

# Mapping ERDF's Strategic Intervention in Regional Innovation Performance

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## Abstract

In recent years, there has been consensus regarding the EU's cohesion policy and the role of the European Regional Development Fund (ERDF) in enhancing regional development through improved innovation performance. This paper examines the influence of the ERDF on regional innovation systems, proposing a pragmatic methodology as a starting point for impact assessment. Utilizing the European Innovation Scoreboard methodology, this research introduces a conceptual model that underscores the importance of considering multiple driving dimensions in promoting innovation. The study aims to address the gap in understanding how funding instruments, particularly within EU cohesion policy like the ERDF, impact regional innovation performance.

**Keywords:** regional innovation system, erdf, performance, innovation, european innovation scoreboard.

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## 1 Introduction

Recognizing the pivotal role of innovation in bolstering regional economies, the European Commission (EC) has mandated the development of regional innovation strategies as an integral component of the European Regional Development Fund (ERDF) operational programs. These programs are designed to foster research, innovation, and business competitiveness. The legislative package implemented for the 2014-2020 programming period, as a part of the EU cohesion policy, introduced strict guidelines that heightened the focus on innovation (Schmidt, 2019). Consequently, there has been a pronounced shift, where the integration of the European Union's cohesiveness and a steadfast commitment to innovation has gained significant attention.

The combination of a long-term support program with substantial allocated funds and contentious political decisions places a growing emphasis on assessing effects of ERDF (Bachtler and Wren, 2006). However, the association between EU structural policy, despite its ambition, is more complex to identify since innovation performance and capacity vary even in regions with similar EU-budget and regional priorities. The question that emerges here is: How do funding

instruments, particularly those within cohesion policy like ERDF, influence regional innovation performance? To address this research question, we explore the influence of the ERDF instrument within West Sweden's Regional Innovation System (RIS) as a case study. This approach offers a comprehensive examination of ERDF's impact on regional innovation performance by analyzing its specific implementation and outcomes.

The multifaceted nature of regional innovation activities presents challenges in identifying best practices. Each RIS possesses unique characteristics and interacts within a specific governance process, thereby influencing its performance. An increasing recognition of the importance of considering the specific contextual nuances in promoting innovation through ERDF implementation has emerged (Smętkowski et al., 2017). This acknowledgment is rooted in the understanding that regional characteristics play a significant role in shaping the outcomes and effectiveness of innovation initiatives.

Regional innovation performance measures the effectiveness and success of innovation activities within a defined geographic area known as a "region." It encompasses inputs like R&D investment, education levels, and skilled labor availability, as well as outputs such as patents, new products, and economic growth stemming from innovation (Tripl, Zukauskaitė, Healy, 2019). To provide a comprehensive evaluation of the impact of ERDF on regional innovation performance, this study proposes using the European Innovation Scoreboard (EIS) as an essential assessment tool. The EIS considers the multidimensional nature of innovation activities by integrating a range of indicators measuring innovation inputs (such as investment in R&D and human capital) and outputs (such as patents and exports of high-tech products) to offer a comprehensive evaluation of innovation performance within a given RIS (EC, 2021). As traditional empirical prediction models, such as regression analysis, fail to elucidate whether Cohesion Policy, particularly ERDF funding, influences regional innovation (Płoszaj et al. 2016; Gorzelak et al. 2016; Schmidt, 2019; Henriques et al. 2022), we propose a novel approach using analogical modeling based on the EIS methodological framework. The model integrates fundamental performance measurements from the EIS, including framework conditions, investments, innovation activities, and impact, while considering the expected effects of ERDF operational programs. Our focus in this paper is specifically on how ERDF, as part of broader efforts, contributes to regional innovation performance at a systematic level. By employing analogical reasoning, we aim to provide valuable insights into the impact assessment of ERDF funding, leveraging the multidimensionality proposed by the EIS methodology. A paradigmatic case study, focusing on the assessment of innovation-related impacts in West Sweden during 2014-2020, exemplifies the application of our proposed model. West Sweden, ranking highest in the EIS, is a leading region for innovation in Europe, making it a pertinent case study. The efficiency of the input-output mechanisms in West Sweden's RIS provides valuable insights into the proposed model's applicability in evaluating the impact of the implementation of ERDF .

This article will first present a literature review on regional innovation systems and their performance (1), establishing the relationship between the performance of RIS and ERDF (2). Our added value lies in measuring the effects of ERDF programs on regional innovative performance (3), applied through a case study in the NUTS 2 region of West Sweden. Since we observe a lack of studies using qualitative approaches and conceptual thinking to measure the effects of funding instruments on the innovation performance of regions (Zabala-Iturriagoitia et al., 2007; Gorzelak et al. 2016), we will systematically highlight our case study, providing a step-by-step demonstration of our proposed methodology.

## 2 Regional Innovation Systems and performance

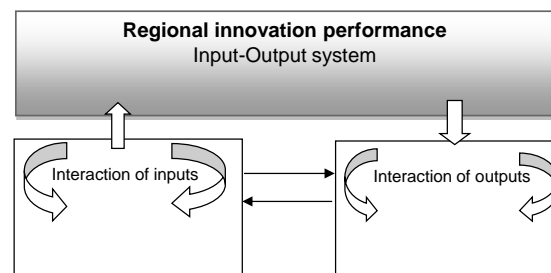
Spatial issues related to approaches to systemic innovation have been particularly important in recent years (Doloreux, Porto Gomez, 2017). Innovations are geographically concentrated where the multiple stakeholders (companies, infrastructures, institutions) have specific knowledge and interact in a delimited space to create positive externalities (Breshi, Malerba, 2001). RIS are places where close communication between companies, socio-cultural structures, and the institutional environment can stimulate socially and territorially rooted innovation. As a result, innovation processes depend on formal and informal regional institutions and cooperating actors from various subsystems (Cooke et al., 2004; Heidenreich et al., 2012).

Regional economic performance is strongly affected by firms and institutions that generate clusters, as is the vitality and plurality of innovation outcomes. The most vulnerable regions, i.e. the organizationally weak RIS, lack a critical mass of innovative regional actors. This means that their primary actors, whether academic or private, are either underperforming or lacking significance to drive regional innovation. Such regions have few support organizations, including universities, intermediaries, and organizations capable of designing an adequate innovation policy (Trippel, Zukauskaite, Healy, 2019; Isaksen & Trippel, 2016).

Nevertheless, the conceptual framework of RIS has been criticized for being overly descriptive and static (Weber, Truffer, 2017). Moreover, the debate often lacks nuance or interest when it comes to accounting for how specific technological bases shape regional innovation patterns (Doloreux, Porto Gomez, 2017) and technological characteristics do not play a role in theoretically explaining regional particularities. Some typologies point to differences in the *modus operandi* of shareholders and investors (Cooke, 2004) or distinguish RIS in metropolitan or peripheral regions (Doloreux, Porto Gomez, 2017). The performance of RIS is analyzed on a consensual basis. The consensus is that the economic value of such systems depends on the performance of two value-transforming activities: the development of innovation and the commercialization of activities that can be assessed by their ability to obtain intellectual property (patents) and to further promote economic growth through commercialization (Lin et al., 2022).

When discussing the impact of cohesion policy, particularly ERDF funding, on RIS performance, empirical regression models that examine ERDF's influence alongside growth measures like GDP often encounter difficulty in fully capturing the nuanced relationship. While studies like Ferrera et al. (2017) reveals a positive impact of Cohesion Policy interventions using a Regression Discontinuity Design method to isolate the influence of policy on innovation. Their study is constrained by its narrow focus on select domains such as technological advancement and transportation infrastructure. Despite observing a positive correlation between ERDF investment and innovation, the study fails to capture the comprehensive impact on the performance of RIS. In contrast, Płoszaj et al. (2016) and Schmidt (2019) suggest that regions receiving substantial ERDF funding may not necessarily exhibit commensurate levels of innovation, challenging the assumption of a positive causal relationship between funding allocation and innovation outcomes. Similarly, Henriques et al. (2022) highlight inefficiencies in Cohesion Policy programs, specifically those targeting innovation and promoting a low-carbon economy (LCE) within small and medium-sized enterprises (SMEs) across EU regions. Their study uses a non-radial slack-based data envelopment analysis (DEA) combined with cluster analysis to examine 102 structural fund programs from 22 countries, considering two inputs and two outputs. The findings reveal that a significant number of the EU's operational programs remain robustly inefficient, indicating that they are not effectively achieving their objectives, particularly in promoting innovation.

The innovation performance of a region can be measured by the efficiency of its RIS (Broekel and Schlump, 2009), which is often defined as an input-output value chain. According to Zabala-Turriagoitia et al. (2007), the performance of the RIS can be measured by the efficiency derived from the interaction between the inputs and the outputs that are essential for building an efficient system. Hence, innovation performance is frequently defined as the result of a multi-directional process, as shown in Figure 1, where various dynamic mechanisms and interactive relations between the inputs and the outputs of RIS involving different interests and regional players occur. Let us now see how the performance of a RIS can be analyzed in the form of a typology with efficient RISs, whose interconnections are fluid and allow the creation of innovation (northern European countries) and less fluid RISs with information asymmetries (central and eastern European countries).



**Figure 1.** Regional innovation performance  
Sources: The framework was created by the authors

The performance of RIS can be conceptualized as an input-output framework, which can be evaluated across multiple dimensions as depicted in Figure 1. Inputs encompass factors such as investment in research and development (R&D), educational attainment levels, and the presence of a skilled workforce. Meanwhile, outputs encompass indicators such as patents, the introduction of new products, and the resultant economic growth stemming from innovative activities. This comprehensive approach allows for a thorough assessment of RIS performance and its contributions to regional innovation.

### 3 On the relationship between ERDF and regional innovation performance

Most regional development strategies have as key elements the improvement of innovation capacity through the support of RISs (Kaufmann and Wagner, 2006). Thus, regional financing and resource allocation seem to be the most relevant instruments to strengthen regional innovation performance. It is therefore important to study the role of the allocation mechanisms of regional capital (Fratesi and Perucca, 2019) within the framework of various policy objectives and regional programs in increasing innovation performance. In the European regional context, the European Structural and Cohesion Policy is one of the most important regional policies in Europe and almost worldwide. Through different policy areas, it aims to support long-term sustainable regional development. Its main goal is to promote investment in jobs and development, extending over a seven-year “programming period”, by using two main funding programs, which are the European Regional Development Fund (ERDF) and the European Social Fund (ESF).

The performance of RIS plays a key role in the conception and implementation of the regional development strategy and particularly in the achievement of the main objectives of the operational ERDF programs. By following this underlying logic, we argue for the main idea that ERDF

programs are directed to improve the performance and capacity of the innovation system. The “Smart specialization” concept (S3), which has already introduced the core concept of the cohesion policy in the programming period 2014-2020, is thus considered as the fundamental instrument for accomplishing this mission. Moreover, the EC is dedicating greater attention and a higher fund allocation to the implementation of the S3 concept in the actual EU programming period 2021-2027 by encouraging all EU regions to use ERDF to target S3 areas. This should lead to a higher goal completion that EU policymakers hope to reach within the first policy objective (PO1) “A smarter Europe”.

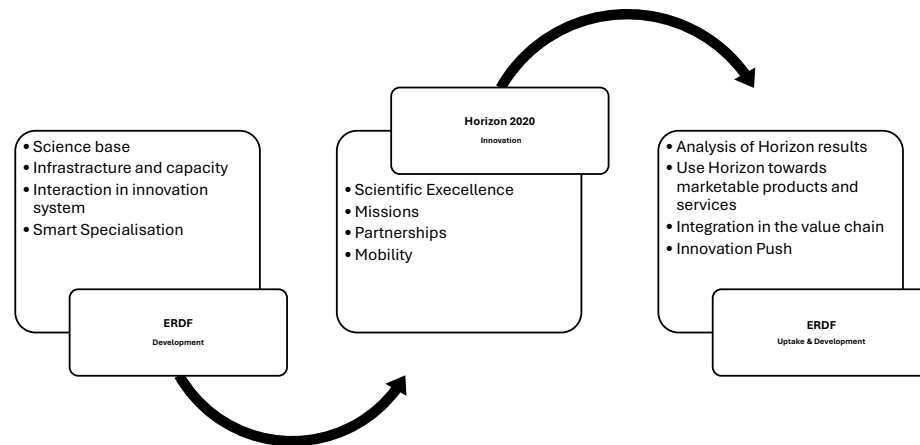
Over the EU’s 2014-2020 period, the ERDF was used by European regions as a common instrument to improve innovation and increase the competitiveness of the innovation system. A clear ambition is emerging within the ERDF objectives where we could say that we are moving from a main objective of correcting regional and territorial economic imbalances to a clearer ambition, aimed at improving regional innovation performance. We are experiencing an increasing focus on combining the EU’s cohesive spirit with an “innovation push”, not least in relation to ERDF thematic orientations and stricter recommendations, in EC directives stimulating more interaction between various European initiatives (eg. the European Digital Innovation Hubs).

The increased innovation focus as a part of the ERDF has been clearly and uniformly adopted by EU Member States when, after 2014, the EC launched the European Union’s Framework Program for Research and Innovation, also known as Horizon 2020. Since then, ERDF has been intended as an “innovation booster” (Schmidt, 2019) aimed at bringing together educational and research institutions with enterprises and business players to foster the development of innovative business and new industries. This complementary relationship between ERDF and Horizon 2020 is manifested by many identified synergies at project and program level, where many ERDF projects were able to integrate expertise and results from other Horizon 2020 projects, and vice versa. In support of this complementarity, the EC has adopted a cohesion policy funds regulatory framework that allows for synergies between ERDF and Horizon Europe (HE) to be strengthened<sup>1</sup>. In a notice addressed to the management authority of ERDF programs published in the EU’s Official Journal in November 2022, the EC points out all the potential coordination between HE and ERDF within the regulatory framework for 2021-2027. The guidance document provides insights into what kind of upstream/downstream synergies can emerge between HE and ERDF as shown in Figure 2. The general recommendation of the EC is that such a kind of identified cooperation between HE and ERDF must be used as a key driver to boost regional development, which brings added economic value particularly within the Policy Goal 1, “Smarter Europe” where S3 can play a crucial role in enhancing innovation.

#### 4 Measuring the effect of ERDF programs on regional innovation performance

This section attempts to examine the possibilities of developing a comparable model that is used in the Regional Innovation Scoreboard, an extension of the EIS, to identify the character of the impact of EU funding through the ERDF operational programs on regional innovation performance.

1. Official Journal of the European Union, 04/11/2022, EU Commission notice on Synergies between Horizon Europe and ERDF programs is the annex to the Communication of the Commission on the Approval of the content of a draft Commission Notice on the synergies between ERDF programs and Horizon Europe



**Figure 2.** Upstream and downstream synergies between the ERDF and HE 2022

Sources: Official Journal of the European Union, 4/11/2022 (C 421/35), Commission Notice Synergies between Horizon Europe and ERDF programs 2022/C 421/03

#### 4.1 Methodological Framework

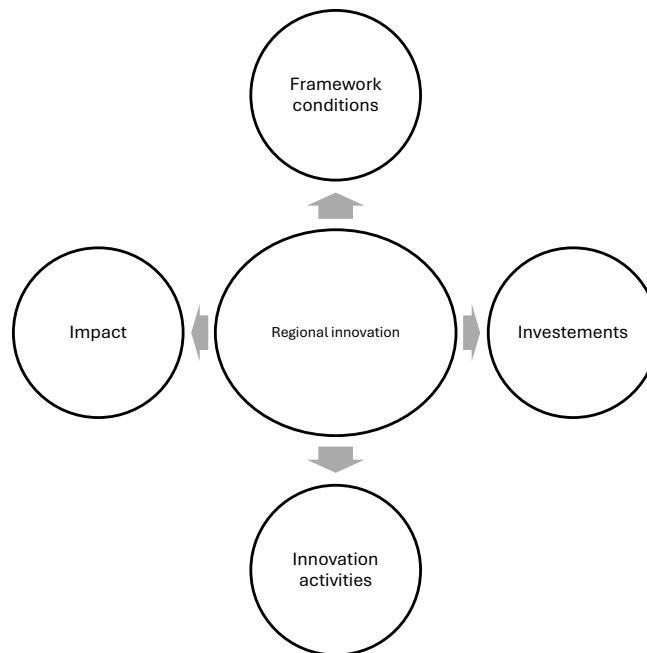
Measuring the effect of ERDF programs on regional innovation performance is a question that should not be as complicated as it is. The foremost condition to succeed in finding insightful answers to this common question is to admit that it is difficult to capture such a value added from a quantitative point of view. As it has been admitted by J. Schmidt (2019), missing the recognizable effects of ERDF funding on innovation suggests that a researcher should overcome the quantitative limitations and pay more attention to the omitted qualitative variables, such as the quality of program management or the effective territorial fund allocation (Fratesi and Perucca, 2019). Since it is difficult to accurately measure the quantitative leverage effects on innovation development with a single indicator in terms of GDP, Gross Regional Product (GRP) or employment growth, a large body of literature has called for consideration of a quality-based multidimensional approach. This approach assesses RIS performance and the impact of regional policy by analyzing several indicators to track the contribution of cohesion policy to the increase in innovation performance (Hajek and Henrikes, 2017, Schmidt, 2019). The need for multidimensionality to assess the effect of support actions on innovation performance is essential for accurately tracking the cause-effect relationship of regional development programs. (Dusza and Hamerska, 2021). The modelling approach to capture the ERDF effects should use the available evidence and regional-level contextual conditions (Crescenzi and Giua, 2016). Zabala-Iturriagagoitia et al. (2007) argue that one of the most appropriate and available tools that allows for efficiently accessing the progress in regional (and national) innovation performance based on many innovation indicators is the “European Innovation Scoreboard” (EIS) developed by the EC.

The so-called “Regional Innovation Scoreboard” is seen in many studies as an adequate tool to observe changes in regional innovation capacity. The Step report (2003), aimed at developing a comparable tool to assess regional innovation for the Oslo region, serves as an example. The Regional Innovation Scoreboard provides an analytical approach that enables the effective management of regional efforts to improve innovation by identifying the strengths and weaknesses of regional innovation systems. In another similar study, Hajek and Henrikes (2017) define the Regional Innovation Scoreboard as a combination of strongly related indicators and

emphasize that it can reliably measure innovation capacity. Based on an extensive benchmarking analysis using different innovation indicators and dimensions, the EC provides annual assessment of the innovation capacity of the European regions<sup>2</sup>. The analysis uses statistics from 240 regions across Europe and compiles regional data into an innovation scoreboard. The Regional Innovation Scoreboard from 2021 is based on a revised measurement framework<sup>3</sup> and used 21 regional indicators (21 out of 32 indicators used in the EIS) which are grouped into four main groups:

- framework conditions,
- investments,
- innovation activities,
- external impact and internal impact on regional companies.

Each group includes four innovation dimensions or results criteria, which have equal weight in the final assessment. This provides measurable insights into the development of innovation performance in a region. These fundamental groups of different dimensions cover both the measurement of the performance of resources invested in the RIS and its multifaceted functionality.



**Figure 3.** Measuring Regional Innovation Index

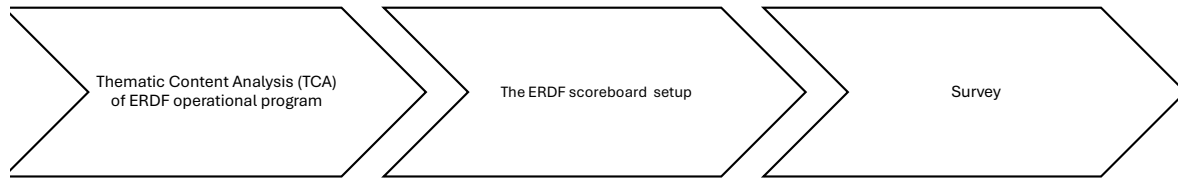
Sources: The figure is reproduced from EU Commission, (2021), Methodology Report European Innovation Scoreboard 2021, Methodology Report, European Union.

To analyze the effect of ERDF on regional innovation, we propose the conceptual creation of an evaluation model based on the EIS measurement. The model follows the same logic and methodology as the EIS (2021) and is also applied for 2014-2020 ERDF program. For a first pilot test in the form of a case study, a predetermined qualitative approach, outlined in Figure 4, has

2. The first EIS rapport was published by the EU Commission in 2001.

3. In the EIS methodology report (2021), the EU Commission pinpoints the fact that over time the measurement framework has been revised several times, with the latest major revision in 2017, to reflect the change in policy instruments.

been implemented following a three-step roadmap.



**Figure 4.** The assessment roadmap

Sources: The figure was created by the authors.

In Step 1, we perform a Thematic Content Analysis (TCA) to gain a comprehensive understanding of the operational program document for the studied EU region. This phase focuses on identifying the regional priorities and the anticipated impacts detailed in the selected ERDF Program.

In Step 2, we employ a conceptual matching process where each one of the 12 dimensions of innovation performance defined in the EIS methodology is aligned with one of the expected effects and results identified in the operational ERDF program. This ensures that the expected effects are categorized into the 12 dimensions. To make the EIS methodology relevant for this study, we validated each dimension against the descriptions in the operational program document, considering the problem formulations analyzed in Step 1. It's important to note that implementing operational programs typically involves supporting numerous regional projects, with each project potentially contributing to more than one dimension. Consequently, every project may generate more than one effect. Figure 5 illustrates the methodological framework.

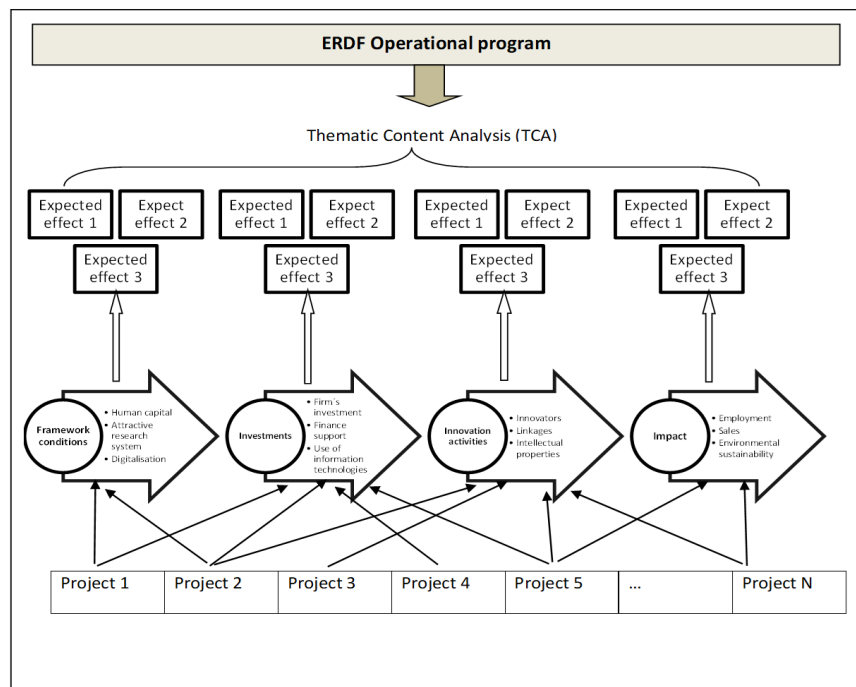
Once the innovation scoreboard is established in connection with the operational program, Step 3 involves conducting structured interviews to understand the effects generated by each project. These interviews are conducted with regional organizations that have implemented or are implementing ERDF-funded projects during the period 2014-2020 to ensure the collection of efficient data. The methodological triangulation of the analysis provides a comprehensive overview of the results and effects of ERDF-funded projects for the selected region.

## 4.2 Case study: West Sweden

In this subsection we examine the coherence of the theoretical methodology proposed in Section 2 by applying it to a specific case, the ERDF program for West Sweden over the programming period 2014-2020. The aim of this case study is to enhance our understanding of how ERDF programs impact regional innovation performance and in what ways. The main database is founded in the "Impact analysis report of the EU Regional Fund in Western Sweden— Portfolio analysis 2014-2020"<sup>4</sup> (Ben Abdelhamid, 2022) published by Tillväxtverket - the Swedish Agency for Economic and Regional Growth.

4. Effektanalys av EU:s regionalfond i Västsverige - Portföljanslys 2014-2020 Pub.nr.: 0389





**Figure 5.** Modelling ERDF effects on innovation performance

Sources: The figure was created by the authors.

### Step 1: TCA of the ERDF operational program for West Sweden

The main goal of the ERDF operational program<sup>5</sup> for West Sweden is to invest around 50 million Euro in job creation and regional growth. The ERDF should also primarily be used by regions as an instrument to strengthen regional innovation, enhance the competitiveness of Small and Medium-sized Enterprises (SMEs), contribute to a greener economy, and promote sustainable urban development. The program covers the NUTS (Nomenclature of Territorial Units for Statistics) 2 region, which includes both the Halland and Västra Götaland regions. West Sweden is one of the strongest innovative regions in Europe and belongs to the “Innovation leaders” category in the latest regional innovation measurement. However, the ERDF operational program points out several challenges. To address these challenges, the main objective of the action plan in the operational program is to provide support to both SMEs and actors within the regional innovation system through three target areas:

- Increasing collaboration between research and innovation in line with regional smart specialization priorities
- Enhancing SME competitiveness
- Supporting innovation for a transition to a low carbon economy

### Step 2: Establishment of the effect of measures based on EIS dimensions

As explained in the previous section, we need in this step to develop a comparable set of dimensions that can be identified in the operational program for West Sweden. consisting of the 12 dimensions

5. The ERDF operational program is a document drawn up at national or regional level, submitted by Member States, and adopted by the EC . The document provides a description of the program ´s strategy, the main regional challenges, and supporting actions that should address this, in line with the cohesion policy political objectives.

which are framed in EIS 2021, as summarized in the table below:

**Table 1.**Effect of measures of the ERDF operational program for West Sweden

EIS 2021 category of indicators	Scoreboard dimension	West Sweden Operational Program expectation
Framework conditions	Human capital	Knowledge diffusion increasing innovation-oriented activity
	Attractive research system	The development of new methods and instruments supporting innovative SMEs
	Digitalization	More digital instruments to enhance innovation
Investments	Firm´s investment	Improved conditions to support SME capacity
	Finance support	Improving access to finance for SMEs
	Use of information technologies	Growing R&D investment in new technologies
Innovation activities	Innovators	Enhanced SME capacity to develop and commercialize new products and services
	Linkages	More and better cooperation by innovative SMEs with others
	Intellectual properties	Initiating and supporting patent applications
Impact	Employment	Employment growth in innovative SMEs
	Sales	Increased SME sales in the new market
	Environmental sustainability	Lower carbon emissions through SME use of sustainable resources

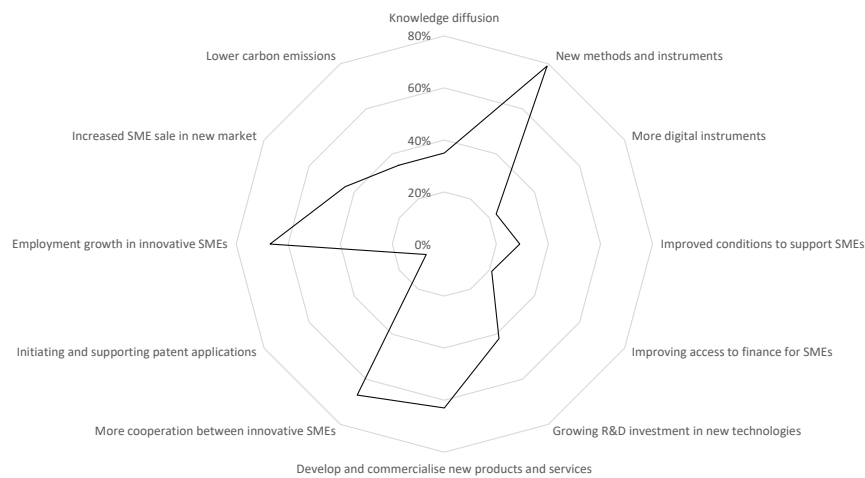
### Step 3: Collecting data and analysis

According to the study design, a structured interview should be used to collect context-related data that provide relevant and insightful findings for the case study. However, the impact analysis report of the EU Regional Fund in Western Sweden (Ben Abdelhamid, 2022) utilized a multiple-choice questionnaire a common feature of qualitative research, as an efficient way to collect data to understand the key contributions of the ERDF program to regional innovation performance in West Sweden. The questionnaire, based on the effect-measures scoreboard presented in Table 1, was distributed as an online survey to respondents from 91 out of 101 projects carried out under the ERDF 2014-2020 program in Western Sweden. . The survey respondents were primarily main beneficiaries and stakeholders in regional fund projects in Western Sweden, including representatives from universities, colleges, research institutes, incubators, regional networks, and more. These actors are also key contributors to the regional innovation system in Western Sweden.

In its simplicity, the questionnaire provides the most comprehensive depiction of the implemented model. The survey data is analyzed through a mixed -methods approach, combining qualitative and quantitative techniques. The qualitative aspect involves the use of a structured interview and a multiple-choice questionnaire to collect responses from stakeholders in Western Sweden. The responses is also coded and categorized to identify common themes and patterns related to the impact of the ERDF program on regional innovation performance.

A total of 48 (51%) respondents completed the survey. The survey response rate of slightly over 50% is considered a satisfactory outcome for this type of survey. However, it is important to acknowledge the potential risk of excluding significant perspectives. Being aware of this limita-

tion is crucial, as it may impact the comprehensiveness and representativeness of the survey findings.



**Figure 6.** The results of the survey on the effects of the ERDF-funded project in West Sweden  
Sources: The figure was reproduced from Ben Abdelhamid, M., (2022), impact report "Effektanalys av EU:s regionalfond i Västsverige— Portföljanalys 2014-2020", Tillväxtverket.

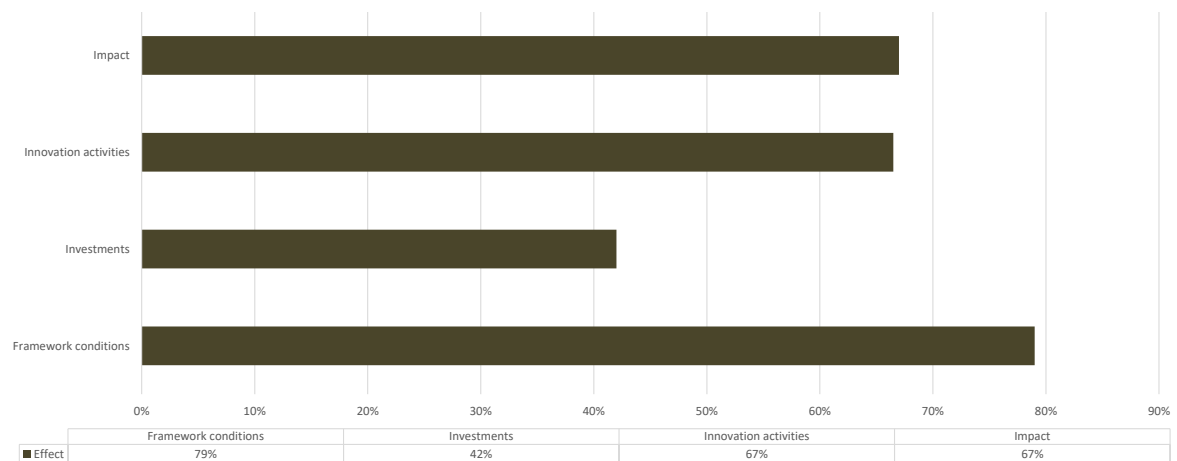
As showed in Figure 6, the data-driven findings from the analysis revealed several key insights regarding the impact of the ERDF program on regional innovation performance in West Sweden:

- Development of new methods and instruments: A significant majority (79%) of respondents reported that actions implemented within ERDF-funded projects contributed to the development of new methods and instruments supporting innovative SMEs.
- Limited success in patent applications: Only 8% of respondents reported success in initiating and supporting patent applications with ERDF financing. This indicates a potential area for improvement in terms of supporting intellectual property development and protection within the region.
- Increased cooperation among innovative SMEs: A majority (67%) of respondents reported that ERDF-funded projects led to more and better cooperation among innovative SMEs with others. This suggests that the program has facilitated networking and collaboration opportunities, which are essential for driving innovation.
- Employment growth in innovative SMEs: Similarly, 67% of respondents reported that ERDF-funded projects contributed to employment growth in innovative SMEs. This indicates that the program has had positive effects on job creation within the region's innovative sectors.

Enhanced capacity for product development and commercialization: A significant proportion (63%) of respondents reported that ERDF-funded projects enhanced SME capacity to develop and commercialize new products and services. This suggests that the program has supported the growth and competitiveness of SMEs in the region.

The diagram Figure 7 also provides a comprehensive overview of the ERDF program's contribution of the implemented interventions to four fundamental areas measuring regional innovation performance in West Sweden, as identified through interviews with project stakeholders themselves. These areas include Impact (67%), Innovation activities (67%), Investments (42%), and Framework

conditions (79%).



**Figure 7.** ERDF Contribution to the four fundamental areas of EIS 2022

Sources: The figure was reproduced from Ben Abdelhamid, M., (2022), impact report "Effektanalys av EU:s regionalfond i Västsverige— Portföljanslys 2014-2020", Tillväxtverket.

The study has shown that the large scale of ERDF financing has contributed to strengthening the regional framework conditions for the improvement of regional innovation in West Sweden. Strengthening and developing the structure of the regional system - by knowledge diffusion and the development of a new and digital support system - is closely linked with the intensification of innovation activities by SMEs that can also lead to the creation of a sustainable impact. As was expected, the ERDF program in West Sweden is also making a valuable contribution to regional innovation performance. The program provides support for the development and establishment of new and existing infrastructure, which is needed to raise and stimulate the innovation performance of European regions.

## 5 Discussion and concluding remarks

### Theoretical contributions

The multifaceted nature of regional innovation, as revealed by previous research (Smętkowski et al., 2017 and Gorzelak et al., 2016) has posed significant challenges in assessing the impact of cohesion policy funding program particularly on innovation. These challenges stem from the diverse range of factors influencing the dynamics within a RIS (Gorzelak et al. 2016; Smętkowski et al., 2017). Our study makes significant contributions to the existing body of knowledge on regional innovation performance in two ways. First, it underscores the importance of considering specific contextual and place-based nuances when promoting innovation through the implementation of funding programs like the ERDF, as regional dynamics within RIS substantially influence innovation outcomes (Samara et al., 2012; Crescenzi and Giua, 2016; Smętkowski et al., 2017). The study enhances the understanding of the multidimensionality of regional innovation performance measurement (Lau and Lo, 2015; Hajek and Henrikes, 2017; Smętkowski et al., 2017). Second, our research delves into the measurement of regional innovation performance by evaluating the effectiveness of innovation activities through the relationship between inputs and outputs of the RIS (Zabala-Iturriagoitia et al., 2007).

This study contributes to the literature by proposing a methodological and conceptual framework that uses analogical modeling based on the EIS to study the influence ERDF funding on innovation. The model introduced in our study provides valuable insights into the impact assessment of funding programs by considering the complex nature of regional innovation activities. By acknowledging and addressing the multifaceted nature of regional innovation through the multidimensional perspective of the EIS methodology, we propose an approach that is crucial for accurately evaluating the effectiveness of ERDF programs in promoting innovation. To assist the implementation of our methodology design, through a case study we examined the applicability of the framework of the European Innovation Scoreboard, which can be employed to assess the effect of structural. The case confirms the initial hypothesis adopted in this work which explains that ERDF contribute to the regional innovation.

### **Methodological limits and recommendations**

The analysis reveals an overall emerging effect that can be derived from ERDF funded projects in West Sweden, which is the development of regional framework conditions that are indispensable for fostering innovation. These conditions include increased knowledge diffusion, the development of new methods and instruments to support innovative SMEs, and the implementation of more digital tools to enhance innovation. These elements are crucial for stimulating and initiating major changes in the regional innovation system, aligning with the political objectives of EU cohesion policy. This suggests that ERDF is effectively supporting innovation in West Sweden. However, the success of the ERDF in West Sweden may have various underlying factors that need to be considered. The methodological approach presented in our work highlights that while ERDF-funded projects contribute positively to the regional innovation framework, the specific characteristics and the performance of the West Sweden's RIS might differ from those in other regions. These differences could be due to unique regional factors such as local governance structures, industry composition, and existing innovation capacities, which play a role in shaping the outcomes of ERDF funding.

We think that one of the main limitations of previous methodologies for evaluating the impact of the ERDF is the diversity of focus areas being evaluated within the same analysis. The starting point of our work was, thus, to isolate the effects of EU support from other policy instruments by emphasizing the close association of ERDF to innovation. Therefore, isolating the main identified effect in this work that can be attributable to ERDF in West Sweden from other national and regional programs outputs seems to be a systematic methodological difficulty. Overcoming this methodological issue is crucial to analyze the convergence between different policy instruments with the aim of improving and stimulating innovation. Nevertheless, the presentation of an overall figure for ERDF's impact is important.

We conclude that, through focusing on the performance RIS, this work confirmed that the ERDF adds value, which makes it worth more attention in the context of regional development. Despite the qualitative nature of the analysis and the insufficiency of answers to our research question, the contribution made by this work is a starting point for a pragmatic methodology which can guide other researchers through an investigation of the impact of the EU's cohesion policy.

### **Public Policy implications**

The conceptual creation of this evaluation model allows us in the first place to demonstrate that the performance of the RIS is not yet entirely consensual. In our case, it is undeniable that the ERDF contributes to regional innovation. The ERDF is one of the main instruments of the Union's

cohesion policy. It helps to reduce the disparities between the levels of development of European regions and to improve living conditions in the least favored regions. Thanks to the ERDF, the RIS develops innovative solutions related to strategic areas. If these arguments are intuitive to value, they are much less simple to demonstrate if there is no prior tool. Public policies must therefore be based on this type of tool to improve regional innovation capacities and make innovation processes more efficient. The effectiveness of these policies not only depends on the level of mobilization of the resources allocated to them (particularly in terms of investment), but also considers the interrelationships between the elements of the system and their situation in the process.

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