POSEUR in a specific EU region in five analytical dimensions, closely related to the POSEUR's three central intervention axes: 1) Low emissions economy, 2) Adaptation to Climate Change, 3) Risk Prevention and Management, 4) Environmental protection and 5) Resource efficiency. A Territorial Impact Assessment (TIA) methodology was used to assess the more significative impacts of the POSEUR in these five dimensions in the Central region of Portugal. The research team selected the TARGET_TIA (ESPON, 2012; Medeiros, 2020) methodology because of its reliability and flexibility. This TIA tool uses quantitative and qualitative data to produce impact scores in all policy evaluation phases, selected territorial scales and analytical dimensions.

From a methodological standpoint, qualitative data was obtained via interviews and a literature review. Quantitative data was collected via the POSEUR's project database and national statistics. For this article, the five interviewees were the APIN (Empresa Intermunicipal do Pinhal Interior), the Coordination Commission for the Regional Development of the Centre Region, the Beira Baixa Inter-municipal Community, the Coimbra Inter-municipal Community and INOVA (Empresa de Desenvolvimento Económico Social de Cantanhede). The crucial insight given by these groups, which had direct contact with the analysed Operational Programme, contributed to obtaining critical information on the POSEUR's relevance, effectiveness, efficiency, added value and causality. Moreover, the collected data is critical to provide sound guidance towards relevant policy recommendations for more effective and efficient implementation of a future similar Operational Programme in the region.

The structure of this article is divided into four sections. The following section discusses the state of the art of EU Cohesion Policy's impacts on EU Member States' environmental sustainability. In the following, the impact assessment methodology TARGET_TIA is explained, emphasising the concepts of regional sensibility, political intensity and causality. The subsequent section interprets the results and debates the significant impacts of POSEUR in the Portuguese Centre NUT II.

It is also essential to address the factors that contributed to the successful impact of some dimensions and the underachievement of others. Finally, a conclusion will be drawn based on the achieved policy impacts. These results bridge the literature gap on the POSEUR's role in promoting sound environmental sustainability processes in EU regions and informing the main regional actors in this policy field about the most complex barriers to increasing the efficiency and effectiveness of EU Cohesion Policy implementation.

2. LITERATURE REVIEW

The EU Cohesion Policy is the main mechanism to promote the 2030 Agenda's Sustainable Development Goals (Firoiu et al., 2022) for the different EU regions (Nekvasil & Moldan, 2018). The awareness of climate change and the adoption of greener behaviours in European areas depend greatly on the efficacy of implementing the projects funded by the EU Cohesion Policy (Pirvu et al., 2019). The Centre NUT II is an eloquent example of a region with strong potential for transitioning towards a more environmentally friendly circular economy with several mid-sized cities in the national context. These cities can work as hubs to bring people into new sectors of activity and raise the area's attractiveness (Henriques et al., 2022). Nonetheless, the growth of economic activities in the Portuguese centre NUT II must be balanced by ecosystem preservation, as the literature points out.

The propensity to wildfires in the Portuguese centre region (Vicente et al., 2012; Vieira et al., 2022), the escalating numbers of CO^2 emissions caused by industrial and agricultural activities (Marques et al., 2018; Gadelha et al., 2019) and the desertification effect, forces the regional stakeholders to apply a model of local governance appropriate to the region's environmental protection needs. The growing number of complaints about the environmental quality of some prominent cities of this NUT II (Carvalho & Fidélis, 2009) illustrate the importance of urban sustainability models to ensure these areas' long-term environmental and economic competitiveness (Esteves et al., 2017).

A dialogic dynamic is needed between the regional entities to follow the guidelines of the urban sustainability models created for the region (via the local plans for adaptation to climate change). A stakeholder cooperation platform is essential to provide adequate answers to the inhabitants' concerns (Fidelis & Pires, 2009; Dimitrov & Dimitrova, 2022).

The adoption of EU Cohesion Policy measures to close the gap between the mid-sized cities in the central region and the coastal cities of Lisbon and Porto have been one of the biggest regional public policy challenges that Portugal has faced in past years (Vinci, 2021). The state of the art on mid-sized city development points out the vital role of building a strategy sustained by smart infrastructural specialisation (Serbanica & Constantin, 2017), with particular emphasis on the capacity of the universities to lead the impetus of innovation (Fonseca & Salomaa, 2020). The Centre NUT II has a significant network of universities, composed mainly of the University of Coimbra, the University of Aveiro and the Polytechnic of Leiria, that can foster the technological spark in the region (Santos Ferreira & Santos, 2014; Cruz et al., 2017; Bona & Gomes, 2021; Fonseca & Cinar, 2017).

This innovation drive in urban areas is even more fundamental in crisis management (Camagni & Capello, 2017; Zimmerman & Atkinson, 2021) once the regional needs increase (Blazyca et al., 2002). Therefore, the rationale behind the measures adopted should follow a place-based approach to mitigate the impact of financial and economic crises (Mendez et al., 2021) and strengthen the credibility of the EU Cohesion Policy Programmes (Royuela & Bazo, 2020).

The development of these mid-sized cities towards peripheral areas represents another challenge to the territorial management of the central region of Portugal (Asefi, 2020). The rural areas surrounding the region's cities will demand broader policy integration between urban and rural activities from the local entities (Dax & Copus, 2018). Efficient integration of these areas is required to guarantee the long-term sustainability of the territory (Vasconcelos & Vasconcelos, 2017). Not only at the environmental level, but also in assuring the employability rates in the agricultural sector (Santos & Simões, 2013) and modernising the infrastructural living conditions of the population. In detail, the transitions in the peri-urban areas (Rauws & de Roo, 2011) must be articulated with resources such as spatial planning and close integrated monitoring (Banzhafet al., 2009) to provide the environmental protection of the region, one of Europe's pillars through the Natura 2000 network (Borre et al., 2011).

To better understand the ex-post impacts of the EU Cohesion Policy Programmes, there is a need to evaluate how they can penetrate and produce a significant positive change in the Member States' heterogeneous territories (Medeiros & Rauhut, D.,2020). Building an unbiased model that can equally evaluate environmental indicators in such a diverse policy implementation ecosystem is a complex task when looking at the different regions inside the EU (Medeiros et al., 2022). Consequently, the elaboration of impact assessment models is a field of literature that deserves more attention from academics and policymakers (Assumma et al., 2021).

The literature strongly tends to see impact assessment models as imperfect mechanisms that can contribute to undermining EU policies (Smith et al., 2010; Luccheta, 2012). However, evaluating the risks and impacts of these policies by TIA models has become the decision-makers' primary tool for implementing EU Cohesion Policy Programmes and projects (Radaelli et al., 2013). Likewise, several impact assessment models have emerged in Portugal in the last few years. Some with a national approach (Medeiros, 2014; Partidario & Monteiro, 2019; Coelho et al., 2022); others with a more regional approach (Stefanova et al., 2016; Morais et al., 2018; Valente & Medeiros, 2022). Both intend to better analyse the challenges posed by potential environmental risks, and contribute to providing stakeholders with critical information on attaining sustainable development goals.

The presented impact evaluation of the POSEUR action in the Portuguese Centre NUT II can contribute to solidifying the TARGET_TIA territorial assessment model as a coherent policy evaluation mechanism at the regional level, which inform policymakers about the region's needs to be addressed in future similar operational programmes.

3. METHODOLOGY

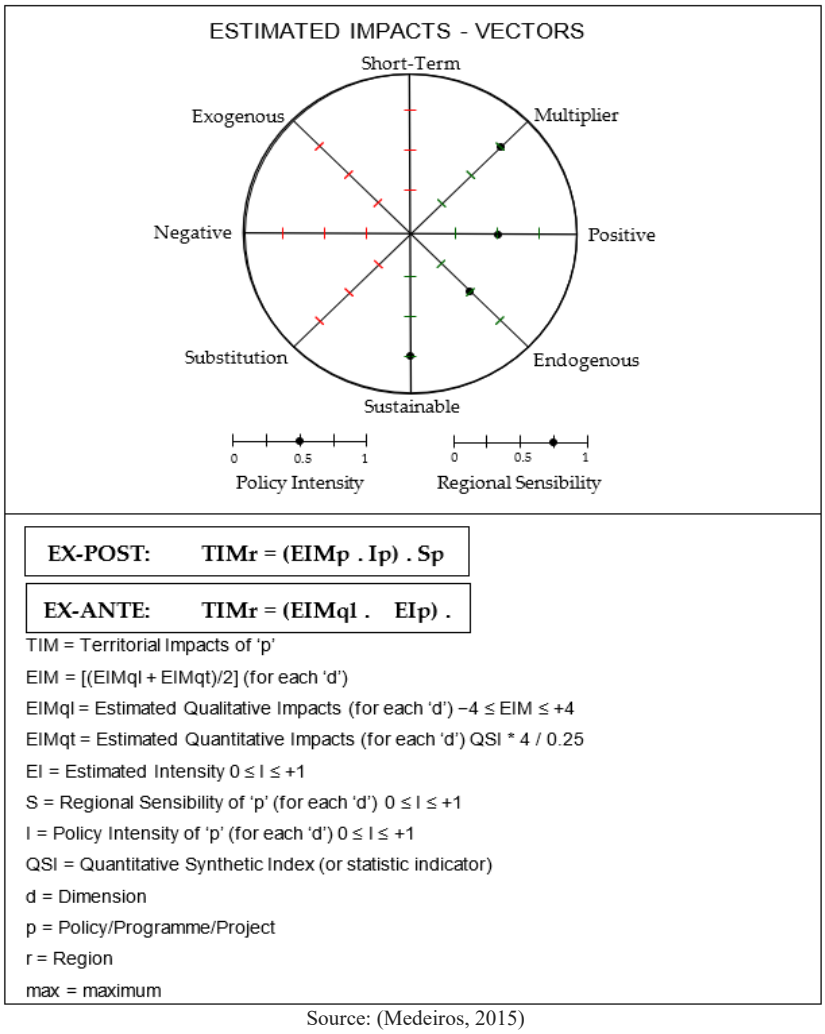
As previously stated, from a methodological standpoint, the analysis was supported by a mix of quantitative and qualitative data. The qualitative data was obtained through interviews with the five already mentioned regional entities and a literature review analysis, which helped to better

understand the region's environmental sustainability challenges and needs. Conversely, quantitative data from national statistics was used to verify the trends (causality) of key indicators related to each of the five selected analytical dimensions before (2013) and after (2021) the POSEUR was implemented. These sustainability indexes included data on the production of renewable energy in the region, the % of burnt area or the levels of waste collection. The heterogeneity of data collected between 2013 and 2021 aimed to mirror the diversity of dimensions analysed in this research.

This causality analysis was complemented by a project and literature analysis and the analysis of information collected via interviews. Moreover, the analysis of the regions sensibility to the POSEUR investments was supported by a literature review on the issues of the centre region before 2014. Here, the higher the need for environmental sustainability investments, the higher the score (from 0 to 1) was inputted in each analytical dimension. Finally, the POSEUR project database analysis helped to input an adequate score to the 'policy intensity' evaluation element. Here, the higher the share of the total financing for each analytical dimension, the higher the inputted score (from 0 to1) (Figure 1),

Finally, the project member who interviewed the five stakeholders proposed the selected values for inputted impact scores on each analytical dimension. The scores range from -4 (a very significant negative impact) to +4 (a very significant positive impact) for each analytical dimension. The overall impact resulted from the arithmetic average of these five scores. It should be noted that the analysis did not receive sufficiently robust data to input scores in the three TARGET_TIA counterfactual evaluation elements (see Figure 1). As such, similar values to the general Impact scores were inputted on the TARGET_TIA matrix, in each analytical dimension, for the counterfactual evaluation elements not to undermine the impact average. In this analysis, the TARGET_TIA model was used as an ex-post evaluation methodology, even though it can be used for ex-ante and mid-term policy evaluation phases.

Figure 1. TARGET_TIA ex-ante and ex-post formulas.



Source: (Medeiros, 2015)

3.1 Interview Structure

The interviews were conducted with five entities directly working on implementing projects related to or funded by POSEUR 2014-2020. As mentioned before, the interviewees were APIN (Empresa Intermunicipal do Pinhal Interior), the Coordination Commission for the Regional Development of the Centre Region (CCDR Centro), the Beira Baixa Inter-municipal Community, the Coimbra Inter-municipal Community and INOVA (Empresa de Desenvolvimento Económico Social de Cantanhede). The results by TARGET_TIA reflect the answers of these entities to a semi-structured interview script questions based on the perceptions (on a Likert scale) about the impact of POSEUR in the region, the visible changes in the region cohesion policy during 2014-2020, the goals of European policy for the region and the added value of POSEUR mechanisms to the NUTII. Each interviewed entity had room to classify these features from -4 to 4 in every question, requiring an extensive answer to legitimate the respective score.

4. RESULTS AND DISCUSSION

This section presents the results of the interviews and the indexes collected to this research as tables for all the five dimensions of analysis. The totals obtained and presented in this chapter are symptomatic of the general feeling of the interviewed entities, which showed their overall optimism about the European cohesion programmes. However, despite the positive feedback about POSEUR actions, the interviewed enterprises also emphasised the lack of effective results when looking at the development of the Center region from 2014 to 2020. The coefficients achieved through the formula presented in the methods section captured the perceptions and mixed feelings of the interviewed entities as accurately mirrored in the following tables and subsequent discussion.

Table 1 represents the TARGET_TIA matrix of the impact scores of the POSEUR in the Portuguese Centre NUT II. The interview results were based on the levels of specialisation of all the five entities interviewed. Therefore, the numbers displayed above represent an average based on the local, regional and national scales, depending on the area of activity of the interviewed entity. As can be seen, the average impact score of this Programme was 1.136. Hence, based on the collected information, the POSEUR produced a relatively low positive impact on the environmental sustainability process in the Portuguese Centre region. This impact was substantially positive in the 'adaptation to climate change' (3.5) and 'environmental protection' (2.5) analytical dimensions, and relatively reduced in other analytical dimensions, such as the 'low emission economy (0.375), and the 'risk prevention and management' (0.188).

Instead, Table 2 presents the distribution of the POSEUR funding for each analytical dimension as a means to analyse the Policy Intensity evaluation element of the TARGET_TIA. The following presents a deeper analysis of POSEUR's main impacts on each analytical dimension, primarily based on the information collected via interviews and literature review.

Table 1. POSEUR Evaluation Impact Matrix–NUTII Centre

Dimensions	Impact Scores (-4/+4)/Contrafactual					Tuning Elements (0–1) (0-1)		Causality—Territory Features (0–1)		Impact (score))
	Pos/Neg	End/ Exo	Sus/Cu r	Mul/ Sub	Mean	Int/Pol	Sen/Re g	2014	2020	(-4/+4)
Low Emission Economy	3	3	3	3	3	0,5	0,5	0,75	0,75	**0,375**
Adaptation to Climate Change	4	4	4	4	4	0,5	1	0,25	0,5	**3,500**
Risk Prevention and Management	3	3	3	3	3	0,25	0,5	0,25	0,25	**0,188**
Environmental Protection	3	3	3	3	3	0,5	0,75	0,25	0,5	**2,513**
Resource Efficiency	4	4	4	4	4	0,25	0,75	0,25	0,5	**1,313**
Total (Average)	3	3	3	3	3	0,5	0,5	0,75	0,75	**1.136**

Note: Pos/Neg: Positive vs Negative; End/Exo: Endogenous vs Exogenous; Sus/Sho: Sustainable vs Short-Term; Mul/Sub: Multiplier vs Substitution; Pol/Int: Policy Intensity; Reg/Sen: Regional Sensibility. Source: Own elaboration

Table 2. POSEUR investment in the Centre NUTII by analytical dimension (€)

Dimension	€
Low Emission Economy	12 998 911,00 €
Adaptation to Climate Change	46 053 367,00 €
Risk Prevention and Management	88 314 241,00 €
Environmental Protection	113 335 541,00 €
Resource Efficiency	264 210 828,00 €
Total	524 912 888,00 €

Source: own elaboration based on the Portugal 2020 project database.

4.1 Low emission economy

Regarding the low emission economy dimension, there were noticeable difficulties in achieving the expected POSEUR goals in the Centre region. The low positive impact score (0,375) illustrates the small influence that changes to promote a cleaner economy, such as implementing green hydrogen or replacing public transport with less pollutant vehicles, had in the territory. This moderate improvement has nothing to do with the projects' applications or with POSEUR's definition of the priority intervention axis. The initiatives tracked the region's sensitivity properly by taking advantage of the endogenous resources and tackling the depopulation trends by promoting new ways of public mobility (the ferry between São Jacinto and Forte da Barra is an example of those innovative measures).

The literature in the field has given relevance to the need to reduce CO^2 emissions in the Coimbra region (Prata et al., 2013; Diaset al, 2016; Torres et al., 2018). The worrying rise of pollutant emissions in the area (Ferreira et al., 2016) has contributed to the emergence of greener mobility solutions (Almeida et al., 2009). The CCDR Centro has mentioned the importance of the University of Aveiro in introducing a biking rent service. This system was complemented by an investment funded through regional programmes that materialised in constructing bike lanes connecting the diverse entrance points to the city's university (Frade et al., 2022).

The CCDR Centro also pointed out significant projects that aimed at replacing the energy systems in public buildings, such as the Portuguese Institute of Oncology in Coimbra or the University of Coimbra, with more energy-efficient lights and environmentally friendly roof covers. The Centre region requires the same measures to be implemented in residential buildings (Rossiet et al., 2012). However, the POSEUR funding does not include interventions in privately owned residential buildings in the policies implemented between 2014 and 2020.

The areas of intervention in the low-emission economy transition were managed effectively in the theoretical plan, which resulted in a low positive impact of these policies in the terrain. The INOVA association partially explained these bottlenecks in the EU cohesion policy action towards sustainable development. Following INOVA's position, the fluctuation of materials' prices and the need for more companies in the market interested in concluding these enterprises delayed the results. Besides that, the Coordination Commission for the Regional Development of the Centre Region (CCDR) included the short-term goals of the policies implemented as one of the reasons for such a discrete positive change in this analytical dimension. For the CCDR, creating awareness of the need to establish long-term policy goals to promote a desired structural change is essential.

4.2 Adaptation to Climate Change

The positive impacts of the POSEUR obtained in the adaptation to climate change dimension helped tackle the region's high sensitivity to policy interventions in this domain. The territorial needs of the Centre region were addressed by the POSEUR programme that financially incentivised the elaboration of inter-municipal plans covering pro-active measures to improve the region’s capacity to deal with climate change-related challenges (Braga et al., 2018). The most effective plans were drawn and implemented in the Coimbra region, Viseu Dão Lafões, Serra da Estrela and Leiria areas. The inter-municipal community of Coimbra and the Beira Baixa inter-municipal community mentioned the importance of these plans to adopt long-term solutions to face the obstacles to sustainability in the region.

The Centre of Portugal is affected by climate phenomena that undermine the region's natural resources. The coastal and river shore erosion (Fidélis & Carvalho, 2015), the rising sea levels, the high propensity to wildfires that have ravaged the area in the last decade (Oliveira et al., 2020) and the effects of tourism in hotspots such as Berlenga or Alcobaça (Guerreiro et al., 2016; Braga et al., 2018) contribute to the fragile sensitivity of the region.

Other projects were influential for the region to overcome the consequences of climate change, proving that there is no positive linear correlation between the level of investment (46 053 367 €) and the impact of POSEUR projects in each specific analytical dimension. The mapping of areas at risk due to water scarcity, rural desertification and soil erosion helped to widen the knowledge in the field about how smaller towns such as Vila Velha de Rodão can diminish the future impacts of environmental degradation.

The artificial insertion of sediments on the shores of Aveiro's stream, in the Vouga River, or the seaside towns of Figueira da Foz and Vagos (Zandvoort et al., 2017) have also represented a significant proportion of the investment made by POSEUR in this dimension. Critically, several municipalities have developed environmentally friendly sensibilisation initiatives to create awareness of the risks inherent to climate change in the Centre region. The CCDR Centre pointed out the effective communication between the Inter-municipal communities and the POSEUR leading structure. Furthermore, the Beira Baixa Inter-municipal Community gave relevance to the strict rules that POSEUR imposed on the public hiring process, which force the beneficiaries to comply with tight legislation that makes it more efficient to achieve the goals in this dimension.

4.3 Risk Prevention and Management

The POSEUR measures in this dimension are aimed at tackling structural risks of the region. As mentioned before, coastal erosion (Alves et al., 2007), wildfires (Fernandes et al., 2022), and the growing expansion of urban areas in the Centre of Portugal (Barros et al., 2021) are causes for concern for the local entities. Due to this regional sensitivity level, the POSEUR financed several projects dedicated to stabilising the slopes and dunes on the shores of Portuguese beaches in the central region.

Regarding the prevention of wildfire-related consequences, the POSEUR intervention financed the acquisition of vehicles for the firefighters, thus improving the firefighter's headquarters with new needed infrastructures and building new accesses to areas where the risk of wildfire is constant. As the Coimbra Inter-municipal Community pointed out, the invasion of the agricultural regions by the *Vespa velutina,* also known as the Asian predatory wasp, forced the POSEUR to channel investment to an unpredictable phenomenon that took funds initially devoted to other essential features of the region.

A clear example of an aspect addressed insufficiently by the EU Cohesion Policy was the pressure the growing urban areas put on the coastal peripheries. It would be helpful to assess how the pollution resulting from that demographic transition can impact the inhabitants' lives and population health in central Portugal.

The weak positive result in this dimension (0,188) can be associated with two essential factors. On the one hand, the diverse and heterogeneous composition of the territory makes it difficult for POSEUR to address the totality of the risks in the region. Issues such as the seismic risks in Leira (Blyth et al., 2020) and the pollution of the Aveiro stream (Pastorinhoet al., 2010) were not considered a priority for the programme. On the other hand, the most considerable portion of the total investment in this dimension (88 314 241€) went to wildfire control. The results of such investment will be noticed when there is a real urgency to tackle the expansion of wildfires. The new points of access to forestry areas and the acquisition of more efficient vehicles for the firefighters will be more significant once there is an urge to mitigate the effects of wildfire in the territory.

The local entities are still to recognise the efforts made by the POSEUR to implement new technologies to prevent forestry degradation. The addition of surveillance cameras in conservation areas made the Beira Baixa inter-municipal community and the Coordination Commission for the Regional Development of the Centre praise the action of POSEUR. However, the Coimbra inter-municipal community identified some obstacles to implementing projects in this realm of activity, such as the delay in contractualization with the beneficiaries. Giving the surveillance cameras system for environmental protection of Viseu Dão Lafões as an example, the Coimbra inter-municipal

community defends that if all the bureaucratic requirements were agreed upon sooner, the POSEUR would not have had projects being finished in 2022. The same situation applies to the Asian hornet contention projects. Here, retardation in launching special measures to tackle the *Vespa velutina* had severe consequences in preventing its invasion. As the Beira Baixa inter-municipal community indicates, despite the solid investment in controlling this exogenous phenomenon, the timing could be more appropriate if defined when the first reports of Asian hornets' appearance came to the public.

4.4 Environmental Protection

The POSEUR interventions had a tangible positive impact on the environmental protection dimension (2,513). This dimension is quite relevant for the Portuguese NUT II of the Centre, once sixteen per cent of its territory is protected under the Natura 2000 network framework. Under this scenario, these natural protected areas are fundamental for conserving the regions' biodiversity and are essential spaces for valorising endogenous natural resources (Lillebø et al., 2020). Besides that, the pollution of the shallow waters in this region (Pereira et al., 2009; Fidélis et al., 2019) can contribute to worsening living conditions in highly populated areas.

These rising pollution levels are partially explained by anthropogenic factors such as the industrial growth in the region, which is gradually expanding its activities to peripheral zones and applying pressure in typical rural areas. Lastly, tourism activity has experienced new dynamics in the Centre NUT II. For instance, Portuguese beaches started to feel a growing influx of surf-related tourism in the Peniche area (Springwald et al., 2020) and the surrounding territory (Oliveira et al., 2017).

To effectively promote the pre-existing natural resources and tackle the abovementioned issues, the POSEUR helped finance projects in the coastal and interior areas of Centre NUT II. In the coastal area, the most meaningful changes concerned the dredging of sand and sediments to reinforce the dune stability from Aveiro to Nazaré, which helped to re-establish the ecosystem balance lost due to the erosion and tourist influx. The surveillance tools used to monitor the Natura 2000 network were updated, which made some local entities mention the importance of the work done on protecting exotic species in their interviews (CIM Coimbra, CIM Beira Baixa).

In the interior, restoring former mine infrastructures that were dangerous for the region's sustainability helped protect the surrounding environment in Ribeira do Bôco, Picoto or Mortórios. Besides that, the creation of Ecocentros (Recycling innovative structures that facilitate the collection of bio and recyclable waste) allowed the population in smaller towns easy access to improved waste management mechanisms. The same can be said of the renewed water sanitation networks that have seen their system widening because of POSEUR action, emphasising the modifications made in the residual water treatment centres (ETARs).

The impact score achieved by the POSEUR for environmental protection amplifies the relative success of the beneficiary projects in the area. The INOVA association explained that the well-managed POSEUR team makes the application process flexible, contributing to the positive outcome of its actions. Moreover, the CCDR Centre explained that this flexibility was translated into various moments of informal and practical conversation between the beneficiaries and the POSEUR, which placed the local entities in a position to implement some of the measures proposed successfully.

4.5 Resource Efficiency

The impact score achieved in the Resource Efficiency dimension (1.313) was lower than expected by local entities implementing the POSEUR. The main reason for that was the relatively high share of investment allocated within the POSEUR funding in this dimension. When compared with the other dimensions (264 210 828€). The leading national water reservoirs are located in Centre NUT II. Simultaneously, the hydromineral resources in the area are fundamental to the region's development (Fidelis & Roebeling, 2014). The INOVA association noted that more effective modifications were executed throughout the water cycle. The association gave the Cantanhede water supply improvement as an example of the POSEUR activity. The water losses were reduced to 29%, better than the national average of around 40%. Cantanhede's water supply territorial coverage achieved numbers close to 100%.

Furthermore, the APIN association referred to the new residual water treatment stations created with the help of European funds as a source of significant social impact; otherwise, the inhabitants could not financially support the improvements in the sanitation systems. The waste collection network has also been improved to promote more effective circular economy dynamics in the region (Antunes et al.,2022). The INOVA association mentions the recently created stations of biowaste treatment as some of the best in Europe. The implementation of a hybrid system of waste collection that includes a door-to-door assemblage complemented by conventional garbage containers offers the population diverse recycling solutions. This improvement has visible effects on the cleaner urban areas of the centre region.

The other components which saw improvements as a result of the implementation of the POSEUR in this dimension included the promotion of renewable energies, following the EU guidelines towards increasing energy efficiency in public buildings (Gordo et al., 2011). The plans to build two hydrogen plants in Cadaval and Nazaré are still to be implemented, so their impact can only be evaluated once fully functional. Moreover, the Prio enterprise applied for POSEUR funding with a biomethane project that stuck to the bioenergy priorities in the region (Cardoso et al., 2019).

The energy efficiency enhancement in public buildings aims to reduce consumption and install more environmentally friendly materials in hospitals, universities and social services. Under the National Action Plan for Energy Efficiency (PNAEE), the goal was to reduce 25 per cent of primary energy consumption in such structures. According to the interviewees, the impact of the POSEUR was successful. The Portuguese Institute of Oncology in Coimbra is an example of the positive impact that POSEUR brought to energy efficiency in the region.

An honourable mention should also be given to the Metrobus Mondego project that promised to change the paradigm of public mobility in the Coimbra region, towards a more environmentally sustainable solution. The vast POSEUR investment allocated to this electric and sustainable transportation domain should continue in future regional, national and EU environmental sustainability Operational Programmes to benefit the region's sustainable development process. Ultimately, a significant reduction in the influx of motorised vehicles towards the main regional urban areas is expected, with positive consequences for diminishing CO^2 emissions.

5. CONCLUSION

The presented analysis intended to assess the main impacts of the POSEUR (2014-20) in five analytical dimensions: i) low-emissions economy, ii) adaptation to climate change, iii) risk prevention and management, iv) environmental protection, and v) resource efficiency. Based on the collected quantitative (project database + statistical indicators) and qualitative (interviews + literature review) data, applied to a TIA (TARGET_TIA) methodology, it was possible to conclude that the POSEUR had a low positive overall impact on the sustainable development process of the Portuguese Centre region (NUT II).

The results of this study follow a growing literature trend, concluding that there are high levels of ineffective and inefficient implementation of EU Cohesion Policy-related funding, which is especially visible in the southern peripheries of Europe (Polverari, 2016). A standard narrative legitimated by the outcomes achieved in this work points out the misallocation of EU funds (Medve-Bálint, 2018), which leads to low impact in the less developed areas of the peripheral Member States. This study corroborates the idea that more should be done to achieve high regional impact scores via implementing EU Cohesion Policy-related investment.

Policy implementation obstacles cannot, however, be reduced to funding misallocation. They also express governance and administrative capacity fragilities. In the case of the POSEUR, several implementation bottlenecks contributed to the overall low impact score, which was unfolded mainly by the interviews with the local stakeholders. These barriers to the POSEUR development can be divided into internal and external bottlenecks. The former concerns the stakeholders denominating the short-term goals policy, in which the POSEUR promoted funding to smaller projects.

At the same time, the structural issues of the region remained unsolved. Besides that, the timing of the call launching and the delay in signing the public contracts were internal obstacles that hindered the execution of the projects within the proposed deadlines. The latter is a result of the external conjuncture that directly affected the concretisation of some of the projects. The pandemic

quarantine that postponed the execution of the projects, the crisis related to the fluctuation of the prices, and the labour shortage that followed it did not help raise the Centre region POSEUR's impact score.

Nonetheless, the regional entities praised the POSEUR management and coordination commission due to the administrative flexibility presented through challenging times. This more flexible mechanism gave the beneficiaries new tools to keep their projects running, despite the internal and external barriers to EU Cohesion Policy initiatives.

Even if the results were not as positive as expected, given the high prior sensibility of the region, the POSEUR's interventions helped tackle some of the climate degradation dynamics in the Centre NUT II. Emphasis must be given to the projects integrated into the dimensions of adaptation to climate change and environmental protection. The effective action of the EU Cohesion Policy in these two dimensions is partially explained by the success of projects such as mapping and monitoring areas at desertification risk and reinforcing the NATURA 2000 network. These impact scores still have room to improve in subsequent Programme implementation phases, as the project of the Mondego Metrobus and new wildfire prevention mechanisms are still under development. Moreover, these projects had a significant amount of funding allocated. They promised to deliver a new paradigm of public mobility in Coimbra and a reduction in the wildfire damage in the region. At this point, it is still impossible to trace its impact with an ex-post impact assessment methodology.

EU Cohesion Policy established with the POSEUR in the Centre region of Portugal the sustainability foundations for the interventions of future environmental sustainability investments. The overall impact of the POSEUR was low positive. Consequently, future Programmes need a more efficient and effective implementation, and a broader adaptation to the regional environmental sustainability needs and challenges (the regional sensibility factor). In the case of the Portuguese Centre NUT II, the dominant role of the universities and the importance of urban sustainability management models that can tame the uncontrolled peri-urban expansion need further attention. Only by doing that can the mid-sized cities in the central Portuguese region improve their levels of regional development, by addressing their needs without producing environmental damage to the surrounding rural areas.

Additionally, future programmes need better monitoring and evaluation mechanisms that can effectively assess the main changes and impact resulting from implementing environmental sustainability-related public investment. EU Cohesion Policy still has a vital role in fomenting environmental sustainability processes in all EU regions- For that, however, it needs to strengthen its financial capacity in this domain to increase its positive impacts, in particular in the low emissions economy domain, towards the desired EU green and digital transition.

REFERENCES

Alves, F. L., Silva, C. P., & Pinto, P. (2007). The assessment of the coastal zone development at a regional level–the case study of Portugal central area. *Journal of Coastal Research*, SI 50 (Proceedings of the 9th International Coastal Symposium), 72-76. Gold Coast, Australia. ISSN 0749.0208

Antunes, J. C. C., Eugénio, T., & Branco, M. C. (2022). Circular Economy for Cities and Sustainable Development: The Case of the Portuguese City of Leiria. *Sustainability*, *14*(3), 1726. DOI:10.3390/su14031726

Asefi, S., Matias, J., & Gonçalves, C. (2020). Transitions between Centralization and Metapolization: From City Development Strategy (CDS) to Peri-Urban Development Strategy (PDS). *Sustainability*, *12*(24), 10653. DOI:10.3390/su122410653

Assumma, V., Datola, G., & Mondini, G. (2021). New Cohesion Policy 2021–2027: The Role of Indicators in the Assessment of the SDGs Targets Performance. *Computational Science and Its Applications – ICCSA 2021*, 614–625. DOI:10.1007/978-3-030-87007-2_44

Banzhaf, E., Grescho, V., & Kindler, A. (2009). Monitoring urban to peri-urban development with integrated remote sensing and GIS information: a Leipzig, Germany case study. *International Journal of Remote Sensing*, *30*(7), 1675–1696. DOI:10.1080/01431160802642297

Barros, J. L., Tavares, A. O., Monteiro, M., & Santos, P. P. (2018). Peri-urbanization and urbanization in Leiria city: The importance of a planning framework. *Sustainability*, *10*(7), 2501. DOI:10.3390/su10072501

Barros, J. L., Tavares, A. O., & Santos, P. P. (2021). Land use and land cover dynamics in Leiria City: relation between peri-urbanization processes and hydro-geomorphologic disasters. *Natural Hazards*, *106*(1), 757-784. DOI:10.1007/s11069-020-04490-y

Blazyca, G., Heffner, K., & Helińska-Hughes, E. (2002). Poland-can regional policy meet the challenge of regional problems? *European Urban and Regional Studies*, *9*(3), 263-276. DOI:10.1177/096977640200900305

Blyth, A., Di Napoli, B., Parisse, F., Namourah, Z., Anglade, E., Giatreli, A., Rodrigues, H. & Ferreira, T. M. (2020). Assessment and mitigation of seismic risk at the urban scale: an application to the historic city Centre of Leiria, Portugal. *Bulletin of Earthquake Engineering*, *18*(6), 2607-2634. DOI:10.1007/s10518-020-00795-2

Bona, S., & Gomes, R. (2021). Potential for the Use of Rainwater in Higher Education Institutions: A Case Study of Building D of Campus 2 of the Polytechnic of Leiria. *Springer EBooks*, 744–753. DOI:10.1007/978-3-030-75315-3_79

Vanden Borre, J., Paelinckx, D., Mücher, C. A., Kooistra, L., Haest, B., De Blust, G., & Schmidt, A. M. (2011). Integrating remote sensing in Natura 2000 habitat monitoring: Prospects on the way forward. *Journal for Nature Conservation*, *19*(2), 116–125. DOI:10.1016/j.jnc.2010.07.003

Braga, H. O., Pardal, M. A., & Azeiteiro, U. (2017). Incorporation of Local Ecological Knowledge (LEK) into Biodiversity Management and Climate Change Variability Scenarios for Threatened Fish Species and Fishing Communities—Communication Patterns Among BioResources Users as a Prerequisite for Co-management: A Case Study of Berlenga MNR, Portugal and Resex-Mar of Arraial do Cabo, RJ, Brazil. 237–262. DOI:10.1007/978-3-319-70066-3_16

Cardoso, J., Silva, V., & Eusébio, D. (2019). Techno-economic analysis of a biomass gasification power plant dealing with forestry residues blends for electricity production in Portugal. *Journal of Cleaner Production*, *212*, 741–753. DOI:10.1016/j.jclepro.2018.12.054

Carneiro, M. J., Breda, Z., & Cordeiro, C. (2016). Sports tourism development and destination sustainability: the case of the coastal area of the Aveiro region, Portugal. *Journal of Sport & Tourism*, *20*(3-4), 305–334. DOI:10.1080/14775085.2016.1220863

Camagni, R., & Capello, R. (2017). Rationale and design of EU cohesion policies in a period of crisis. In Seminal studies in regional and urban economics 345-372. *Springer eBooks*. DOI:10.1007/978-3-319-57807-1

Carvalho, D. S., & Fidélis, T. (2009). The perception of environmental quality in Aveiro, Portugal: a study of complaints on environmental issues submitted to the City Council. *Local Environment*, *14*(10), 939-961. DOI:10.1080/13549830903244425

Santos Coelho, R., Lopes, R., Coelho, P. S., Ramos, T. B., & Antunes, P. (2022). Participatory selection of indicators for water resources planning and strategic environmental assessment in Portugal. *Environmental Impact Assessment Review*, *92*, 106701. DOI:10.1016/j.eiar.2021.106701

Cruz, L., Barata, E., Ferreira, J. P., & Freire, F. (2017). Greening transportation and parking at University of Coimbra. *International Journal of Sustainability in Higher Education*, *18*(1), 23-38. DOI:10.1108/IJSHE-04-2015-0069

Darvas, Z., Mazza, J., & Midoes, C. (2019). How to improve European Union cohesion policy for the next decade. Policy Contribution Issue n˚ 8, 30670, May 2019. Bruegel.

Dax, T., & Copus, A. (2018). Towards vibrant, inclusive and sustainable rural regions: orientations for a future rural cohesion policy. *European Structural & Investment Funds Journal*, *6*(3), 198-209.

De Almeida, A. T., Inverno, C., & Santos, L. (2009). Integration of renewable energies for trolleybus and mini-bus lines in Coimbra. *World Electric Vehicle Journal*, *3*(4), 863-874. DOI:10.3390/wevj3040863

Di Caro, P., & Fratesi, U. (2022). One policy, different effects: Estimating the region-specific impacts of EU cohesion policy. *Journal of Regional Science*, *62*(1), 307-330. DOI:10.1111/jors.12566

Dias, D., Tchepel, O., & Antunes, A. P. (2016). Integrated modelling approach for the evaluation of low emission zones. *Journal of environmental management*, *177*, 253-263. DOI:10.1016/j.jenvman.2016.04.031

Dimitrov, S., & Dimitrova, T. (2022). Governance of Territorial Cohesion and Cooperation Policies (On the Example of Spain and Portugal). *International Journal of Economics, Management and Tourism*, *2*(1), 7-29. DOI:10.46763/ijemt2221057d

EC (2019) *A European Green Deal*. European Commission, Brussels

Esteves, T., Vaz, E., & Alves, F. L. (2017). Supporting policy development in the Aveiro region by modeling urban sustainability. *Public Policy Portuguese Journal*, *2*(2), 19-37.

Farinha, C. S., Caeiro, S. S., & Azeiteiro, U. (2020). Universities speak up regarding the implementation of sustainable development challenges: The case of Portugal. *International Journal of Sustainability in Higher Education. 21*(3), 465-506 DOI:10.1108/IJSHE-08-2019-0250

Fernandes, A. P., Lopes, D., Sorte, S., Monteiro, A., Gama, C., Reis, J., Menezes, I., Osswald, T., Borrego, C., Almeida, M., Ribeiro, L. M., Viegas, D., Miranda, A. I. (2022). Smoke emissions from the extreme wildfire events in central Portugal in October 2017. *International Journal of Wildland Fire*. *31*(11) 989-1001. DOI:10.1071/WF21097

Ferreira, A. J., Soares, D., Serrano, L., Walsh, R. P., Dias-Ferreira, C., & Ferreira, C. S. (2016). Roads as sources of heavy metals in urban areas. The Covões catchment experiment, Coimbra, Portugal. *Journal of Soils and Sediments*, *16*(11), 2622-2639. DOI:10.1007/s11368-016-1492-4

Fidelis, T., & Pires, S. M. (2009). Surrender or resistance to the implementation of Local Agenda 21 in Portugal: the challenges of local governance for sustainable development. *Journal of Environmental Planning and Management*, *52*(4), 497-518. DOI:10.1080/09640560902868363

Fidelis, T., & Roebeling, P. (2014). Water resources and land use planning systems in Portugal—Exploring better synergies through Ria de Aveiro. *Land use policy*, *39*, 84-95. DOI:10.1016/j.landusepol.2014.03.010

Fidélis, T., & Carvalho, T. (2015). Estuary planning and management: the case of Vouga Estuary (Ria de Aveiro), Portugal. *Journal of Environmental Planning and Management*, *58*(7), 1173-1195. DOI:10.1080/09640568.2014.918874

Fidélis, T., Teles, F., Roebeling, P., & Riazi, F. (2019). Governance for Sustainability of Estuarine Areas — Assessing Alternative Models Using the Case of Ria de Aveiro, Portugal. *Water*, *11*(4), 846. DOI:10.3390/w11040846

Firoiu, D., Ionescu, G. H., Pîrvu, R., Bădîrcea, R., & Patrichi, I. C. (2022). Achievement of the sustainable development goals (SDG) in Portugal and forecast of key indicators until 2030. *Technological and Economic Development of Economy*, 1-35. DOI:10.3846/tede.2022.17645

Fonseca, L., & Cinar, R. (2017). Engaged and Innovative Universities in Less-Developed Regions: The Case of the University of Aveiro. (RUNIN Working Paper Series; Vol. 2017/01). DOI:10.3990/4.2535-5686.2017.01

Fonseca, L., & Salomaa, M. (2020). Entrepreneurial universities and regional innovation: matching smart specialisation strategies to regional needs?. In Examining the Role of Entrepreneurial Universities in Regional Development. 260-285. *IGI Global*. DOI:10.4018/978-1-7998-0174-0.ch014

Frade, I., Ribeiro, A., Dias, D., & Tchepel, O. (2022). Bike sharing systems implementation impact on emissions, for cyclist preferred routes in urban areas. *International Journal of Sustainable Transportation*, *16*(10), 901-909. DOI:10.1080/15568318.2021.1949076

Gadelha, J. R., Rocha, A. C., Camacho, C., Eljarrat, E., Peris, A., Aminot, Y., et al. (2019). Persistent and emerging pollutants assessment on aquaculture oysters (Crassostrea gigas) from NW Portuguese coast (Ria De Aveiro). *Science of the Total Environment*, *666*, 731-742. DOI:10.1016/j.scitotenv.2019.02.280

Gordo, E., Campos, A., & Coelho, D. (2011). Energy efficiency in a hospital building case study: Hospitais da universidade de Coimbra. In *Proceedings of the 2011 3rd International Youth Conference on Energetics.* 1-6. IEEE.

Guerreiro, A., Maduro, A., & Gonçalves, E. (2016). The Alternative Path of Strategic Tourism for Alcobaça: Legacy and Sustainability. In *Tourism and History World Heritage–Case Studies of Ibero-American Space*, 16-38. Interdisciplinary Centre of Social Sciences – University of Minho (CICS.NOVA.UMinho)

Henriques, C., Viseu, C., Trigo, A., Gouveia, M., & Amaro, A. (2022). How Efficient Is the Cohesion Policy in Supporting Small and Mid-Sized Enterprises in the Transition to a Low-Carbon Economy?. *Sustainability*, *14*(9), 5317. DOI:10.3390/su14095317

Keeble, B. R. (1988). The Brundtland Report: "Our Common Future." *Medicine and War*, *4*(1), 17–25. DOI:10.1080/07488008808408783

Lillebø, A.I. *et al.* (2020). Mitigating Negative Unintended Impacts on Biodiversity in the Natura 2000 Vouga Estuary (Ria de Aveiro, Portugal). In: O'Higgins, T., Lago, M., DeWitt, T. (eds) Ecosystem-Based Management, Ecosystem Services and Aquatic Biodiversity . Springer, Cham. DOI:10.1007/978-3-030-45843-0_24

Luchetta, G. (2012). Impact Assessment and the Policy Cycle in the EU. *European Journal of Risk Regulation, 3*, 561 - 575. DOI:10.1017/S1867299X00002476

Marques, F. J., Pedroso, V., Trindade, H., & Pereira, J. L. (2018). Impact of vineyard cover cropping on carbon dioxide and nitrous oxide emissions in Portugal. *Atmospheric Pollution Research*, *9*(1), 105-111. DOI:10.1016/j.apr.2017.07.006

Medeiros, E. (2014). Assessing territorial impacts of the EU Cohesion Policy: The Portuguese case. *European Planning Studies*, *22*(9), 1960-1988. DOI:10.1080/09654313.2013.813910

Medeiros, E., & Rauhut, D. (2020). Territorial Cohesion Cities: a policy recipe for achieving Territorial Cohesion? *Regional Studies*, *54*(1), 120-128. DOI:10.1080/00343404.2018.1548764

Medeiros. E., Zaucha, J. & Ciołek, D. (2022) Measuring Territorial Cohesion trends in Europe. A correlation with EU Cohesion Policy, *European Planning Studies*, *31*(9), 1868-1884. DOI:10.1080/09654313.2022.2143713

Medve-Bálint, G. (2018). The cohesion policy on the EU's Eastern and Southern periphery: Misallocated funds?. *Studies in Comparative International Development*, *53*(2), 218-238. DOI:10.1007/s12116-018-9265-2

Melo, R., Andrade, C. S., Rheenen, D. V., & Sobry, C. (2021). Portugal: Small Scale Sport Tourism Events and Local Sustainable Development. The Case of the III Running Wonders Coimbra. In *Small Scale Sport Tourism Events and Local Sustainable Development*. 173-190. Springer, Cham. DOI:10.1007/978-3-030-62919-9

Mendez, C., Van Der Zwet, A., & Borkowska-Waszak, S. (2021). Rescaling urban development policy in the EU: the impact of integrated place-based approaches in Cohesion Policy. *Regional Studies*, *55*(6), 1154-1165. DOI:10.1080/00343404.2021.1891215

Morais, T. G., Silva, C., Jebari, A., Álvaro-Fuentes, J., Domingos, T., & Teixeira, R. F. (2018). A proposal for using process-based soil models for land use Life cycle impact assessment: Application to Alentejo, Portugal. *Journal of Cleaner Production*, *192*, 864-876. DOI:10.1016/j.jclepro.2018.05.061

Nekvasil, M., & Moldan, B. (2018). Could Cohesion Policy push EU climate efforts?. *Climate Policy*, *18*(1), 129-139. DOI:10.1080/14693062.2016.1251878

Oliveira, M., Delerue-Matos, C., Pereira, M. C., & Morais, S. (2020). Environmental particulate matter levels during 2017 large forest fires and megafires in the Centre region of Portugal: A public health concern?. *International journal of environmental research and public health*, *17*(3), 1032. DOI:10.3390/ijerph17031032

Partidario, M. R., & Monteiro, M. B. (2019). Strategic environmental assessment effectiveness in Portugal. *Impact Assessment and Project Appraisal*, *37*(3-4), 247-265. DOI:10.1080/14615517.2018.1558746

Pastorinho, M. R., Telfer, T. C., & Soares, A. M. V. M. (2010). Heavy metals in urban channel sediments of Aveiro City, Portugal. *Interdisciplinary studies on environmental chemistry-biological Responses to Contaminants*, 197-204.

Percoco, M. (2017). Impact of European Cohesion Policy on regional growth: does local economic structure matter?. *Regional Studies*, *51*(6), 833-843. DOI:10.1080/00343404.2016.1213382

Pereira, M. E., Lillebø, A. I., Pato, P., Válega, M., Coelho, J. P., Lopes, C. B. et al. (2009). Mercury pollution in Ria de Aveiro (Portugal): a review of the system assessment. *Environmental monitoring and assessment*, *155*(1), 39-49. DOI:10.1007/s10661-008-0416-1

Pereira, C., & Coelho, C. (2013). Mapping erosion risk under different scenarios of climate change for Aveiro coast, Portugal. *Natural Hazards*, *69*(1), 1033-1050. DOI:10.1007/s11069-013-0748-1

Pîrvu, R., Drăgan, C., Axinte, G., Dinulescu, S., Lupăncescu, M., & Găină, A. (2019). The impact of the implementation of Cohesion Policy on the sustainable development of EU countries. *Sustainability*, *11*(15), 4173. DOI:10.3390/su11154173

Polverari, L. (2016). Cohesion policy in the southern periphery. In Handbook on Cohesion Policy in the EU. Cheltenham, UK: Edward Elgar Publishing. DOI:10.4337/9781784715670.00030

Prata, J., Arsenio, E., & Pontes, J. P. (2013). Moving towards the sustainable city: The role of electric vehicles, renewable energy and energy efficiency. *WIT Transactions on Ecology and the Environment*, *179*, 871-883. DOI:10.2495/SC130742

Radaelli, C. M., Dunlop, C. A., & Fritsch, O. (2013). Narrating impact assessment in the European Union. *European Political Science*, *12*, 500-521. DOI:10.1057/eps.2013.26

Rauws, W. S., & de Roo, G. (2011). Exploring transitions in the peri-urban area. *Planning Theory & Practice*, *12*(2), 269-284. DOI:10.1080/14649357.2011.581025

Rossi, B., Marique, A. F., & Reiter, S. (2012). Life-cycle assessment of residential buildings in three different European locations, case study. *Building and Environment*, *51*, 402-407. DOI:10.1016/j.buildenv.2011.11.002

Royuela, V., & López-Bazo, E. (2020). Understanding the process of creation of European identity – the role of Cohesion Policy. *Investigaciones Regionales - Journal of Regional Research*, *46*(1), 51-70.

Santos, E., & Simões, M. C. (2013). The economic importance of agriculture in Portugal: a recent period. In *Agriculture in Serbia and Portugal: Recent developments and economic policy implications*, 7-42. DOI:10.4074/S1966960714014027

Santos Ferreira, V. H., & Santos, A. (2014). The impact of knowledge management in innovation performance in the Leiria region. In European Conference on Intangibles and Intellectual Capital. 24. Academic Conferences International Limited

Serbanica, C., & Constantin, D. L. (2017). Sustainable cities in central and eastern European countries. Moving towards smart specialization. *Habitat International*, *68*, 55-63. DOI:10.1016/j.habitatint.2017.03.005

Smith, K., Fooks, G., Collin, J., Weishaar, H. & Gilmore, A. (2010) Is the increasing policy use of Impact Assessment in Europe likely to undermine efforts to achieve healthy public policy? *Journal of Epidemiology & Community Health*, *64*, 478-487. DOI:10.1136/jech.2009.094300

Springwald, S., Jorgeb, J. P., Ramosc, D., & Vianad, A. S. (2020). Environmental awareness of surf tourists: the case study of Peniche, Portugal. *Proceedings Book*, 302.

Stefanova, A., Krysanova, V., Hesse, C., & Lillebø, A. I. (2015). Climate change impact assessment on water inflow to a coastal lagoon: the Ria de Aveiro watershed, Portugal. *Hydrological sciences journal*, *60*(5), 929-948. DOI:10.1080/02626667.2014.983518

Torres, P., Ferreira, J., Monteiro, A., Costa, S., Pereira, M. C., Madureira, J. et al. (2018). Air pollution: A public health approach for Portugal. *Science of the total environment*, *643*, 1041-1053. DOI:10.1016/j.scitotenv.2018.06.281

UN (2016) *Transforming Our World: The 2030 Agenda for Sustainable Development*. United Nations, New York.

Valente, B., & Medeiros, E. (2022). The Impacts of EU Cohesion Policy on Sustainable Tourism: The Case of POSEUR in Algarve. *Sustainability*, *14*(19), 12672. DOI:10.3390/su141912672

Vasconcelos, P. A., & Vasconcelos, P. S. (2017). Strategic Management Of Degraded Areas Recovery: Public Policy And Social Function Of Rural Properties. *Business Management Dynamics*, *7*(6), 1.

Vasta, A., Figueiredo, E., Valente, S., Vihinen, H., & Nieto-Romero, M. (2019). Place-based policies for sustainability and rural development: the case of a Portuguese village "Spun" in traditional linen. *Social Sciences*, *8*(10), 289. DOI:10.3390/socsci8100289

Vicente, A., Alves, C., Monteiro, C., Nunes, T., Mirante, F., Cerqueira, M., et al. (2012). Organic speciation of aerosols from wildfires in central Portugal during summer 2009. *Atmospheric environment*, *57*, 186-196. DOI:10.1016/j.atmosenv.2012.04.030

Vieira, A. M. D., Vaňková, M., Campos, I., Trubač, J., Baieta, R., & Mihaljevič, M. (2022). Estimation of mercury emissions from the forest floor of a pine plantation during a wildfire in central Portugal. *Environmental Monitoring and Assessment*, *194*(10), 1-12. DOI:10.1007/s10661-022-10436-7.

Vinci, I. (2021) Cities and regional disparities in the European Union: evolving geographies and challenges for Cohesion Policy. *Urban Research & Practice*, *14*(4), 350-371. DOI:10.1080/17535069.2021.1958252

Zandvoort, M., Campos, I. S., Vizinho, A., Penha-Lopes, G., Lorencová, E. K., van der Brugge, R., et al. (2017). Adaptation pathways in planning for uncertain climate change: Applications in

Portugal, the Czech Republic and the Netherlands. *Environmental Science & Policy*, *78*, 18-26. DOI:10.1016/j.envsci.2017.08.017

Zimmermann, K., & Atkinson, R. (2021). Urban policy in European Cohesion policy. In *EU Cohesion Policy and Spatial Governance* (pp. 83-97). Edward Elga

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