



**EvEUCoP 2022**

**Evaluating challenges in the implementation of EU Cohesion Policy**

# **Booklet of Abstracts**

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The workshop takes place as part of a scientific research project that aims to develop an innovative methodology to support the monitoring and evaluation of the implementation of programs around three major thematic axes: **Research and Innovation; Low carbon economy; and Information & Communication Technologies.** This project is co-financed by the European Regional Development Fund (ERDF) through the Portugal 2020 Partnership Agreement – Technical Assistance Operational Programme (POAT 2020) under the POAT-01-6177-ERDF-000044 ADEPT: Evaluation of Co-Financed Intervention Policies in Enterprises.



*Coimbra Business School/ISCAC*



*Institute for Systems Engineering and Computers at Coimbra*

## **Workshop Overview**

The European Union (EU) cohesion policy aims at attaining the convergence of economic, social, and territorial cohesion across EU Member States (MS). The funds dedicated to the EU cohesion policy constitute the second-highest group of expenditures in the EU budget. Therefore, the evaluation of their implementation assumes a prominent role in cohesion policy formulation because it helps supporting policy design, also providing sound evidence on the results and impacts of the actions undertaken. During the 2014-2020 programming period, MS became obligated (for the first time) to conduct evaluations to appraise the effectiveness, efficiency, and impact of each programme's objective. These rules apply to the European Regional Development Fund, the European Social Fund and the Cohesion Fund.

Most of these assessments are focused on implementation matters and evaluate progress regarding targets achievement, being mainly concerned with the alignment of the projects and actions with the programmes' objectives as well as with the effectiveness and efficiency of their implementation. These evaluations also focus on whether the existing funding is spent or not and if the targets established, particularly those of the performance framework, are achieved. The impact assessments are performed later in the programme cycle when most actions already took place and have also generated impacts.

This workshop aims at bringing together scientists, policymakers, managing authorities, evaluation experts, academics, and other stakeholders, to share recent research, stimulate discussion and disclose new research directions regarding the use of models and methods to address the challenges arising in the evaluation of the EU cohesion policy.

Contributions to the workshop are expected to cover a wide range of topics including (but not limited to) the monitoring data; the clearness of indicators in measuring the impact of interventions; evaluation methods; case studies and applications on evaluations of the thematic objectives under scrutiny of the cohesion policy, namely:

- Research, Technological Development and Innovation;
- Information and Communication Technologies;
- Competitiveness of Small Medium-Sized Enterprises;
- Shift towards a low-carbon economy;
- Climate change adaptation, risk prevention and management;
- Preserving and protecting the environment and promoting resource efficiency;
- Sustainable transport and key network infrastructures;
- Employment and labour mobility;
- Social Inclusion, combating poverty and any discrimination;
- Education, training and vocational training for skills and lifelong learning;
- Enhancing Institutional Capacity of public authorities and stakeholders and efficient public administration.

## **Keynote Speaker**

Anabela M. Santos

European Commission, Joint Research Center, Seville, Spain



Anabela M. Santos is an Economic Analyst at Joint Research Center - European Commission and an Expert in Innovation and Regional policy evaluation.

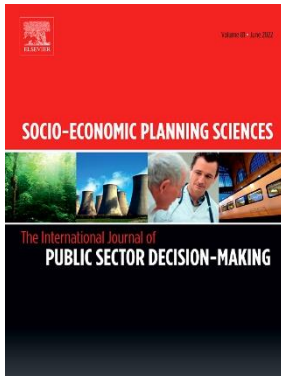
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Sérgio Pereira dos Santos (Faculty of Economics, University of Algarve)  
Teresa Cardoso Grilo (Department of Marketing, Operations and General Management ISCTE Business School )

## Publication Opportunities



A Special Issue on Socio-Economic Planning Sciences (**Special Issue on Evaluating Challenges in the Implementation of EU Cohesion Policy - Call for papers - Socio-Economic Planning Sciences - Journal - Elsevier**) will be organized devoted to the best contributions presented at EvEUCoP 2022. Authors will be invited to submit their contributions to the Special Issue based on the abstracts and the presentation at the EVEUCoP2022. All submitted abstracts will be considered for this Special Journal Issue. The paper choice will be conducted throughout the peer review procedure as well as at the workshop presentation phase. Submitted papers should

not be under consideration by any other journal or publication and will be subject to a review procedure according to the Journal guidelines.

A book of proceedings is also under preparation and will be submitted to Springer.

## **Programme Outline**

### **Wednesday, July 6 (Lisbon time)**

09:15-09:30	Opening Session
09:30-10:30	Plenary Session
10:30-10:45	Coffee-Break
10:45-12:45	Session A
12:45-14:00	Lunch
14:00-16:00	Session B
16:00-16:15	Coffee-Break
16:15-18:15	Parallel Sessions C
18:15-18:30	Closing Session

## Wednesday, July 6 (Lisbon time)

- 09:00-09:30 Opening Session (Link [here](#)) Zoom ID: 873 6296 6483; Password: 347557
- 09:30-10:30 Plenary Session (Link [here](#)) Zoom ID: 873 6296 6483; Password: 347557  
Chair – Carla Henriques  
MONITORING AND EVALUATION OF INNOVATION POLICY FOR SUSTAINABILITY: NEW DATA, INDICATORS AND CONCEPTUAL FRAMEWORK  
Anabela M. Santos, European Commission, Joint Research Center, Seville, Spain
- 10:30-10:45 Coffee-break
- 10:45-12:45 Session A

**Session A (Link [here](#))** Zoom ID: 873 6296 6483; Password: 347557

### Impact Assessment

Chair – Anabela Marques

ASSESSING THE IMPACT OF EU STRUCTURAL FUNDS: WHICH FUNDS ARE MORE EFFECTIVE IN SUPPORTING REGIONAL PRODUCTIVITY?

Ilias Kostarakos, Anabela Marques-Santos and Andrea Conte

TRICKLE DOWN FROM THE CORE, OR SPILLOVERS FROM THE PERIPHERY? THE EQUITY-EFFICIENCY TRADE-OFF OF THE EUROPEAN COHESION POLICY

Francesca Crucitti, Javier Barbero, Nicholas Lazarou, Philippe Monfort and Simone Salotti

ACTIVE LABOUR MARKET POLICIES IN FLANDERS. EVALUATION OF THE ESF “WORK EXPERIENCE FOR YOUNG PERSONS

Giulia Canzian, Elena Meroni and Giulia Santangelo

FIRM COMPETITIVENESS, SPECIALIZATION, AND EMPLOYMENT GROWTH: TERRITORIAL LEVEL RELATIONSHIPS

Federico Fantechi and Ugo Fratesi

EU COHESION POLICY IMPLEMENTATION IN POLAND – RANKING REGIONS USING MULTI-CRITERIA METHODS

Dorota Górecka

12:45-14:00 Lunch

14:00-16:00 Session B



**Session B (Link [here](#))** Zoom ID: 873 6296 6483; Password: 347557

**Low-Carbon Economy**

Chair - Chiara D'Alpaos

**DO REDISTRIBUTIVE EFFECTS OF INCENTIVES TO BUILDINGS ENERGY RETROFITTING  
HAMPER FUEL POVERTY REDUCTION IN PUBLIC HOUSING?**

Chiara D'Alpaos and Paola Valbonesi

**SMART AND SUSTAINABLE SCHEDULING OF CHARGING EVENTS FOR ELECTRIC BUSES**

Padraigh Jarvis, Laura Climent and Alejandro Arbelaez

**MULTIPLE IMPACTS OF ENERGY EFFICIENCY TECHNOLOGIES IN PORTUGAL**

Marcos Tenente, Carla Henriques, Álvaro Gomes, Patrícia Silva and António Trigo

**THE DEPLOYMENT OF CARBON CAPTURE, UTILIZATION AND STORAGE IN ENERGY  
INTENSIVE INDUSTRIES: COST ESTIMATION ANALYSIS FOR EUROPE, CHINA, AND INDIA**

Vivek Kumar Singh and Carla Oliveira Henriques

16:00-16:15            Coffee-break

16:15-18:15           Parallel Sessions C

**Parallel Sessions C**

**DEA as a tool for assessment – [Link here](#)**

Zoom ID: 873 6296 6483; Password: 347557

**Case studies – [Link here](#)**

Zoom ID: 863 4314 3456; Password: 489218

Chair – Ana Amaro

Session C.1

ASSESSING THE APPLICATION OF ERDF FUNDS DEVOTED TO A LOW CARBON-ECONOMY IN SMEs

Carla Henriques, Clara Viseu, António Trigo, Maria Gouveia, Ana Amaro

EVALUATING THE IMPLEMENTATION OF STRUCTURAL FUNDS DEDICATED TO FOSTERING INNOVATION IN SMEs

Carla Henriques, Clara Viseu, António Trigo, Maria Gouveia, Ana Amaro

HOW EFFICIENT IS THE IMPLEMENTATION OF STRUCTURAL FUNDS COMMITTED TO ENHANCING ICT ADOPTION IN SMES?

Carla Henriques, Clara Viseu, António Trigo, Maria Gouveia, Ana Amaro

IS THE COHESION POLICY EFFICIENT IN SUPPORTING THE TRANSITION TO A LOW-CARBON ECONOMY?

Maria Gouveia, Carla Henriques, Clara Viseu, Ana Amaro, António Trigo

18:15-18:30

Closing Session ([Link here](#)) Zoom ID: 873 6296 6483; Password: 347557

Chair - Gabriela Neagu

Session C.2

THE YOUTH GUARANTEE IN EASTERN EUROPE. A SYSTEMATIC REVIEW

Gabriela Neagu

THE SUSTAINABILITY AND ACCOUNTABILITY REPORT IN PUBLIC UNIVERSITIES IN PORTUGAL

Maria da Conceição da Costa Marques

EUROPEAN STRUCTURAL AND INVESTMENT FUNDS 2021-2027: PREDICTION ANALYSIS BASED ON MACHINE LEARNING MODELS

Victor Santos

TECHNOLOGY SERVING JUSTICE

Ana Paula Lopes

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## **Monitoring and Evaluation of Innovation Policy for Sustainability: New Data, Indicators and Conceptual Framework**

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**Keywords:** Innovation; Sustainability; Policy Monitoring and Evaluation.

**Disclaimer:** The views expressed are purely those of the author and may not in any circumstances be regarded as stating an official position of the European Commission

**Abstract:** We are living in exceptional times, exposed to an ecological emergency. Climate change is one of the biggest challenges of the century, with effects on environmental ecosystems, population health, socio and economic development. Innovation is seen as an important driver for the development of new technologies to support climate change mitigation; and public policy is crucial to provide effective incentives for this pathway. Adding a directionality to innovation policy makes its design, monitoring and evaluation more complex and challenging. New data, indicators and methods are required. It implies to move from a traditional approach to other methods more inclusive and participative. It also involves to add other evaluation criteria (e.g. equity and acceptability) and in addition to the traditional ones (relevance, coherence, efficiency, effectiveness, utility and sustainability).

Based on the literature on transformative innovation policy, the paper aims to describe a conceptual framework for the monitoring and evaluation of innovation policy for sustainability, as well as, to illustrate how the use of big data can generate new indicators to support monitoring and evaluation.

Findings reveal that monitoring and evaluation of innovation policy for sustainability should not be static and linear, but should follow a dynamic, interactive and flexible approach. It should follow a holistic and multi-level perspective, starting at projects level, moving to programme and then assessing changes in the whole territorial ecosystem. Monitoring should also differ in terms of scope and dimensions of analysis. For instance, instead of monitoring achievements, measured by indicators associated with subsidized beneficiaries, it should focus on the monitoring of outcomes and net impacts. Furthermore, it should also screen the spillovers at the territorial level to assess not only the desired effects but also the non-desired effects. Such concepts are also associated with policy footprint. The evaluation framework should be based on a more continuous process, and to go hand in hand with the evaluation of investment projects to be implemented in the territory. Inputs of the policy/programme include not only funding opportunities but also the multi-level governance, policy-mix, and stakeholders' involvement.

The paper contributes to the literature on policy evaluation and aims to support the policy-decision making process to be more effective in a context of post-pandemic recovery and transition to a climate neutral economy. Gaining a better “real-time” understanding of the impact of R&D and innovation (R&I) funds seems a highly relevant issue, especially when in 2021-2027 EU Member States will have more than double the amount of EU funds available (coming from Cohesion policy and Next Generation EU) to enhance R&I knowledge than in previous programming period.

## **Assessing the impact of EU Structural Funds: Which funds are more effective in supporting regional productivity?**

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**Keywords:** EU funds; Productivity; Long-run effects; Heterogeneous panels; Common factors.

**Disclaimer:** The views expressed are purely those of the author and may not in any circumstances be regarded as stating an official position of the European Commission

**Abstract:** The European Structural and Investment (ESI) funds were designed to support the economic development and convergence of EU Member States. Over the last decades, many scholars<sup>1</sup> have assessed the socio-economic effects of EU funds. However, there are issues that have received little attention, like the heterogeneous impact of the ESI funds and the potential complementarities between the various funds. The present paper aims to fill this gap by estimating regional-level effects of different ESI funds on economic performance, utilizing a novel dataset of EU fund payments that covers more than 30 years, available from the Cohesion data Portal. The analysis is based on recently developed panel time series econometric techniques that are able to address a number of methodological issues that have already been identified in the literature. In particular, the empirical approach builds on the unobserved common factor framework while the estimation approach is conducted using the so-called common correlated effects estimators (see Pesaran (2006)<sup>2</sup>). These estimators allow for the identification of heterogeneous, region-specific effects of EU funds on economic performance. Additionally, they allow for the incorporation of both large, global shocks (akin to the recent Global Financial Crisis of 2008 and the novel Covid-19 pandemic) as well as more localized, spatial effects (e.g. in the form of spillovers or effects stemming from geographical proximity etc.). Finally, the issue of (the various forms of) endogeneity –a focal point in the relevant empirical literature– is readily addressed within this framework. Another novel approach undertaken in this paper is that we also focus on both growth and level effects of the EU funds; that is, we examine whether they can alter the long-run growth trajectory of the regions or if they lead to an increase of the regional output levels. Our preliminary results indicate that, for the panel as a whole, EU policy has had a positive and statistically significant impact; that is, it significantly and positively contributed to the economic performance of EU regions. On the region-specific level, although the impact varies, the vast majority of the EU regions were positively affected by the EU funds expenditures

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<sup>1</sup> See for example Pienkowski and Berkowitz (2015), Dall'Erba and Fang (2017) for a survey of the literature.

<sup>2</sup> Pesaran, M. H. (2006). "Estimation and Inference in Large Heterogeneous Panels with a Multifactor Error Structure", *Econometrica*, 74(4):967-1012

## **Trickle Down from the Core, or Spillovers from the Periphery? The Equity-efficiency Trade-off of the European Cohesion Policy**

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**Keywords:** Cohesion Policy, General Equilibrium, Spillovers

**Abstract:** The aim of the European Union's (EU) Cohesion policy is to reduce disparities between the levels of development of the various regions and the backwardness of the least favoured regions in order to promote its overall harmonious development. While the Cohesion policy investments could specifically target the less developed regions with the purpose of reducing disparities, this may come at the expense of investing in other regions in which the returns could be potentially higher and more beneficial for the country as a whole. This opportunity cost is referred to in the literature as the equity-efficiency trade-off. In this paper we investigate the presence of this trade-off within nine peripheral EU Member States that are net recipients of Cohesion policy funds. We use a spatial dynamic general equilibrium model calibrated for all the NUTS 2 regions of the EU to simulate the impact of a suite of €100 million investments in 105 regions comprising the nine countries. The investments cover the scope of Cohesion policy by targeting public and transport infrastructure, aid to firms, and labour market interventions. We obtain the combination of region-specific GDP impacts and the intra-country spillovers these investments generate. We find that there is no systematic equity-efficiency trade-off across investment categories and regions of a country. the trade-off dominates in regions with high concentration of production that generate little spillovers elsewhere in a country. such a situation, although beneficial for national GDP, amplifies regional disparities . on the contrary, when there is no trade-off, investments that directly target the less developed regions in a country have the capacity to promote overall country growth, while also reducing intra-country disparities. the existence of the trade-off in regions with high concentration of production, which also dominates when all types of investment are simultaneously deployed, and the fact that spillovers are substantial if investments take place elsewhere, implies that the policy maker could mitigate disparities and enhance overall development in a country, by promoting a balanced portfolio of investments.

## **Active Labour Market Policies in Flanders. Evaluation of the ESF “Work Experience for Young Persons”**

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**Keywords:** Labour market policies, Coarsened Exact Matching, Propensity Score Matching, Evaluation, Flanders

**Abstract:** The aim of this paper is to evaluate the “Work Experience for Young Persons” or “WIJ” program, implemented in Flanders for three years starting from June 2015. The WIJ program is targeted at unqualified young unemployed with the aim of facilitating their entrance in the labour market, through an intensive guiding trajectory which includes labour market orientation and coaching, and possibly competence strengthening activities.

The analysis is based on administrative data sources from the Flemish Public Employment Service (PES). Using detailed information on the past labour market histories of youth, we apply matching approaches to evaluate the impact of WIJ on labour market prospects of young job-seekers. We analyse the WIJ impact both in terms of employment opportunities and activation, considering as possible outcomes the employment probability and the probability of re- entering education following the program participation.

Through matching techniques we compare WIJ participants with two groups of similar young job-seekers, namely those (i) who did participate in standard labour market programs normally offered by the PES, and (ii) those who did not benefit from any programs. While the first setting allows to assess the Average Treatment Effect on the Treated (ATT) of WIJ in terms of added value with respect to PES programs, the second one provides a measure of WIJ impact with respect to the absence of any type of program. Our results suggest that those who have participated in the WIJ programme have lower employment and education probabilities. However, if we only consider those participants within the standard trajectory that is with a WIJ intervention lasting less than 14 months, there are no significant differences between the treated and the control group in terms of employment probability.

Furthermore, the negative effect on the probability of being enrolled in education is smaller in this group than in the whole sample. Those who followed the standard trajectory thus clearly outperformed those in extended trajectories.



## **Firm competitiveness, specialization, and employment growth: territorial level relationships**

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**Keywords:** Smart Specialization, Counterfactual methods, Firm-level data, Territorial growth

**Abstract:** The aim of this paper is to test the link between firm competitiveness, industry specialization and territorial wealth at a small regional scale. The objective is to see whether, in places where firms are more competitive, more jobs are really created, and the extent to which specialization is favourable or detrimental to these processes. This is especially important since many regional policy measures pass through enhancing firm competitiveness but their final implicit objective is to create jobs. Moreover, smart specialization strategies push for these measures to be selective, assuming that then their positive impact spreads to the whole regional economy.

For its analysis, the paper employs firm-level data to measure intraregional competitiveness at the NUTS-3 level, using territorial differences in the most common indicators found in the literature for firm-level competitiveness. With these indicators, territorial competitiveness is measured using counterfactual techniques, producing ATTs at the provincial (NUTS-3) level, both in a static and a dynamic setting.

To test the hypothesis that these firm-level indicators can characterize the intraregional differences in aggregate performance, the paper sets up a meta-analysis framework between these indicators and structural indicators (employment growth and specialization index) measured at the NUTS-3 level. For the meta-analysis at this novel intraregional level, the paper exploits the case of Lombardy, a large and competitive Italian region, unitary in terms of administration and smart specialization strategy but also highly differentiated inside.

The results of the analysis show that firm-level competitiveness indicators, in particular TFP growth, correlate with the aggregate employment performance of regions and that this effect is stronger in sectors of specialization. Hence, the competitiveness of firms seems to translate into aggregate territorial performance at small spatial scales, providing evidence in support of the principle of firm-competitiveness policies for territorial development.

However, the analysis also implies that territorial specificities are also relevant inside Nuts2 regions and should be considered in designing regional policy interventions, such as those of S3.

## **EU Cohesion Policy implementation in Poland – ranking regions using multi-criteria methods**

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**Keywords:** ‘Europe 2020’ Strategy, modified BIPOLAR method, TOPSIS.

**Abstract:** Cohesion Policy is the strategy of the European Union (EU) to encourage and support the ‘overall harmonious development’ of its Member States and regions. It has contributed to the realization of thousands of projects co-financed by the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the Cohesion Fund. It aims at levelling of economic and social conditions in all regions of the EU by improving economic growth, job creation, business competitiveness, sustainable development, and citizens’ quality of life. To reach these goals approximately a third of the total EU budget has been allocated for Cohesion Policy both for the years 2014-2020 and 2021-2027. The majority of Cohesion Policy funding is focused on less developed European countries and regions, such as Poland, to help them to catch up and to reduce disparities in the level of development that still exist in the EU [European Commission; Government of Ireland]. Economic and social coherence, which is to be safeguarded by Cohesion Policy, as defined in the Single European Act of 1986, aims to ‘reducing disparities between the various regions and the backwardness of the least-favoured regions’. The Lisbon Treaty signed in 2007 gives cohesion additional significance by mentioning ‘economic, social and territorial cohesion’. Considering that Poland is the largest beneficiary of the Cohesion Policy, the aim of the study is to evaluate and compare the socio-economic condition of seventeen Polish regions at NUTS 2 level between the year 2014 and 2020 in order to verify the impact of the EU funds on their development. In the assessment conducted the TOPSIS method [Hwang, Yoon, 1981; Lai, Liu, Hwang, 1994] and the modified BIPOLAR method [Górecka, 2009; Górecka, Muszyńska, 2011] are used. The analysis is based on the ‘Europe 2020’ indicators since the main goal of this strategy for smart, sustainable and inclusive growth [Europe 2020..., 2010] was to provide the EU countries with the best possible conditions for sustainable development and long-term economic growth as well as to build a knowledge-based economy and promote environmentally friendly technologies [Gasz, 2014; Polish Central Statistical Office, 2018]. As a result, the rankings obtained show the progress made by Polish regions in the area of social, economic and environmental development during the last EU programming period.

## **Do redistributive effects of incentives to buildings energy retrofitting hamper fuel poverty reduction in public housing?**

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**Keywords:** Buildings energy retrofitting, Public housing, Fuel poverty, Vulnerable households

**Abstract:** The building sector is responsible for about 40% of primary energy consumption and 36% of greenhouse gas (GHG) emissions in Europe. The energy retrofitting of existing buildings represents therefore a cornerstone in the EU energy policies targeted to the reduction of energy consumption and relative CO<sub>2</sub> emissions and the acceleration of the transition to a post-carbon economy.

As almost 90% of the Italian building stock exhibits an excessive energy demand/consumption, since 1999 the Italian Government has introduced fiscal incentives to favor investments in buildings energy retrofitting. Nonetheless, it is likely that low-income households, living in energy inefficient homes and at risk of energy poverty, would not benefit from these policy incentives because financially constrained, and/or because they are tenants of privately or publicly owned properties. According to the metric proposed by Faiella and Lavecchia (2015), about 2.2 million Italian households (8,6%) suffer from energy poverty. The reduction of energy poverty is, therefore, a top priority target for Italian policymakers, as it affects a significant share of the Italian population. Buildings energy retrofitting can play therefore a key role in reducing energy poverty, especially in public housing contexts, where there is a convergence of unfavorable factors: low-income households, who cannot afford high energy prices, the poor energy efficiency of homes due to the lack of insulation and/or inefficient heating systems, and social exclusion.

In this contribution, we address the nexus between energy policies to accelerate the energy transition and vulnerable households, i.e. households in energy poverty. In detail, we investigate the redistributive effects of energy policies in the building sector and their impacts on low-income households. Indeed, in the public housing context, where there is a large occurrence of vulnerable households among tenants, specific problems such as the landlord-tenant dilemma add up to common problems, which usually arise in buildings energy retrofitting. Our aim is to provide some insights to support policymakers in the design of vulnerable households/public housing target-oriented policy incentives for buildings energy retrofitting and propose a related split-incentive scheme, tested in a real-world case study.

## **Smart and sustainable scheduling for charging events for electric buses**

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**Keywords:** Electric buses, Scheduling, Reactive Approaches, Renewable energy

**Abstract:** The Irish transportation sector currently accounts for more than 30% of the energy related CO<sub>2</sub> emissions of the country. Therefore, in order to reach the sustainable goals, the Irish government is working on multiple incentives to promote electric vehicles to decarbonize the sector, e.g., free domestic charging points, toll reductions, and the implementation of electric Buses (eBuses) in the medium to long term. In particular, eBuses operate with rechargeable batteries with a capacity to store approximately 300 kWh (and up to 600 kWh), equivalent to around 7.9 gallons of diesel, while reaching approx. 200 KMs. In order to ensure a proper transition from regular diesel buses to eBuses, charging stations must be conveniently located to ensure availability and coordinated charging times. In this work, we present a framework for an efficient management of renewable energies to charge a fleet of eBuses without perturbing the quality of service. Our framework starts by building a deep learning model for wind power forecasting to predict clean energy time windows, i.e., periods of time when the production of clean energy exceeds the demand of the country. Then, the optimization phase schedules charging events to reduce the use of non-clean energy to recharge eBuses while passengers are embarking or disembarking. The proposed framework is capable of overcoming the unstable and chaotic nature of wind power generation to operate the fleet without perturbing the quality of service. As expected, the size of the batteries does have a notable impact on the percentage of clean energy required to operate the fleet of eBuses. Methods developed in this paper help to mitigate potentially poor performance from prediction models. As a result, our optimisation model uses nearly the same proportion of clean and non-clean energy to recharge the fleet of eBuses as the base case-scenario with an oracle with perfect predictions under certain conditions.

## Multiple impacts of energy efficiency technologies in Portugal

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**Keywords:** Energy efficiency; Hybrid Input-Output Lifecycle Analysis; Multiple benefits

**Abstract:** In Portugal the programs aimed at fostering Energy Efficiency (EE) measures often rely on cost-benefit approaches that only consider the use phase and neglect other potential impacts generated. Hence, this work aims at suggesting a novel framework for conducting a holistic assessment of the impacts attainable with the adoption of several EE measures. In this context, Hybrid Input-Output Lifecycle Analysis has been combined with the seasonal method employed by the Portuguese building energy certification system. With this purpose distinct EE measures (Table 1) have been selected through the combination of distinct thermal insulation options for roof and façades, with the replacement of windows, also considering the use of space heating and cooling (SHC) and domestic heating water (DHW) systems. These impacts were simulated for EE measures applied in a representative single dwelling T2, built in 1980, located in Coimbra. The indicators used in this study were greenhouse gases (GHG) savings, GHG payback time (GPBT), energy payback time (EPBT), savings to investment ration (SIR), Net Present Value (NPV), employment, Gross Value Added (GVA), impact on the household budget and reduction of premature deaths.

**Table 1 - EE retrofit packages.**

Package	Façades		Roof		Windows	SHC	DHW	Solar heater	GHG savings	GPBT	EPBT	SIR	NPV	Jobs	GVA	Impact on Household budget	Premature deaths	Energy Savings
	N°	Type	Type	Type														
151	0	0	XPS	0.04	SAW	EH	GWH	No	1.81	9,19E-04	5,20E-04	23.83	654.4	1,98E-07	5,76E-06	11.96	2,09E-09	0.0537
265	0	0	XPS	0.06	SAW	EH	GWH	No	1.98	8,96E-04	5,07E-04	20.68	710.5	2,07E-07	6,09E-06	13.07	2,28E-09	0.0587
10965	XPS	0.08	XPS	0.08	SAW	AHP	GWH	Yes	4.51	0.020	7,87E-03	4.21	1301.0	2,85E-06	1,03E-04	29.38	1,50E-09	0.1318
18150	XPS	0.12	XPS	0.10	SAW	AHP	EWHP	No	4.17	8,96E-03	3,96E-03	4.42	1196.6	1,60E-06	5,71E-05	26.35	4,18E-09	0.1191
18331	XPS	0.12	XPS	0.12	DPW	BB		Yes	2.85	0.059	0.014	2.38	913.7	4,84E-06	1,74E-04	30.79	-2,64E-07	0.1290
18335	XPS	0.12	XPS	0.12	DPW	DHW+H+C HP		Yes	4.62	0.376	0.016	1.75	757.9	6,96E-06	2,44E-04	30.27	-4,05E-09	0.1350
18339	XPS	0.12	XPS	0.12	DPW	AHP	DHP	Yes	4.64	0.027	0.011	2.59	1079.9	4,24E-06	1,51E-04	30.06	-1,05E-09	0.1348
91257	ICB	0.12	ICB	0.12	SAW	DHW+H+C HP		Yes	4.54	0.047	0.020	1.15	226.45	9,97E-06	4,02E-04	30.03	-6,20E-09	0.1334
18254	XPS	0.12	XPS	0.12	SAW	BB		No	5.08	0.019	0.009	3.82	1164.6	2,75E-06	9,98E-05	29.98	-3,7E-07	0.1233

Note: XPS - Extruded polystyrene; ICB - Insulation cork board; SAW - Single-glazed aluminum window; DAW - Double-glazed aluminum window; DPW - Double-glazed PVC window; EH - Electric heater; GWH - Gas water heater; EWH - Electric water heater; DHW+H+C HP - DHW + heating and cooling Heat pump; BB - Biomass boiler; AHP - Air-source Heat Pump; DHP - DHW heat pump.

Results show that package 151 presents the highest SIR; package 265 minimizes the number of years needed to recover the embodied energy and GHG emitted in the manufacturing stage; package 91257 is the best solution to increase the economic and labor benefits; package 18339 is the “cleanest”; package 10965 has the best NPV; package 18331 maximizes the household budget; package 18150 has the highest potential to reduce premature deaths, and solution 18335 reaches the highest energy savings. If carbon neutrality is assumed for biomass, the minimization of GHG savings is obtained with solution 18254. In light of these trade-offs, it can be ascertained that a more comprehensive assessment is required to support decision-makers in the choice of the EE measures that should be funded by the EE programs.

## **The deployment of carbon capture, utilization and storage in energy intensive industries: cost estimation analysis for Europe, China, and India**

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**Keywords:** Climate change, Low-carbon Economy, Net- zero emissions, Investment, Cost estimation

**Abstract:** The fight against climate change is gaining momentum and governments around the world are looking to restart with 'low-carbon economic reforms'. To achieve the climate targets set out in the Paris agreement, the world needs to move towards 'net zero' carbon emissions by 2050. In general, in hard-to-abate sectors, carbon capture, utilization, and storage (CCUS) is one of the few technology options that can yield significant emission reductions. In fact, the IPCC 1.5 0C report mentions that CCUS systems can play a vital role in bounding global warming. While Carbon Capture utilization (CCU) technology is fit for the long-term vision, Carbon Capture Storage (CCS) technology is essential on the way to reach massive reductions of CO<sub>2</sub> emissions as soon as possible.

In this context, investing in low-carbon technologies is an important tool for deploying energy policy in developing and developed countries. In this paper, we employ a novel system dynamic modelling approach for assessing the impacts of fostering the investment in CCUS technologies, emission abatement cost, and emission mitigation potential of CCUS that can be adopted commercially in Europe, China and India. In addition, we also identify the trade-offs and barriers in implementing CCUS systems and recommend policy strategies. Our preliminary results show that, in the particular case of CCSU systems, there would be an energy loss of about 20–35%, significantly affecting the deployment of CCSU systems.

## **Assessing the Application of ERDF funds Devoted to a Low Carbon-Economy in SMEs**

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**Keywords:** Low-carbon economy, ERDF, SMEs, Slack-based measure, Cluster analysis

**Abstract:** European Union (EU) funds dedicated to building a low-carbon economy are intended to support Member States and regions in making the necessary investments in energy efficiency, renewable energy, and smart distribution electrical networks, as well as in research and innovation in these areas. In this regard, we evaluated the application of these funds in small and medium-sized firms over different EU regions. As a result, this study evaluated 102 programs from 22 countries using a non-radial slack-based data envelopment analysis model paired with cluster analysis that encompasses distinct performance framework indicators. Overall, we found that 25 efficient operational programs remained robustly efficient, while 51 remained robustly inefficient. Besides, we discovered that 25 efficient operational programs remained robustly efficient, while 51 stayed robustly inefficient for data disturbances between 5 and 10%. There was practically no input excess at the present output level. As a result, efforts to foster a low-carbon economy should handle the issues that are causing poor outcomes, both in terms of greenhouse gas emissions reduction and the pace of programmes execution.

**Funding:** This work has been funded by the European Regional Development Fund within the framework of Portugal 2020—Programa Operacional Assistência Técnica (POAT 2020), under project POAT-01-6177-FEDER-000044 ADEPT: Avaliação de Políticas de Intervenção Cofinanciadas em Empresas.

## **Evaluating the Implementation of Structural Funds Dedicated to Fostering Innovation in SMEs**

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**Keywords:** ERDF; Innovation; SMEs; EU regions; network slack-based measure; cluster analysis

**Abstract:** During the 2014–2020 programming period, the European Regional Development Fund allocated approximately 66 billion Euros towards the funding of productivity and innovation in European firms. We evaluated the execution of the Operational Programmes focused on supporting research and innovation, specifically in small and medium-sized businesses. To achieve this goal, we employed a network slack-based data envelopment analysis model in conjunction with cluster analysis, which includes multiple performance framework indicators, to evaluate 53 Operational Programmes from 19 countries. Our results show that more developed regions have greater potential for improve their efficiency than transition and less developed regions. Furthermore, when compared to more developed countries, less developed regions outperform, implying that further investment should be directed at leveraging research and innovation in these regions. Overall, operational programme managers should concentrate on addressing the issues that are intrinsic to these poor results, such as increasing the number of researchers working in enhanced research infrastructures and boosting technology transfer across research institutions and businesses.

**Funding:** This work has been funded by the European Regional Development Fund within the framework of Portugal 2020—Programa Operacional Assistência Técnica (POAT 2020), under project POAT-01-6177-FEDER-000044 ADEPT: Avaliação de Políticas de Intervenção Cofinanciadas em Empresas.



## **How Efficient is the Implementation of Structural Funds Committed to Enhance ICT adoption in SMEs?**

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**Keywords:** ERDF; ICT; SMEs; EU regions; Weighted Russel Direction Distance model; Stochastic Frontier Analysis

**Abstract:** During the 2014-2020 programming period, more than €20 billion from the European Regional Development Fund (ERDF) were allocated to ICT projects. It is largely consensual that information and communication technologies (ICT) can provide a positive impact on firms' performance, while assisting them on the acquisition of innovative resources and preparing them for the global markets. Small medium-sized enterprises (SMEs) represent a critical role since in Europe SMEs cover 99% of all firms, and are a major player regarding employment (i.e., around 100 million workers). Besides, SMEs are responsible for more than 50% of the European Union (EU)'s Gross Domestic Product. In this context, we evaluated the execution of the operational programmes (OPs) committed to encouraging the adoption of ICT in SMEs. This study addresses an identified gap in the literature by contributing with a novel methodological framework that allows policymakers (e.g., management authorities) to monitor the implementation of OPs devoted to ICT in SMEs. The Weighted Russel Direction Distance (WRDD) model is used that allows to obtain insightful information to prevent and correct eventual deviations from best practices. When compared to other approaches the data envelopment analysis (DEA) model used herein can be especially useful for management authorities (MA), because it allows to identify the benchmarks and modifications that must be done to enhance the execution of this type of funding. To achieve this goal, we employed the WRDD model in conjunction with Stochastic Frontier Analysis, which considers distinct indicators and environmental factors, to evaluate 51 OPs from 16 countries.

The achieved results allow us to conclude that the number of operations supported by inefficient OPs was much lower than those supported by efficient OPs. Furthermore, since there was essentially no input excess, it can be established that the amount of funds devoted to enhancing the ICT adoption in SMEs was in most cases suitable. However, only 5% of efficient OPs were considered robustly efficient while 59% remained robustly inefficient for data perturbations of 5% and 10%. Overall, it can be established that there is still a long way to go in order to enhance ICT adoption in SMEs through cohesion policy funds.

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## **Is the cohesion policy efficient in supporting the transition to a low-carbon economy?**

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**Keywords:** Low-carbon economy, ERDF, EU countries, Value-Based Data Envelopment Analysis

**Abstract:** Cohesion Policy is one of the pillars of the European Union (EU)'s strategy in the transition to a low carbon economy. In this regard, European Regional Development Fund rules were created which obliged Member States, for the first time, to allocate a mandatory minimum proportion of available funding to the low carbon economy for the 2014-2020 funding period. Besides these rules, member states were mandatorily obliged to carry out assessments of the related Operational Programs. In this context, we evaluated the implementation of ERDF funds in the different beneficiary countries of the EU. Therefore, this study uses a three-stage Data Envelopment Analysis (DEA) model to evaluate the efficiency of the implementation of ERDF funds in 23 EU beneficiary countries.

In the first stage, the efficiency scores of each country are obtained through the Value-Based DEA approach, which combines DEA with Multiple Criteria Decision Aiding (MDCA). The second step consists of applying Stochastic Frontier Analysis (SFA) to the countries classified as inefficient to obtain the input and output variables adjusted and in the third stage, considering the inputs and outputs adjusted from stage 2, the Value-Based DEA method is applied again. In the first stage, only 10 efficient countries were found, as well as the main factors that can influence the efficiency of the implementation of ERDF funds in different EU beneficiary countries. After running the SFA analysis only France remains efficient in the third stage. Additionally, a robustness analysis was carried out to the results obtained in stage 1, and it was found that when considering a tolerance of  $\delta=5\%$  and  $\delta=10\%$  only 5 of the 23 countries remain surely efficient, with Spain being the most robust country. Finally, by considering value judgments through the introduction of restrictions on weights, Spain is chosen as a benchmark country both for the scenario more focused on the capacity of fund absorption and for a scenario more environmental prone.

**Funding:** This work has been funded by the European Regional Development Fund within the framework of Portugal 2020—Programa Operacional Assistência Técnica (POAT 2020), under project POAT-01-6177-FEDER-000044 ADEPT: Avaliação de Políticas de Intervenção Cofinanciadas em Empresas.

## **The Youth Guarantee in Eastern Europe. A systematic review**

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**Keywords:** EU cohesion policy, Youth Guarantee, systematic review

**Abstract:** The Youth Guarantee (YG) is one of the most innovative European programs for young people. Given the complexity of the program for the analysis of its effectiveness and efficiency, it is necessary to provide clear information, supported by scientific evidence. This paper aims to examine the empirical evidence on the effectiveness and efficiency of the YG program in the countries of Eastern Europe. The present analysis is based on a systematic review, a scientific method which is effective for both decision-makers and the scientific community because the data they use and submit to the analysis are classified and evaluated based on scientific criteria, and objectives that allow obtaining a complete, up-to-date, and reliable images. The credibility of the investigated sources is ensured by including in the analysis only the reports published by the European institutions (European Commission, European Council) regarding YG. The second selection criteria is the type of measures provided in the program: education and training, employment services and programs, and other active labor market measures (public works, community services, etc.). The following criteria concern the national institutions involved and the criteria for selecting the target group. The reports will be selected in three stages. First, the titles of all retrieved reports will be screened for the above-mentioned inclusion criteria. Second, the abstracts or executive summary of all initially relevant reports will be checked for eligibility by applying uniform criteria. Finally, the full text of all remaining reports will be analyzed. The hypotheses underlying the study are: (1) the efficiency of YG is influenced by the existence at the national level of specific institutional structures and if they were not present, the state's ability to organize and make them functional becomes the determining factor; (2) national experience in conducting similar programs as well as the capacity for institutional collaboration are key factors in YG's success; (3) the eligibility criteria applied to young people to be included in the program differ from country to country, which has an impact on the results of the program; (4) the COVID-19 pandemic had significant effects on the efficiency and effectiveness of YG. By analyzing the documents, we expect to obtain an objective and complete picture of the effectiveness and efficiency of the YG program.

## **The Sustainability and Accountability Report in Public Universities in Portugal**

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**Keywords:** Universities, stakeholders, accountability, sustainability, reports

**Abstract:** Sustainability reporting began to emerge in the 1990s, with the aim of providing stakeholders with information on the company's performance through social, governance and environmental aspects (Eccles and Spiesshofer, 2017).

Lately, the importance of non-financial information has grown significantly, as more and more investors argue that financial information is not enough to understand the performance and value of the organization.

At a time when companies want greater transparency, it is necessary that social justice and environmental protection are increasingly a reality. Information users, on the other hand, are more aware of the need to promote sustainable long-term profitability.

Focusing on universities, these are essential pillars of society. Its main mission includes two main aspects, which are teaching and research; however, these entities were also called upon to contribute to society through the provision of services, their third mission.

Due to growing social and environmental concerns, universities need to support the sustainable development of society, a function increasingly intertwined with their three traditional missions.

The influence that universities have on future generations focuses on communicating a culture of sustainability, sometimes directly, other times through the example that university sets in leading and being accountable for its sustainability performance.

For a long time, few pioneering universities have adopted sustainability reporting, and even the literature on sustainability reporting has received little attention from higher education institutions.

Recently, a growing number of universities around the world have started to address sustainability issues and prepare reports on their activities, to demonstrate their commitment to sustainable development, while at the same time aiming to improve and preserve its legitimacy and image.

And in Portugal, do all public universities produce sustainability reports? Or will it just be a few? The aim of this study is to carry out a survey of the accounts of these institutions, to assess whether they include sustainability reports, through which they convey to stakeholders their practices in this area.

## **European structural and investment funds 2021-2027: prediction analysis based on machine learning models**

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**Keywords:** European Structural and Investment funds, predictive analysis models, predictive algorithms.

**Abstract:** This research presents several machine learning algorithms and prediction models to anticipate the European Structural and Investment Funds (ESIF) application in the different EU countries. These analyses start with data training from 2014 to 2020 ESIF in order to test and predict the application of the future ESI Funds for 2021-2027. We deliver an in-depth analysis focused on the priorities of each fund, highlighting the differences between the programs in different time periods. In the framework of the European Regional Development Fund (ERDF), we will specifically address the assessment the following themes: support innovation of small and medium-sized businesses, to greener, low-carbon and resilient projects with enhanced mobility. In what concerns the European Social Fund (ESF), we will evaluate projects that promote and increase the EU's employment, social, education and skills policies, including structural reforms in these areas. Regarding the cohesion funds (CF), we will be targeting the improvements between the two ESIF's, looking to projects in the field of environment and trans-European networks in the area of transport infrastructure (TEN-T). Overall, this work is designed to answer the following questions:

- 1) What results should be expected based on the behaviour of the previous period of 2014-2020?
  - 2) What are the new priorities and corrections that should be addressed for each fund?
- In summary we will be looking at the future of ESIF with the glasses of artificial intelligence.

## **Technology Serving Justice**

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**Keywords:** Face-to-face interactions, forensic contexts, software development

**Abstract:** Technology has been used for many years with the aim of supporting people in their everyday lives. People, regardless of what they do socially and professionally, have, at least, one aspect in common: they communicate. Transmitting messages is something we permanently do, even when we think that we are quiet and in silence.

Human communication should be understood as having three equally important modalities: what we verbally utter, the way we do so, and the body movements we execute at the same time (Poyatos, 1994).

We are always transmitting messages. Two-thirds of the messages we transmit while communicating face-to-face are passed through our body movements (Aghayeva, 2011) (the movements of our head, torso, feet, legs and hands – the gestures). Ignoring one of these three modalities of communication when there is the need of analysing an interaction means missing a vital part of what had actually been transmitted (Jones and LeBaron, 2002). Because we all have intentions when we pass a message (good or bad ones; telling the truth or lying), we all want that our intention may be understood by our interlocutors. This is valid for any type of communication, but analysing in detail face-to-face interactions in forensic contexts seems to be of major importance. Because it is important to make justice happen, to condemn criminals, to acquit innocent people.

Nowadays, in Portugal, trials and police inquiries are, at the very most, audio recorded.

Most of the time, this register is transcribed not following a canonised criterium. And all the rest is lost: no gestures, no other body movements, nothing. Every human being has the capacity of lying: some are better at doing this, and some others are easily caught. But people cannot lie with their bodies. An attentive analysis can detect incongruencies between speech and body language, and many other important aspects. Lying through what we verbally utter is not difficult. Lying with our body is impossible. In some questionnaires made by the author to police officers and magistrates in Portugal inquiring, among other things, about their opinion concerning the importance of an analysis of this type, the answers were enlightening: about 95% agreed that this analysis would be very helpful and would greatly improve justice in Portugal. In order to be possible to analyse face-to-face interactions in forensic contexts in detail, it is necessary to develop software that could make this analysis an enriching process. Because technology should continue to help people in their lives.