Nature's Price Tag: An Assessment of Market-Based Instruments for Environmental Protection in Spain

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by

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ABSTRACT

Market-based instruments (MBIs) for environmental protection have received increasing recognition in recent years as an effective strategy to align private actors' interests with biodiversity preservation goals. This recent implementation means that there are few examples of the study of the effectiveness of these market mechanisms, and even fewer for those developed and implemented in Spain. The purpose of this paper is to show what are the main existing market mechanisms developed by Spanish public administrations for environmental protection, what is their current state of development (with current examples), what are their level of effectiveness and what could be avenues for further research and work on payment for ecosystem services. This thesis will focus on the three main mechanisms that exist in Spain: Nature Conservation Banks, Carbon Footprint Registry as well as reduction and offsetting; and Carbon Fund for a Sustainable Economy and Climate Projects.

ABSTRACT

Gli strumenti di mercato (MBI) per la protezione dell'ambiente sono stati sempre più riconosciuti negli ultimi anni come una strategia efficace per allineare gli interessi degli attori privati con gli obiettivi di conservazione della biodiversità. Questa recente implementazione significa che ci sono pochi esempi di studio dell'efficacia di questi meccanismi di mercato, e ancora meno per quelli sviluppati e implementati in Spagna. Lo scopo di questo lavoro è quello di mostrare quali sono i principali meccanismi di mercato esistenti sviluppati dalle amministrazioni pubbliche spagnole per la conservazione dell'ambiente, qual è il loro attuale stato di sviluppo (con esempi attuali), qual è il loro livello di efficacia e quali potrebbero essere le strade per ulteriori ricerche e lavori sul pagamento dei servizi ecosistemici. Questa tesi si concentrerà sui tre principali meccanismi esistenti in Spagna: Banche per la conservazione della natura, Registro dell'impronta di carbonio, riduzione e compensazione; Fondo di carbonio per un'economia sostenibile e progetti climatici.

I. INTRODUCTION

A. Background on environmental protection in Spain

Spain's biological richness and diversity is due to several factors: its geographical isolation, its late and scarce industrialisation, its geographical position, and its concentration of population in large cities, which leaves a large part of the territory unpopulated (and therefore devoid of anthropogenic impacts).

Regarding the first of these factors, the Pyrenees have had a natural barrier effect that has kept the Iberian Peninsula isolated from Central Europe for more than 20 million years. A similar situation occurs with the Strait of Gibraltar, as there is an aquatic barrier between the European and African continents that was formed approximately 6 million years ago, which has isolated the African species that lived on the peninsula at the time. This geographical isolation makes the presence of endemic species a common occurrence and proclaims Spain as one of the world's biodiversity hotspots (Peñas et al., 2005).

The geographical position, south of Europe and straddling Europe and Africa, also significantly affects the variability of the species found and the ability of some of them to migrate from the African continent and nest on the Iberian Peninsula (generally migratory birds).

Depopulation in Spain is a serious problem. The abandonment of rural areas with the idea of migrating to the city means that the vast majority of the territory is occupied by rural land and only a small fraction of the population lives in rural areas (Camarero et al., 2009) (see *Figure 1*). This depopulation problem has been tackled by the Spanish Government through the creation of the Ministry for Ecological Transition and the Demographic Challenge by means of RD 500/2020[1]. This action combines environmental policies (carried out through the Secretary of State for the Environment) and demographic challenges or depopulation policies (carried out by the General Secretariat for the Demographic Challenge or by the Undersecretariat for Ecological Transition and the Demographic Challenge) in the same Ministry.

[1] *BOE-A-2020-4814 Real Decreto 500/2020, de 28 de Abril, Por El Que Se Desarrolla La Estructura Orgánica Básica Del Ministerio Para La Transición Ecológica y El Reto Demográfico.*

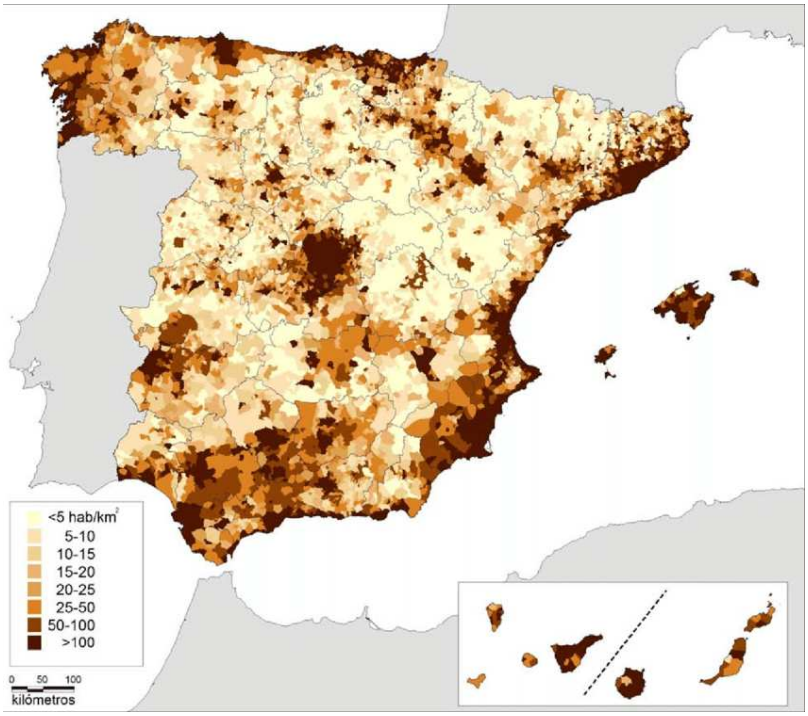

***Figure 1**: Spanish Population Density Map (Martínez Fernández & Delgado Urrecho, 2017).*

With regard to environmental protection and its historical context and evolution in Spain, it should be noted that this has been a late development. The concept of nature protection and the "polluter pays" principles were introduced into the Spanish legal system through Article 45 of the Spanish Constitution of 1978[2]. The creation of a ministry dedicated to environmental policymaking is relatively recent as it was established in 1996. This implies that there is barely 30 years of public dedication to promoting environmental policies from a ministry entirely dedicated to environmental protection.

In relation to market-based instruments for environmental protection, these began to be introduced in 1993 with measures proposed by European institutions for this purpose, making express reference for the first time to "market-based and other economic instruments" (Watson, 2004). Since then, numerous instruments have been incorporated at both European and national level. There are few studies carried out on market-based mechanisms developed entirely by Spanish administrations, so there is a clear knowledge gap in this area.

[2] *BOE-A-1978-31229 Constitución Española.*

B. Purpose and research questions of the thesis

The general objectives of this thesis are to show what are the main existing market mechanisms developed by Spanish public administrations for environmental protection, what is their current state of development (with current examples), what is their level of effectiveness and what could be avenues for further research and work on payment for ecosystem services.

This general objective related to assessing the effectiveness for each studied market mechanism is divided into the assessment of four specific objectives:

The instrument design of each of the market-based instrument.
The capacity of the mechanisms to empower and encourage the participation of local and regional communities in the projects.
The monetary value of ecosystem services.
The application of the hybrid governance.

Among the different types of market mechanisms for nature conservation that exist in Spain, the focus for this thesis will be on the three main ones that have been exclusively developed by Spanish public administrations: nature conservation banks; carbon footprint registry (as well as reduction and offsetting); and Carbon Fund for a Sustainable Economy and Climate Projects. The reason to focus only on market mechanisms developed by Spanish institutions is that there is currently very little information and research on the subject. A study focused only on these mechanisms could help to better understand the Spanish situation with respect to them and to know what their shortcomings and strengths are, as well as possible future lines of research or paths to follow to improve the results in terms of environmental protection.

Among the existing mechanisms, the Green Public Procurement Scheme is excluded from the study due to the lack of data published to date, which makes it impossible to assess the effectiveness of this mechanism.

Research Questions:

- What are the market-based instruments used for environmental protection in Spain entirely developed by Spanish institutions?

- What factors influence the effectiveness of these instruments in Spain?

- How effective are these instruments in achieving environmental protection goals in Spain?

II. SPANISH SITUATION

This section will clarify the administrative situation regarding environmental competences (central and regional administrations), as well as the main market-based instruments developed by Spanish administrations. This second section will also present the three main mechanisms, which will be analysed in depth in subsequent sections.

A. Spanish administrative competences on environmental protection

In Spain, environmental and nature management competences are distributed among various institutions according to Articles 148 (competences assumed by Autonomous Communities) and 149 (competences assumed by General State Administration) of the Spanish Constitution. These articles specify who has what powers over whom.

At first, the General State Administration holds responsibility in terms of basic legislation. This means it is responsible for setting general policies and regulations regarding nature management throughout Spanish territory. Some key institutions at state level include:

1. Ministry for Ecological Transition and Demographic Challenge (MITERD): this ministry oversees environmental policy at state level and oversees biodiversity preservation, natural resource protection, water management and other environmental aspects.

2. Hydrographic Confederations: these bodies are accountable for overseeing water resources in Spain's various hydrographic basins and their goal is to guarantee sustainable and equitable utilization.

3. Autonomous Bodies: beyond ministries, several autonomous bodies dependent on the State are also responsible for various aspects of nature management such as INIA (National Institute

for Agricultural and Food Research and Technology) or IGME (Spanish Geological and Mining Institute).

Autonomous Communities in Spain possess similar environmental powers. They manage nature on their respective territories while developing legislation within the legal framework set out by the General State Administration (they possess environmental management responsibilities while the Central Administration handles basic legislation matters). Their powers are set forth in each region's Statute of Autonomy and include areas like land-use planning, environmental protection, and biodiversity conservation.

Autonomous Communities establish their own environmental policies and regulations, creating specific bodies or agencies tasked with nature management at regional levels.

Market mechanisms designed to preserve nature are overseen by both the Central Administration and Autonomous Communities; with each Autonomous Community taking responsibility for managing them on its respective territory and reporting back to the Central Administration on any actions they undertake.

B. Overview of the main Spanish market-based instruments for environmental protection

In order to understand the existence of market mechanisms for environmental conservation, it is important to point out 1992 as a key year when the Maastricht Treaty was signed, coinciding with the conclusion of the Rio de Janeiro Convention on Environment and Sustainable Development, since this convention gives rise to the United Nations Framework Convention on Climate Change, where the use of market mechanisms (also called flexibility mechanisms) in climate matters is made official. The Rio Convention laid the foundations for the most recent climate conventions, agreements, and objectives at European and Spanish level. Some of these recent examples are the European Green Pact (from which the Biodiversity Strategy 2030 and the Forestry Strategy 2030 derive) as well as the new Common Agricultural Policy. In these recent agreements, market mechanisms are of particular importance, for example, with income

support (an example of payment for ecosystem services) being the first pillar of the Common Agricultural Policy[3].

This thesis will focus on the three main mechanisms developed by Spanish public administrations focused on environmental conservation at the national level.

B.1. Nature Conservation Banks

Nature conservation banks are a biodiversity conservation tool whose main objective is the protection of species, habitats and ecosystems through the creation of conservation areas and their appropriate management (Bunn et al., 2014).

Nature conservation banks, as a form of Market-Based Instrument (MBI), are innovative mechanisms designed to promote biodiversity conservation and habitat preservation. They operate by creating a market for ecosystem services, particularly compensatory mitigation, where developers or individuals who impact natural habitats can purchase credits from conservation banks to offset their ecological footprint. These banks consist of ecologically valuable lands set aside and managed specifically for conservation purposes. By quantifying and valuing the ecological benefits provided by these lands, nature conservation banks enable the trading and transfer of credits, allowing developers to meet their regulatory obligations while simultaneously supporting the protection and restoration of natural ecosystems. This MBI encourages the integration of economic incentives into conservation practices and offers a flexible and market-driven approach to safeguarding biodiversity.

In Spain, nature conservation banks lack specific regulation, although they are currently under regulatory development and have been recognised and mentioned in Law 42/2007 on Natural Heritage and Biodiversity[4].

At an international level, the Convention on Biological Diversity (CBD) acknowledges the significance of nature conservation banks as an effective tool for biodiversity preservation.

[3] *First Pillar of the Common Agricultural Policy (CAP): II – Direct Payments to Farmers | Fact Sheets on the European Union | European Parliament*
[4] *BOE-A-2007-21490 Ley 42/2007, de 13 de Diciembre, Del Patrimonio Natural y de La Biodiversidad.*

According to CBD's recommendations, conservation banks are one of the most effective tools available and should be implemented alongside other conservation measures.

There are multiple examples on both a national and international scale of successful use of nature conservation banks, with the first example of a species conservation bank in California for the protection of *Sternula antillarum* in 1985 (Carreras Gamarra & Toombs, 2017). On a national level, La Hoya experimental farm will also serve as an ex situ example of Saharan fauna preservation in Almeria Province (Moreno, 2010).

In Spain, nature conservation banks are overseen by Autonomous Administrations (Moreno Saiz et al., 2003) according to Article 148 of the Spanish Constitution on the distribution of powers. Individuals, companies or non-governmental organisations may also manage them (all always under supervision by autonomous governments). Management involves creating conservation areas as well as applying restoration measures such as reintroducing species or rejuvenating degraded habitats.

Nature conservation banks in Spain operate by creating conservation areas that are properly managed to ensure species, habitats and ecosystems are preserved for future generations. These terrestrial or marine areas must then be subject to suitable management and restoration measures including reintroducing species into degraded habitats as well as safeguarding endangered species populations (González, 2014).

B.2. Carbon Footprint Register

Carbon footprint registration is an efficient way of measuring, reducing, and offsetting greenhouse gas (GHG) emissions produced by an organisation or entity. It works by creating an emissions calculation which represents the amount of GHG emitted over a certain timeframe, including both direct and indirect emissions (Álvarez Gallego & Rubio Sánchez, 2015).

In terms of carbon footprint reduction and offsetting, there are various initiatives and programmes in Spain. One of the most prominent is the Climate Programme of the Spanish Climate Change Office, which offers grants for projects to reduce and offset GHG emissions.

There are also certifications such as ISO 14064 (Sangwan et al., 2018), which establishes a framework for measuring, reducing, and offsetting the carbon footprint.

Internationally, there are several successful examples of carbon footprint reduction and offsetting. For example, the UN Climate Neutral Now initiative encourages companies to commit to climate neutrality and to offset their GHG emissions through mitigation projects in developing. The Kyoto Protocol also established a legal framework for reducing GHG emissions globally(Knox, 2004).

The operation of the carbon footprint registry in Spain is relatively simple. Companies or entities wishing to calculate their carbon footprint can do so using tools such as the GHG Protocol methodology, which establishes a framework for accounting and reporting GHG emissions. Subsequently, organisations can register their emissions in the National Carbon Footprint Registry, created by Royal Decree 163/2014[5].

Short of that, carbon footprint registries are an invaluable asset in combatting climate change and mitigating its effects. They allow companies and organisations to accurately measure GHG emissions, reduce them, offset them, thus contributing to environmental sustainability while combatting global warming.

B.3. Carbon Fund for a Sustainable Economy (FES-CO2) and Climate Projects

In Spain, the "Carbon Fund for a Sustainable Economy" (FES-CO2) was created as an innovative financial mechanism in 2009 to finance projects that reduce greenhouse gas emissions and advance transition toward low carbon economies. Funded through the General State Budget and an item earmarked for the acquisition of this type of environmental credits, FES-CO2 provides funding to projects which address this need and promote low carbon economic transition (Sarasíbar Iriarte, 2013).

Climate Projects, one of the tools used by FES-CO2, are projects developed by companies, public administrations and non-profit organisations to reduce greenhouse gas emissions. For eligibility in ETS-CO2, certain criteria must be fulfilled such as independent verification of

[5] *BOE-A-2014-3379 Real Decreto 163/2014, de 14 de Marzo, Por El Que Se Crea El Registro de Huella de Carbono, Compensación y Proyectos de Absorción de Dióxido de Carbono.*

reduced emissions; existence of monitoring and follow-up plans; as well as meeting applicable environmental and social standards[6].

Law 2/2011 on Promoting Sustainable Development[7] serves as the legal foundation for FES-CO2 and Climate Projects, setting objectives and regulations to reduce greenhouse gas emissions in Spain. Furthermore, in May 2021 the Climate Change and Energy Transition Law established long-term targets for emissions reductions as well as providing an action framework against climate change (Francisco & García, 2021).

FES-CO2 has supported an impressive range of projects in Spain, from renewable energies promotion and building energy efficiency upgrades, to sustainable mobility promotion, forest management and agriculture management. Notable examples of funded FES-CO2 projects include La Muela II hydroelectric plant in Zaragoza; Gijon's energy improvement plan; and Malaga Airport solar photovoltaic project (Convocatorias y Proyectos Seleccionados).

Financing projects through FES-CO2 involves multiple steps, from applying for funding through to monitoring reduced emissions. This process is overseen by National Accreditation Entity (ENAC), which oversees accreditation of entities that verify emission reductions to ensure quality and transparency throughout.

At present, Spain is taking key steps against climate change through the Carbon Fund for a Sustainable Economy (FES-CO2) and Climate Projects. By financing projects which reduce greenhouse gas emissions, FES-CO2 promotes transition to low carbon economies while meeting national and international climate mitigation objectives.

III. LITERATURE REVIEW

A. Definition and overview of market-based instruments for environmental protection

Market-based tools for environmental protection refer to economic tools and incentives designed to align private actors' interests with nature conservation goals (Ferraro & Kiss, 2002).

[6] *BOE-A-2011-17631 Real Decreto 1494/2011, de 24 de Octubre, Por El Que Se Regula El Fondo de Carbono Para Una Economía Sostenible.*
[7] *BOE-A-2011-4117 Ley 2/2011, de 4 de Marzo, de Economía Sostenible.*

Market-based instruments work by assigning economic values for ecological services provided by ecosystems and encouraging landowners to manage their property in ways that produce positive conservation results (Pagiola & Platais, 2006). Among existing market-based instruments in the European context, two of those have a notable presence: Payments for Ecosystem Services (PESs) and Tradable Environmental Allowances (TEAs) (Pirard, 2012).

Payment for Ecosystem Services (PES) is a market-based approach designed to encourage conservation and sustainable management of natural resources by compensating landowners or resource managers for providing ecosystem services. PES programs aim to create economic incentives for landowners who engage in activities which enhance or protect ecosystem services, such as providing clean water, sequestering carbon emissions, conserving biodiversity and beautifying their landscapes. Bellver-Domingo et al. (2016) provides an in-depth explanation of PES by defining it as a voluntary transaction between buyer and seller in which one party purchases an environmental service from another, through either direct payments, subsidies, or market-based schemes.

Payments may be provided by governments, private companies, or international organizations and distributed to individuals, communities, or organizations who manage land or natural resources. Ingram (2014) describes the benefits of PES, noting its contribution to ecosystem conservation, supporting local livelihoods, and encouraging sustainable development. PES can create economic incentives for landowners to protect or restore ecosystems, leading to improved environmental outcomes. Ola (2019) explores key components of successful PES programs, including clear property rights and contracts; monitoring and enforcement mechanisms; as well as effective governance structures. Engagement of local communities and stakeholders is also crucial to the long-term success and sustainability of PES initiatives. Overall, PES provides a framework for valuing and compensating ecosystem services provided by ecosystems to foster conservation and sustainability management practices. It is an economic approach to environmental management which aligns economic incentives with ecological goals.

TEAs are another market-based instrument, creating a market for tradable permits that limit environmental resource usage (CIFOR, 2005). Permits are issued to users that allow them to participate in activities using environmental resources, such as logging, mining or fishing up to an allowed limit; those not using their entire allocation can sell any excess permits onto other

users who need them; thus creating a market. By restricting total permit allocation TEAs aim to limit environmental resource consumption and thus lessen negative impacts on ecosystems

Studies have demonstrated the potential effectiveness of market-based instruments, particularly PES schemes, as an instrument for environmental protection (Pereira, 2010; Wunder, 2007a). PES schemes have been implemented across various regions such as Latin America, Africa and Asia where it has proven beneficial (Engel et al., 2008; Nelson et al., 2010). PES schemes have also been established across Spain with special relevance in Catalonia, with elevated potential for ecosystem services like water supply, carbon sequestration and biodiversity conservation (Russi et al., 2011).

But the effectiveness of market-based instruments in promoting environmental protection is often contingent upon contextual factors, including design of schemes, social and economic considerations and characteristics of ecosystem services (Pascual et al., 2017; Wunder, 2015). (Corbera et al., 2009) found that PES schemes in Costa Rica had more success at promoting forest conservation due to strong land tenure rights and benefit distribution among participants, while Engel et al. (2008) showed success was determined by participation level and design of payment mechanisms.

Market-based instruments, particularly PES, have the potential to be effective tools in supporting environmental protection efforts; however, their success depends on various contextual considerations and must be tailored specifically for each region in which they operate.

B. Previous studies on market-based instruments for environmental protection in Spain and globally

Market-based instruments (MBIs) for environmental protection have received growing recognition in recent years as an effective strategy to align private actors' interests with biodiversity preservation goals. These economic tools and incentives create economic values for ecosystem services provided by ecosystems, incentivizing landowners to manage their lands in ways that yield positive conservation results.

B.1. Previous studies on market-based instruments for environmental protection in Spain

PES schemes have been implemented across Spain in various regions such as Andalusia, Catalonia and Valencia for various ecosystem services like water provision, carbon sequestration and biodiversity conservation. The vast majority of known cases arise from an initiative (either legislative or for direct nature conservation reasons) by Spanish public administrations. However, as private organisations participate in this type of mechanism, a continuous public-private collaboration is necessary for the implementation, management and monitoring of these market mechanisms. The "Programa de Medidas Agroambientales de Andalucía" (Agri-environmental Measures Program of Andalusia) (Ayudas Agroambientales Medida 10 y Medida 11 - Junta de Andalucía.) is a PES program implemented in the region of Andalusia, Spain. The program provides financial incentives to farmers who implement farming practices that contribute to the conservation of natural resources and biodiversity, such as reducing the use of pesticides and promoting the maintenance of natural habitats. The program is funded by the European Union's Common Agricultural Policy.

One of the main objectives of the program is to improve the quality of water resources in the region by reducing the use of agrochemicals and promoting sustainable farming practices. Another objective is to promote the conservation of biodiversity by supporting the maintenance of traditional farming practices and the preservation of natural habitats.

B.2. Previous studies on market-based instruments for environmental protection at a global scale

MBI's can be an effective means of encouraging nature conservation; however, their success depends on many external factors and conditions in any particular location. As a result, it is vitally important that they are tailored specifically to address social, economic and ecological considerations present there.

MBIs have proven their worth in forest conservation efforts. Forests provide many important ecological services such as carbon sequestration, water regulation and biodiversity preservation. Deforestation is one of the primary contributors to global greenhouse gas emissions and poses a severe threat to biodiversity. As an effective response, market-based

instruments such as REDD+ (Reducing Emissions from Deforestation and forest Degradation) were introduced as financial incentives for forest conservation (A. et al., 2012). REDD+ is a performance-based mechanism which pays developing nations for reduced deforestation emissions as well as carbon stocks increased through afforestation or reforestation activities.

Studies have demonstrated the efficacy of market-based instruments like REDD+ in supporting forest conservation. According to A. et al. (2012), REDD+ may significantly reduce emissions associated with deforestation and forest degradation in developing countries; however, its success depends upon various factors including its design, governance context and social-economic context.

Market-based instruments can have positive social and economic effects beyond simply encouraging conservation outcomes. PES schemes, for instance, can provide income and employment opportunities to rural communities that rely heavily on natural resources for their livelihood (Wunder, 2007). Furthermore, market-based instruments can foster more equitable use of natural resources by encouraging sustainable practices like adopting more eco-friendly methods or decreasing overexploitation (Pagiola et al., 2005).

Market-based instruments for environmental protection present several unique challenges. One such hurdle is design of the scheme itself: choosing appropriate indicators for measuring conservation outcomes, setting payment levels, and identifying eligible participants (Pascual et al., 2014). Another is governance context issues related to corruption, weak institutions, unequal power relations (Corbera et al., 2007). Market-based instruments may have unexpected repercussions as well; for instance shifting negative environmental impacts onto other areas or disenfranchising marginalized groups from participating (Wunder, 2007).

The conclusion is that market-based instruments offer great potential to promote environmental protection, especially forest protection. However, their success depends on many variables specific to each context and circumstance, including design of the scheme itself, governance environment and social and economic environment. Market-based instruments present their own set of challenges, from design and governance considerations to unintended results and unanticipated events. Market-based instruments have the potential to have profound social and economic benefits; they can promote more equitable use of natural resources while being sustainable in nature. Therefore, it's vital that market-based instruments be tailored specifically

for each region they are employed in as well as being regularly evaluated on their effectiveness and potential unintended impacts.

C. Comparison of Market-Based Instruments with Command-and-Control Regulations

The reason for comparing market-based instruments with command-and-control regulations is to evaluate the effectiveness and efficiency of different policy approaches in achieving environmental objectives according to the literature. Both market-based instruments and command-and-control regulations are commonly used tools in environmental governance, but they differ in their underlying principles and mechanisms.

MBIs include cap-and-trade systems, pollution taxes and subsidies, while CAC regulations specify emission standards while prescribing specific technologies or practices to reach those limits. Both approaches have been applied across many environmental policy contexts, but it remains an open question as to which one works better in reaching environmental goals. This literature review seeks to explore and compare their respective effects.

There is growing research evidence pointing towards MBIs' effectiveness in reducing pollution levels. Cap-and-trade systems have proven highly successful at this, such as in the United States' Acid Rain Program which led to significant reductions of sulfur dioxide and nitrogen oxide emissions (Napolitano et al., 2007) while Europe's Emissions Trading System has reduced carbon dioxide emissions from covered sectors (Denny Ellerman et al., 2016). Pollution taxes also prove effective: For instance, a study on Sweden's sulfur tax was shown to lead to substantial reductions of sulfur dioxide emissions (Shmelev & Speck, 2018).

One of the greatest advantages of MBIs is that they provide economic incentives for firms to reduce emissions. By pricing pollution, firms have an incentive to cut back to avoid incurring the associated costs; this often leads to more cost-effective pollution reduction compared with CAC regulations that may require costly enforcement and limit flexibility (Tietenberg, 2006).

However, MBIs present several unique challenges. One such difficulty lies in making sure the system is designed in such a way as to be fair and equitable for all stakeholders; if pollution permits are allotted on a firm-by-firm basis based on historical emissions alone this could give some firms an unfair advantage over others which leads to market distortions (Stavins, 2011).

Furthermore, concerns have been expressed that MBIs could cause concentrations of pollution in certain communities if permits are sold instead of auctioned (Goeree et al., 2009)

Contrasting CAC regulations with their more prescriptive nature, CAC regulations often take an approach which provides more clarity for firms about what is expected of them under environmental management regulations. By setting specific emissions standards and limits, these CAC regulations provide clear guidance about what their firm must do to comply with them and provide investors and other stakeholders with greater assurances of what can be expected of them. Furthermore, CAC regulations may help address environmental justice concerns by mandating that firms use technologies or practices which reduce pollution more equitably (Yu et al., 2022).

However, CAC regulations can also be more expensive to implement and enforce than MBIs; setting up monitoring systems and conducting regular inspections may incur substantial expenses, while compliance costs for firms can become significant. Furthermore, these CAC regulations tend to be less flexible than MBIs as they don't offer economic incentives to reduce emissions, making it harder for firms to adapt quickly to shifting market conditions or adopt innovative technologies (Guo et al., 2021).

Overall, there is no clear consensus as to which approach is the more effective one; both MBIs and CAC regulations each have their own strengths and weaknesses that must be taken into consideration before selecting one for implementation in any specific situation. MBIs may be better suited for areas with high pollution levels where cost-effective pollution reduction strategies are desired while CAC regulations might prove more suitable when environmental justice concerns come into play.

D. Factors influencing the effectiveness of market-based instruments for environmental protection

Taking into account the literature review, it is presente a selection of relevant factors for studying the effectiveness of the presented market-based instruments presented:

- Design of the Instrument.

- Empowerment and Participation of Local Communities.

- Monetary Valuation of *cosystem ervices*.

- Hybrid Governance.

D.1. Design of the instrument

In the context of market-based instruments, the term "design" refers to the specific characteristics and features of the instrument that determine how it operates and influences behavior. The design of market-based instruments includes key elements such as the allocation of emission rights, the setting of carbon prices, the establishment of trading mechanisms, and the rules for compliance and enforcement.

The design of market-based instruments is crucial because it shapes the incentives and motivations for participants to reduce emissions or engage in conservation activities. It determines the effectiveness and efficiency of the instrument in achieving its conservation goals.

Numerous studies have highlighted the significance of instrument design in achieving desired conservation outcomes. Bingham et al. (2021) reported that auction design significantly affected their effectiveness at achieving conservation results; similarly, Le Velly & Dutilly (2016) discovered that payment for ecosystem services schemes with particular attention paid to structuring incentives and types of ecosystem services targeted could significantly impact their effectiveness.

Instrument design also plays a pivotal role in policy implementation processes. A study by Yang et al. (2010) highlights this fact, noting how market-based instruments' design is essential to ensure successful policy implementation, with optimal designs increasing effectiveness while simultaneously encouraging stakeholder participation.

Notably, market-based instruments' designs also play a crucial role in their implementation costs. According to Jakob et al. (2012)'s study, initial allocation of emission rights had an enormous effect on overall program costs associated with cap-and-trade programs.

Market-based instruments play a critical role in achieving conservation outcomes, as numerous studies have shown their significance.

D.2. Empowerment and participation of local communities

Empowering and engaging local communities in the development and implementation of market-based instruments are vital for effective environmental conservation. Many studies have highlighted this aspect of conservation efforts; (Agrawal & Gibson, 1999) provided evidence that local community participation led to improved forest management results than centralized administration; Ostrom (1990) demonstrated how participation by local residents can result in more sustainable resource use.

Community involvement in market-based instruments of environmental protection takes many forms, from participation in decision-making processes and co-design of projects, to sharing of benefits. A study by Bennett et al. (2017) discovered that community participation was critical to the success of payments for ecosystem services (PES) schemes, leading to higher trust, greater acceptance, and enhanced environmental outcomes.

McDermott et al. (2012) conducted another study analyzing the importance of community participation in REDD+ (Reducing Emissions from Deforestation and Forest Degradation) projects, finding that community involvement was crucial for ensuring equitable distribution of benefits as well as mitigating risks of elite capture.

Overall, community involvement is an essential factor in the effectiveness of market-based instruments for environmental protection. It ensures that conservation efforts are socially and culturally appropriate, equitable, and sustainable; so involving local communities in designing and implementing market-based instruments should be a top priority of conservation practitioners and policymakers alike.

D.3. Monetary valuation of ecosystem services

Monetary valuation has long been of significant interest among researchers, policymakers, and environmental practitioners. Monetary valuation refers to assigning economic values to natural resources or ecosystem services that support conservation efforts via market-based instruments.

An increasing body of literature demonstrates the significance of monetary valuation in designing and implementing market-based instruments. Research indicates that market instruments may be more successful at conserving natural resources and ecosystem services when their monetary values are accurately assessed and reflected in market prices ((Nunes & Van den Bergh, 2001; (Pagiola et al., 2005)). Conversely, failure to accurately value nature could lead to inefficient market outcomes such as overexploitation of natural resources or undervaluation of ecosystem services (Islam et al., 2019).

However, the accuracy of monetary valuation has long been debated among scholars. Critics argue that it fails to capture ecological and cultural values associated with nature as well as consider long-term consequences of resource depletion, excessive reliance on monetary valuation can lead to commercialization of nature and prioritizing economic efficiency over environmental protection (Paton & Bryant, 2012).

Current valuation techniques fail to capture adequately the diverse array of values associated with nature, including ecological, social, and cultural dimensions. Market-based instruments (MBIs) typically determine pricing through convergence between consumers' willingness-to-pay (WTP) as estimated from demand curves and providers' willingness-to-accept (WTA), which accounts for costs associated with providing ecosystem services. This balance may be attained by including multiple criteria in valuation processes - such as social, cultural, and ecological values - so as to take all aspects of nature into consideration (Lapeyre & Pirard, 2013).

Conclusion In summary, the valuation of nature is an essential component in the effectiveness of market-based instruments for environmental protection. While its purpose can be improved by accurately reflecting natural resource and ecosystem service values more precisely, such valuation must also reflect ecological, social, and cultural considerations to ensure its continued existence in natural systems.

D.4. Hybrid governance

Hybrid governance has emerged as a highly effective approach to the management of ecosystem services, combining market-based mechanisms with collaborative, participatory

governance structures. This approach recognizes that effective and equitable ecosystem service management requires both economic incentives as well as inclusive decision-making processes involving multiple stakeholders.

Mann et al. (2021) conducted an in-depth examination of hybrid governance within ecosystem service provision. According to this research, market-based instruments, like Payment for Ecosystem Services (PES), and participatory approaches like co-creation play a vital role in meeting forest ecosystem service's complex and diverse nature while protecting its values associated with them. Furthermore, this study emphasizes integrating economic incentives with social and ecological considerations so as to achieve sustainable results.

Biggs et al. (2021) build on this concept by exploring the potential of hybrid governance to help address trade-offs between ecosystem services and multiple stakeholders, and reconciling trade-offs through collective decision-making processes such as PES with collaborative governance mechanisms to foster inclusive decision-making processes and enhance social-ecological resilience. They propose a framework combining PES market-based instruments with collaborative governance mechanisms for effective hybrid governance arrangements; additionally adaptive management and participatory processes play a key role in realizing effective hybrid arrangements.

Rana & Chhatre (2017) explore the role of hybrid governance in managing power dynamics and creating social equity when managing ecosystem services. According to them, hybrid approaches facilitate inclusion for marginalized or underrepresented groups so they may actively participate in decision making processes; and emphasize the necessity of using economic incentives together with deliberative processes to reach more equitable results.

Muradian & Rival (2012) emphasize the need for hybrid governance structures to overcome limitations associated with pure market approaches. Market mechanisms may not accurately capture the complexity and context-specific nature of ecosystem services; as a result they call for the incorporation of stakeholder perspectives, local knowledge, and traditional practices into governance structures for more holistic and adaptive ecosystem service management strategies.

Salliou et al. (2019) conducted an in-depth investigation of hybrid governance as it pertains to agricultural landscapes and ecosystem services, specifically through agricultural landscapes and ecosystem services. Their authors contend that integrating market-based mechanisms with collaborative governance practices can enhance ecosystem service provision across agricultural landscapes while emphasizing stakeholder engagement as an essential means for aligning economic incentives with sustainable land management practices.

Higgins et al. (2014) provide an in-depth exploration of hybrid governance in PES programs in Australia, exploring its challenges and opportunities in terms of both adaptive governance mechanisms that integrate local knowledge with power dynamics to ensure equitable distribution of benefits as well as hybrid governance's role in addressing social and environmental justice concerns during PES implementation.

Overall, literature on hybrid governance of ecosystem services illustrates its importance in effectively overseeing these precious resources. By combining market-based instruments and participatory approaches into an inclusive decision-making process, hybrid governance acknowledges all values associated with ecosystem services while providing potential tradeoff solutions and increasing social equity - as well as supporting adaptive management for sustainable outcomes.

IV. METHODOLOGY

This section will explain the techniques and methods used to obtain, analyse, and interpret the information in relation to the Spanish market mechanisms studied. A diagram (see *Figure 3*) shows the three sources of information used, the direct collection of information from these sources, and a matrix to assess the data and obtain conclusions trying to answer the proposed research questions.

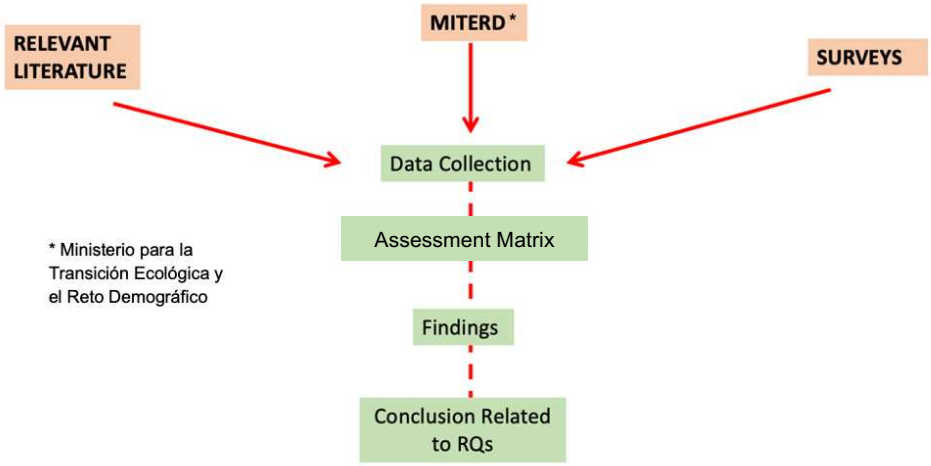

***Figure 2**: Research Methodology.*

A. Data collection methods

This section describes the methods of data collection utilized for studying market mechanisms, specifically Conservation Banks, Carbon Footprint Registry and Carbon Fund for Sustainable Economy (FES-CO2).

Data was gathered through information and reports published by different public administrations, most notably the Ministry for Ecological Transition and Demographic Challenge of Spain. Reviewing documents to extract relevant information was the initial step of data collection for this study; additionally, scientific bibliography was employed which proved invaluable in explaining and understanding various market mechanisms.

Ecoterra, one of the companies involved with FES-CO2, was interviewed extensively as part of my evaluation of this mechanism. To gain first-hand insight into their experiences using it and gather more specific details regarding its implementation process. Questions focused around Ecoterra's participation, project implementation challenges/opportunities related to this mechanism etc.

Notable to note is that information gleaned from various sources of data (reports and information published because of Law 27/2006 of the Spanish Ministry of Environment, private companies that have implemented market mechanisms and published their results, non-

governmental organisations, etc) was combined in order to gain a complete picture of each market mechanism studied. Reliability was evaluated, along with any biases in information obtained.

Overall, multiple data collection methods were employed to explore selected market mechanisms. A combination of desk research and literature review, in-depth interview with Ecoterra and personal observation provided relevant insight into how one company participated in FES-CO2.

B. Data analysis methods

A qualitative analysis was carried out on the results and information obtained from the Ministry for Ecological Transition and the Demographic Challenge and from the interview conducted with Ecoterra, Bosques Sostenibles S.L., and Dehesa del Guijo, as well as the scientific studies that have been carried out to date.

The analysis focused on the evaluation of the effectiveness of market mechanisms-based instruments on three criteria: design of the instrument, empowerment and participation of local communities (this also includes the participation of regional governments) and monetary valuation of nature. Hybrid governance is also analysed but it is excluded from assessing the effectiveness, as it also relies on external activities non-related to the MBI.

The instrument design of each of the market mechanisms studied was analysed to determine whether they were effectively designed to meet Spain's climate and environmental objectives. The capacity of the mechanisms to empower and encourage the participation of local and regional communities in the projects was also assessed. It was also assessed whether the monetary value of ecosystem services was considered in the design of the projects and the application of the hybrid governance was studied. This effectiveness is assessed on a matrix (see *Table 1*) presented at the end of this section and contains the following inputs: affirmative (T), negative (F), inconclusive (-).

***Table 1**: Assessment of the effectiveness for the three studied mechanisms.*

	Design & Objectives	**Local Communities**	**Monetary Valuation**
Nature Conservation Banks	T/F/-	T/F/-	T/F/-
Carbon Footprint Register	T/F/-	T/F/-	T/F/-
Carbon Fund (FES-CO2)	T/F/-	T/F/-	T/F/-

The analysis was carried out based on the results obtained from the documentary, literature review and the interview with Ecoterra, Dehesa del Guijo and Bosques Sostenibles S.L. The results were interpreted and compared with the Spanish climate and environmental objectives. The reliability of the data obtained was considered and possible biases in the information obtained were considered.

In summary, a qualitative analysis of the results and information obtained was carried out to assess the effectiveness of the market mechanisms studied in meeting Spain's climate and environmental objectives. The analysis focused on four key criteria and used a combination of data collection methods to obtain a complete picture of each of the market mechanisms studied.

V. RESULTS & DISCUSSION

A. Nature Conservation Banks

A.1. Overview of this market-based instrument

It is possible that nature conservation banks, among the elements chosen as market mechanisms for nature conservation in Spain, are the most difficult to obtain results from due to the lack of transparency in the publication of data (despite the provisions of the Aarhus Convention on access to information, participation and justice in environmental matters, incorporated into the Spanish legal system through Law 27/2006 regulating the rights of access to information, public participation and access to justice in environmental matters). The recent work of Carmen de Guerrero Manso (Del Carmen & Manso, 2016), as well as information published by

Ferrovial, the company that financed the largest nature conservation bank project in Spain (Enríquez et al., 2021) in 2014, will serve as sources of data to obtain the results presented below, concerning the very few information available on this instrument.

A.2. Factors influencing the effectiveness of this instrument

For each of the four factors identified as affecting the effectiveness of the mechanism, we observed the following results.

A.2.1. Design of the instrument

It is a mechanism that has been created by Law 21/2013, on Environmental Assessment. Its design is created and developed in the eighth additional provision of the aforementioned Law. The third paragraph of the eighth provision refers to the obligations of the owner of land affected by a nature conservation bank:

"*The owners of the land affected by the banks must conserve the natural values created or improved, and this land must only be used for purposes that are compatible with the aforementioned natural values, in accordance with the provisions of the resolution creating each nature conservation bank.*

This limitation of ownership shall be recorded in the Land Register in the registration of the property or properties on which the improvement or creation of natural assets has been carried out. For this purpose, the administrative certificate that the action of creation or improvement of the natural asset is registered in the corresponding nature conservation bank will be sufficient title to make this registration".

The technical specifications of how these banks are to be used will be established by regulation, and this legislation has not yet been passed, although, according to Law 21/2013, on Environmental Assessment, they are "a set of environmental titles or conservation credits granted by the Ministry of Agriculture, Food and Environment and, where appropriate, by the autonomous communities, which represent natural values specifically created or enhanced". The credits mentioned by Law 21/2013 are intended to be used for compensating

environmental damages, but their correct implementation and specific use case scenario are yet to be developed.

As Professor Carmen de Guerrero Manso argues (Del Carmen & Manso, 2016), the lack of regulatory development is one of the main causes of the opaque application of this measure. There are no clear guidelines from the Ministry for Ecological Transition and the Demographic Challenge as to how nature conservation banks are to be developed. This contrasts with the legal certainty provided by the regulatory development of this type of measure in countries such as the US, where the use of nature conservation banks is more widespread (Burgin, 2008).

A.2.2. Empowerment and participation of local communities

In accordance with the Spanish Constitution, competences in environmental matters are concurrent, i.e., the General State Administration is responsible for basic environmental legislation and the Autonomous Communities for the execution and legislative development following the frameworks established by the Central Administration.

Bearing this in mind, coordination between administrations is essential for the implementation of nature conservation banks. Given that there is currently no regulatory development at either state or autonomous community level, involving local communities is a difficult task and there is no record of it being carried out.

As reflected by CONAMA (Bancos de Hábitat y Custodia Del Territorio Coordina: Fundación Tormes) and Enríquez et al. (2021), in the few examples of nature conservation banks that exist, they have been implemented after a period of public consultation with local administrations, non-governmental organisations and interested individuals. These examples are the estate known as Dehesa del Guijo, which is located in the Monfragüe National Park, in Cáceres; as well as the estate known as "La Garganta", in the Valle Alcudia y Sierra Madrona Natural Park, in Ciudad Real. The participation in the development of conservation banks of all these social and economic actors is a key element in ensuring the success of them, ensuring their acceptance and respect in the long term.

In the two studies mentioned above, the lack of implementation and development of conservation banks is evident, so that the participation and social awareness of local communities at a general level cannot be considered adequate.

For the most representative example of Conservation Banks in Spain, the "Dehesa del Guijo" farm in Malpartida de Plasencia (Cáceres), it was possible to interview one of the owners of the land that has also participated in the elaboration of legislation regarding conservation banks with the Ministry (which still has not yet been approved). She kindly agreed to answer a series of questions about her experience and perception of nature conservation banks. Below is the sequence of questions and answers.

1- What has been your experience in the implementation and management of the nature conservation bank at the "Dehesa del Guijo" farm and what do you consider to have been the main achievements so far?

"The banks (NCBs) were done virtually, on paper to assess the process and interest of the parties. As you know, it was blocked by the environmental associations of CAMA (Environment Advisory Council). Subsequently, technical tables were formed for each sector to review/contribute/argue to the draft regulation, and the same thing happened again, there were direct orders from above to reject the approval of the document, they functioned almost "paramilitarily".

The virtual development was very useful for us to adapt actions that were underway, and to continue with others when their relevance became apparent."

2- How do you think the implementation of a market mechanism for environmental protection, such as a conservation bank, could benefit biodiversity conservation in Spain?

"Undoubtedly, currently, the big problem of the countryside is its low profitability, and conservation falls on the landowners, helped by RDPs (Rural Development Programmes), under the guidelines of the authorities, which is absolutely insufficient. The NCBs would provide income tools to be able to undertake many more actions, and prevent new generations from abandoning. Property is nothing more than taxes and expenses, and young people, and

not so young, prefer to make cash if they can, just look at the number of solar/photovoltaic parks... And the great abandonment and rural demographic vacuum.

Private property accounts for more than 70% of the rural surface in Spain, and a large part of Narura 200 network is included, words are enough. There are many generations dedicated to conservation and the future is not flattering. They are more urbanites, and the countryside makes it difficult for them, and if to top it off it costs them money, then that's it! We are responsible for many jobs, which will go to unemployment if we do not obtain income for the conservation and exploitation of the rural environment."

3- Taking into account the lack of specific legislation for this mechanism in Spain, what challenges have you faced in the management of the conservation bank and what recommendations would you have for overcoming them?

"Challenges are current, when we are offered unregulated certifications for companies to invest and compensate in the field. This is worrying because of the lack of control and regulation. OECC (Spanish Climate Change Office) only recognises forestry sinks and has to open up to the rest approved by the European Commission, so that carbon farming is effective for conservation, soil, biodiversity, fire prevention systems, etc."

4- What is your perception of the acceptance and participation of companies and other actors in the nature conservation bank on the "Dehesa del Guijo" estate? Do you think there is interest on the part of companies in participating in this type of initiative?

"There is a lot, but as long as it is regulated, it creates a lot of uncertainty on the outside. The Autonomous Regions can do it, but I don't think some of them understand the model well."

5- What are the criteria and procedures used to evaluate and select the conservation projects included in the bank? How do you ensure that the projects are effective and contribute to biodiversity conservation?

"The one set out in the draft regulation was followed. It provides for environmental monitoring by an approved scientific entity, which periodically submits reports linked to the release of conservation credits.

But without regulations, it cannot work. Compensation for major works must be put out to tender and nothing can be included that is not backed up by regulations."

6- Considering the importance of the participation and collaboration of multiple actors in nature conservation, what role do alliances and collaborations with other organizations or entities play in the functioning and success of the conservation bank of the "Dehesa del Guijo" estate?

"The alliance of all the actors that make up the value chain is very important: Authorities-Certifiers-insurers-custodian or environmental monitoring entity-scientific committee that endorses the proposal of the actions -owners-promoters-companies.... All of them have a specific role in the virtual NCB."

A.2.3. Monetary valuation of nature

Estimating the monetary value assigned to each nature conservation bank is complicated by the lack of transparency and the absence of data. The only way it can be estimated is by knowing the amount of money invested in a particular project, and identifying the number of credits that were granted, exchangeable as compensatory measures according to Law 21/2013.

In the pilot bank of Castilla La-Mancha called "La Garganta", "a total investment of 355,202.85 euros was made, where 83,951.35 euros was the cost of the environmental improvement activities, and the remaining 271,251.50 euros was used to cover the amount of the financial guarantee required by Law 26/2007, on Environmental Liability, to deal with possible environmental damage arising from economic activities.". In total, 560 environmental credits were granted for a total of 260 ha, which is equivalent to a value of 634.29 euros per environmental credit (Enríquez et al., 2021).

Taking into account the study, it can be deduced that given the lack of regulatory development, economic valuation is put on the back burner in the absence of clear guidelines and "environmental valuations" are carried out, in which the economic value is not taken into account but the type of degraded/conserved ecosystem.

A.2.4. Hybrid Governance

Since the application of nature conservation banks is scarce, and Law 21/2013 makes express reference to the cases in which nature conservation banks can be used as a compensatory measure (basically when there are imperative reasons of the first order for the implementation of projects for which there is no viable alternative), in needs to be complemented with other market or non-market instruments for nature conservation.

The bibliography is scarce and lacking in data that it is impossible to affirm or deny the existence of these practices (meaning that this MBI do not complement other conservation policies, but it is used solely as an intention, but as they are vaguely covered by current legislation, it would seem that they do not apply to nature conservation banks.

A.3. Effectiveness of this instrument in achieving environmental protection goals in Spain

The conservation targets that relate most closely to nature conservation banks are the targets to protect at least 30% of the land area and 30% of the sea area by 2030 (Hermoso et al., 2022), as well as the emission reduction targets presented in the National Integrated Energy and Climate Plan. As the banks do not quantify emissions, the 2030 target for protected areas could be helped by conservation banks being used as compensatory measures for potential impacts on protected areas.

At present, the lack of data and evidence published by the ministry or by companies that have carried out this type of project does not allow their effect to be quantified, but due to the absence of legislation it is estimated to be negligible.

The results obtained show that the use of nature conservation banks is to be considered as an important tool to be taken into account in order to meet conservation objectives, but that it is currently barely being taken into account, as evidenced by the fact that this concept has not been legally developed, despite the discussions that have taken place for more than ten years between the main interest groups in this area.

It cannot be considered an effective measure at present, but by laying the legal foundations and encouraging the participation and inclusion of local communities in the elaboration of this type of project, it may become a useful tool for environmental protection in Spain in the future.

B. Carbon Footprint Registry

B.1. Overview of this market-based instrument

The Carbon Footprint registry is a market mechanism created by Royal Decree 163/2014. It is a market mechanism that allows companies to improve their corporate social responsibility by calculating their direct emissions and those derived from energy requirements (Scope 1+2), as well as calculating companies' indirect emissions, such as workers' commuting to work (Scope 3). It also allows companies to obtain official seals when emissions are reduced over time, certifying the company's environmental commitment, as well as to offset their emissions with official CO2 emission absorption projects that have been registered for this purpose in the mechanism. The latter absorption projects must meet a series of requirements that guarantee a minimum size (1 ha), as well as a duration of at least 30 years, with the idea that they become long-term projects that act as CO2 sinks (Inscripción En El Registro de Huella, Compensación y Proyectos de Absorción de CO2).

B.2. Factors influencing the effectiveness of this instrument

It will now be discussed the four factors that have been identified as important in determining the effectiveness or otherwise of this MBI.

B.2.1. Design of the instrument

This instrument has been designed and implemented at national level by the Ministry for Ecological Transition and the Demographic Challenge. It is mainly composed of three sections which are schematized in *Figure 3*.

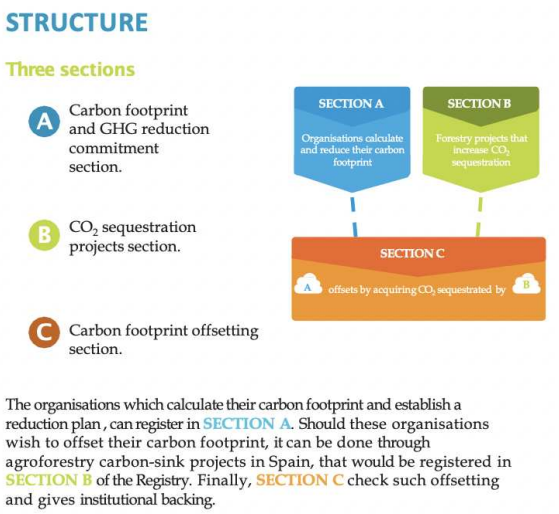

***Figure 3**: Spanish Carbon Footprint Registry Structure. Source: MITERD.*

This is a schematic structure but it fulfils three main tasks: firstly, it encourages companies to calculate and reduce their emissions, directly affecting the Annual Greenhouse Gas Inventory; secondly, it also encourages the creation of carbon sinks, which also have an effect by being included as a LULUCF (Land Use, Land Use Change and Forestry) sector within the Inventory; finally, it proposes a free market mechanism, in which supply and demand allows agreements to be reached between companies wishing to offset their emissions, with absorption projects that have been implemented and have accounted for the CO2 emissions to be absorbed.

To enable monitoring and compliance with Law 27/2006, annual reports on the implementation of this market mechanism are drawn up. The latest report, published in 2021 (Registro de Huella de Carbono, Compensación y Proyectos de Absorción, 2021), shows that there has been an increase over the years in the number of companies calculating their carbon footprint, as well as in the number calculating and reducing emissions. *Figure 4* shows data from 2014 to 2021 from the 2021 report on the number of companies that: calculate their carbon footprint; calculate their carbon footprint and reduce their emissions; calculate their carbon footprint and offset their emissions; and calculate their carbon footprint, reduce their emissions and offset their emissions. In the last three annual reports the information provided has been significantly more detailed than in the first reports.

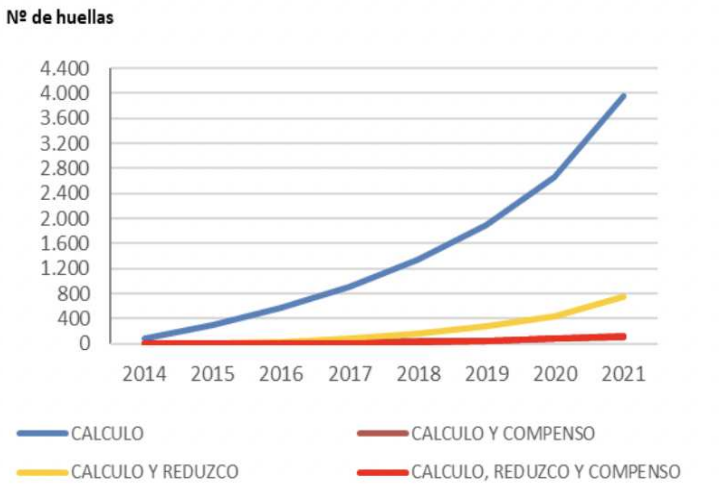

***Figure 4**: Spanish Carbon Footprint Registry Data 2014-2021. Source: MITERD.*

The upward trend in the application of this market mechanism speaks highly of its design, which has led to an approximately tenfold increase in the number of companies using the scheme in just seven years.

B.2.2. Empowerment and participation of local communities

As it has been already mentioned, although the mechanism has been created by the central administration, it is the Autonomous Communities that are responsible for implementing it, as well as for monitoring participation. In the previous section, we noted that the trend in carbon footprint calculation had been going upward in recent years. In the same 2021 report, data appears referring to the distribution by Autonomous Communities of the number of footprints and registered organisations. *Table 1* shows how this register has a certain homogeneity, as the Autonomous Communities with the largest populations have the most registers, and the autonomous cities of Ceuta and Melilla have only one register each, which is related to their isolation and low population.

***Table 2**: Spanish Carbon Footprint Registry Data by Region. Source: MITERD.*

Comunidad Autónoma	Nº huellas	Nº organizaciones
Andalucía	496	230
Aragón	226	94
Asturias, Principado de	73	34
Balears, Illes	224	100
Canarias	83	49
Cantabria	60	28
Castilla - La Mancha	241	172
Castilla y León	319	136
Cataluña	269	122
Ceuta	1	1
Comunitat Valenciana	897	331
Extremadura	22	19
Galicia	235	70
Madrid, Comunidad de	1.101	419
Melilla	1	1
Murcia, Región de	254	110
Navarra, Comunidad Foral de	62	23
País Vasco	221	83
Rioja, La	141	35
Total	**4.926**	**2.057**

Regarding the participation of small communities, there is relative data from the Ministry of Industry on the distribution of companies in Spain according to their size (see *Figure 5*).

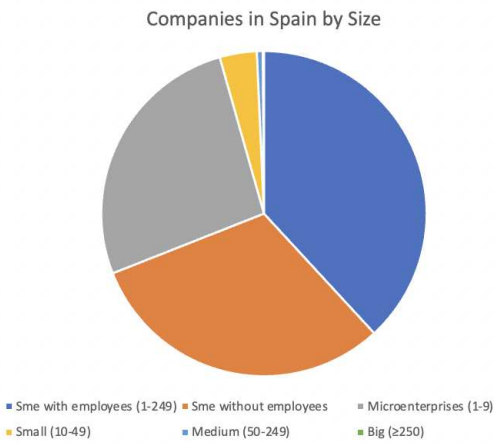

***Figure 5**: Companies by Size in Spain.*

If we compare this data with the data from the 2021 report which refers to the participation and registration of companies in the Carbon Footprint Mechanism (see *Figure 6*) according to their size, we can see that small companies have not been able to participate in this system.

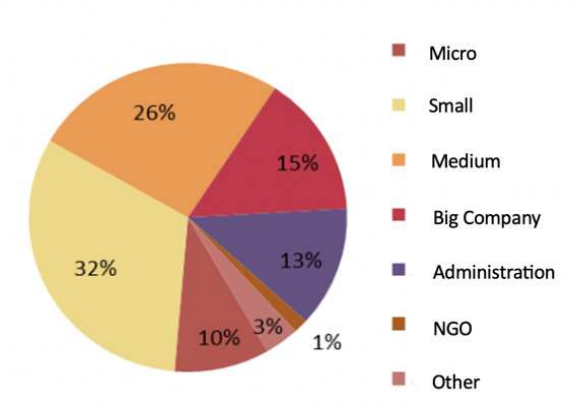

***Figure 6**: Company Participation in Carbon Footprint Registry by Size.*

Medium and large companies that have calculated their carbon footprint account for 41% of the total number of entities that have done so, while of the total number of companies in Spain, the sum of large and medium-sized companies is approximately 0.72% of the total number of companies. This abysmal difference denotes and reaffirms that there is greater participation on the part of the larger companies.

Undoubtedly, and despite the good dynamics in terms of the registration of entities, it is necessary to redouble efforts to involve and raise awareness among small companies, which, given the Spanish business fabric, represent the vast majority of existing companies.

It was possible to speak with a representative of the company Bosques Sostenibles SL, who have been involved on numerous occasions in Carbon Footprint Registry offset projects. Below is a series of questions they kindly answered about their perception of this market mechanism for nature conservation.

1- How do you perceive the effectiveness of the Carbon Footprint Registry in promoting carbon offsetting practices among the companies you work with? What evidence or indicators do you use to assess its impact?

"The Registry has promoted carbon footprint management, mainly among SMEs, where it was less well established, and has made organisations aware of the possibilities for offsetting their emissions through local projects. However, the impact on offsetting has been less than expected, based on the number of carbon footprints offset, which, according to the Registry's

own data, is less than 6% of the total, or if we analyse the withdrawal of allowances compared to those available (6.16%).

Even so, the Registry has provided a framework for validation of forest sink projects due to the lack of applicability of international standards, and there has been an exponential growth in the number of projects of this type in our country under this scheme, which are transferring future absorption rights to other entities without these necessarily participating in the Registry."

2- In your experience, what are the main benefits for companies of participating in the Carbon Footprint Registry and offsetting? Have you seen positive changes in their sustainability practices or reputation as a result?

"From our point of view, there are three main benefits: initiating or advancing in the management of their carbon footprint with the implications that this may have in relation to the efficient use of resources by the organisation; reputational, by allowing the use of the corresponding seal and giving visibility to part of the environmental work carried out by the organisation; and those related to contracting, since, although incipiently, participation in the Register is beginning to be imposed as a requirement or evaluation criterion in public tenders."

3- Can you give examples of successful carbon offset projects facilitated through the Carbon Footprint Registry? What were the key factors that contributed to their success and how were they evaluated?

"The reforestation project in MUP No. 134 "ORZADUERO". T.M. SAN MARTÍN DEL PIMPOLLAR promoted by Bosques Sostenibles S.L. is among the 6 projects with the most removals out of the 452 registered. This project has 200 ha, of which 35 ha were registered, and allowed, through the offsetting of emissions, the restoration of a burnt area included in the Network of Protected Natural Spaces of the Junta de Castilla y León and the Natura 2000 Network.

The key factors of the project were its associated benefits, this being a fundamental issue in all the reforestations implemented by our organisation, together with the participation of local companies. The assessment of these factors is carried out in the design phase and is evaluated

throughout the monitoring period of the plantation itself by means of indicators such as the number of working days generated, area/trees planted, protected area affected, number of catalogued species present in the project area, etc."

4- From your point of view, what are the main challenges or barriers that companies face when participating in the Carbon Footprint Register and implementing carbon offsetting initiatives? How do you help them to overcome these challenges?

"1. The need to have their carbon footprint registered, as this is an essential step in offsetting and there are companies for which this is an obstacle, as they need to carry out verification of the footprint, are not interested in reporting their emissions, or have complex processes that make the calculation difficult.
2. The fact of being a company with headquarters (CIF) in Spain, as there are foreign companies that could be interested in participating in national projects and do not have this possibility.
3. The high price of allowances compared to other markets, due to the fact that these are recent plantations, the project implementation costs, the limited absorption capacity of the species used in our geographical area and the restrictions imposed by the registry itself for the transfer of planned removals."

5- How important do you think government support and favourable policies are in encouraging companies to participate in the Carbon Footprint Registry and adopt carbon offsetting measures? Are there specific policy measures or incentives that, in your opinion, could increase the effectiveness of the Registry?

"Government support is essential for the consolidation of carbon footprint management, including offsetting, with measures such as tax incentives, incorporation into procurement processes and, above all, the establishment of a regulatory framework that includes certain obligations adapted to the type of companies, being the most effective in this regard."

6- Based on your experience and interaction with companies, what recommendations would you give to improve the effectiveness of the Carbon Footprint Registry and encourage more companies to participate in carbon offsetting? Are there any specific improvements or changes you would suggest?

"1. Making the Registry's eligibility requirements more methodologically sound and aligning them with the main principles of carbon accounting, especially in terms of ensuring additionality of projects.
2. Improve the traceability and transparency of the transfer of carbon credits (registry function), including the transfer of future removals or to organisations not involved in the calculation of the carbon footprint.
3. Improve coordination with regional registries and other international initiatives."

B.2.3. Monetary valuation of nature

For results on how and how much emissions are valued in the Carbon Footprint Registry, it is necessary to go to section "C" of the mechanism. This section refers to offsets, and despite the fact that 481 offsets have been carried out since the registry was set up, the prices agreed between companies per tonne of CO2 are not usually disclosed. Research carried out by EFEVERDE estimates that the price at which offsets are being traded is around 7 or 8 euros per tonne of CO2 (El Interés de Empresas y Organizaciones Por Compensar CO2 Se Dispara - EFEverde). This contrasts sharply with the 2022 average price per tonne of CO2 in the Emissions Trading Scheme (currently in its fourth phase), which was 80.87 euros (Precios CO2 - Sendeco2). The valuation per tonne of CO2 would be ten times lower than the valuation under the ETS. Data published by the Ministry shows that the total amount of emissions offset by the Carbon Footprint Registry are 38,774 tonnes of CO2 (see *Table 2*), which means a transaction volume of just over 270 thousand euros, a very low figure compared with ETS.

***Table 3**: Compensations and Organizations Included in the Carbon Footprint Registry. Source: MITERD.*

YEAR	Sum of compensations (tCO2)	Count of Organizations
2013	52	2
2014	268	12
2015	747	20
2016	1,176	22
2017	1,280	29
2018	1,516	42
2019	2,509	71
2020	18,222	130
2021	13,004	153
Grand Total	**38,774**	**481**

B.2.4. Hybrid Governance

In this case, and taking into account the data presented by the Ministry, it is not a mechanism that can be abused and need from synergies with other instruments, since compensation is freely established between entities (they negotiate and agree on the price and quantity to be compensated and notify the Ministry of the tonnes of CO2 to be compensated) on the side of the entities dedicated to compensation. On the other hand, absorption projects included in section "B" of the mechanism must comply with the requirements of Law 43/2003 on forests, with the forest management promoted by the autonomous community where the project is located, as well as with the minimum standards established in Royal Decree 163/2014.

The latest report from 2021 shows a tenfold increase in tonnes of CO2 available for offsetting compared to 2020 (see *Figure 7*). Given that the prices are not public, it is important to know what type of forestry plantations have been carried out, and to check that this mechanism is not being used to make money by making forestry plantations that may not be suitable for the land where they are being carried out, and that may aggravate problems of fires, lack of water or destruction of arable land, which the Spanish territory already suffers from.

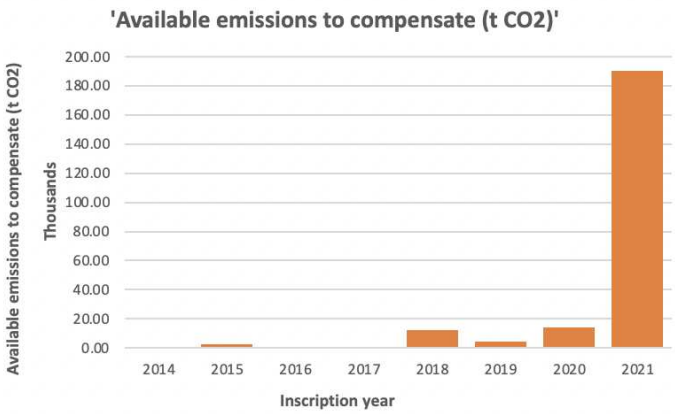

***Figure** 7: Evolution over Time of Amount of Emissions Available to Compensate under Carbon Footprint Registry Scheme.*

B.3. Effectiveness of this instrument in achieving environmental protection goals in Spain

The environmental protection objectives most closely related to this market mechanism would be to reduce greenhouse gas emissions by 55% by 2030 compared to 1990 emission levels (Fit for 55 - The EU's Plan for a Green Transition – Consilium). As can be seen, the trend for companies to calculate and reduce their carbon footprint has been growing over the last 8 years in a major way.

According to the latest report of the Spanish annual inventory of greenhouse gas emissions (Inventario Nacional de Gases de Efecto Invernadero (GEI)) in the year 2021, 288,8 million tonnes of CO2 equivalent green house gasses were emitted in Spain. In 2020, the carbon footprint was recorded and calculated at more than 27 million tonnes of CO2 equivalent. Taking into account that the report specifies that these emissions also include those calculated in companies that are active abroad (generally it is medium and large companies that are active abroad and have their headquarters in Spain), and that some sectors are allowed to carry out emissions accounting that is not updated in real time, there is a large disparity between the actual emission reduction data and those published in the Ministry's report.

With the current data it cannot be concluded that it is an effective measure to achieve these emission reduction targets, but what can be said is that the trend of registration and calculation of carbon footprint has been growing (increasing environmental awareness of companies and

consumers) and that this registration has occurred in greater proportion in medium and large companies (they are ultimately those that accumulate a higher level of emissions).

Having said all this, it is concluded that although the data point to a positive trend in the calculation and reduction of emissions, more information and a more detailed provision by public administrations is needed to discern whether this measure is having a significant impact in helping to meet the 2030 emission reduction targets.

C. Climate Projects of the Carbon Fund for a Sustainable Economy (FES-CO2)

C.1. Overview of this market-based instrument

This mechanism aims to encourage reductions in the so-called "diffuse" sectors, which are not included in the Emissions Trading Scheme (such as the residential sector, transport, agriculture or waste). The Climate Projects receive funding through the FES-CO2 and involve the acquisition of emission reduction credits by the State Administration from companies or entities that accredit such emission reductions. Since 2012, the Ministry for Ecological Transition and the Demographic Challenge has created annual calls for proposals, as well as developed calculation tools that allow companies to estimate the emission reductions they will carry out for six different sectors: agriculture and livestock, transport, residential, waste management, fluorinated gases, and industry and mining.

C.2. Factors influencing the effectiveness of this instrument

It will now be examined the four factors determined to be crucial for determining whether or not this market instrument is effective.

C.2.1. Design of the instrument

The way this mechanism works is as follows: a company or organisation intends to carry out an activity for the reduction of greenhouse gas emissions, in all or one of its production processes. This process must be included in one of the "diffuse sectors" mentioned above. In order to be eligible to apply for funding through a "Climate Project', it must meet, among other requirements, those specified in article 7 of RD 1494/2011, which are indicated below:

"*a) Their execution must not be required by the sectoral regulations applicable to them.*

b) They must contribute to compliance with the quantified commitments to limit or reduce emissions assumed by Spain by achieving reductions that are reflected in the Greenhouse Gas Inventory.

c) The greenhouse gas emission reductions they generate shall not come from installations subject to the emission allowance trading scheme, in order to avoid cases of double accounting.

(d) They may not at any time be recognised as joint implementation projects."

According to the Ministry, the two existing modalities are either the traditional Climate Project or Activity Programmes. The traditional Climate Project corresponds to a project that has a set start date for each of its specified activities, whether one or more; whereas the Activity Programmes are comparable to an extensive project approach that considers a series of activities that are gradually added to the programme, allowing similar activities that are dispersed throughout different geographical locations in Spain to be grouped under the concept of a programme. The cycle of the Climate Projects, which has been followed since 2012, is shown in *Figure 8*.

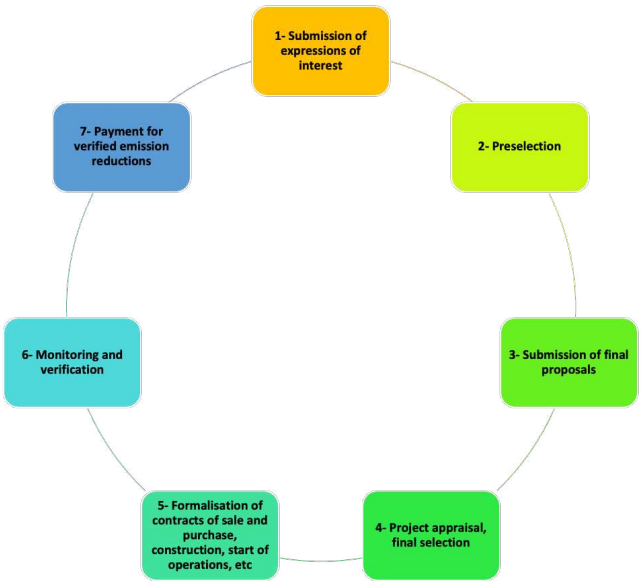

***Figure 8**: Climate Projects Cycle.*

C.2.2. Empowerment and participation of local communities

For the elaboration of this results section, two sources of information will be considered. Firstly, the document published by the Ministry that serves as a follow-up study of the effects and implications that the Climate Projects have had over the years, called "Evaluation and Assessment of the Climate Projects initiative". Secondly, the interview with the company Ecoterrae, beneficiary of the award of several Climate Projects in the 2019 call, for the following sectors: waste, transport, industry, agriculture and residential.

It is now presented the second source of information previously mentioned, incorporating the battery of questions answered by the company Ecoterrae in relation to the Climate Project it was assigned:

1. What were the concrete actions implemented to reduce CO2 emissions and meet the objectives set out in the project?

"*It is a plant that receives organic waste, from sludge to food waste or livestock manure, and manages it in a more sustainable way than would have been done in a "baseline scenario", thereby reducing the potential CH4 and N2O (which is ultimately CO2 equivalent since they are two GHGs) that would have been emitted in the absence of the plant."*

2. What impact has the support had on the company's strategy in terms of sustainability and emission reductions?

"*The company already participated in the FES-CO2 scheme in the first pilot call, and participating again shows that it is always interesting to see the synergy between the public entities that channel this type of incentives, and the industrial actors that make this type of activities that mitigate GHG emissions possible, since having this aid has given a boost to the project's executability.*"

3. How do you measure and verify CO2 emission reductions? Could you provide me with an estimate of CO2 emissions before and after project implementation?

"*The measurement and subsequent verification of GHG emission reductions is done by comparing the baseline (what happened before with that waste) and project (what will happen when the plant is operational) scenarios. To verify this comparison and calculate the emission*

reductions achieved, it will be necessary to measure the amount of waste managed, carry out biochemical analysis at the input and output of the processes, measure the gas generated and its composition, and control the plant's outputs. As for estimation of CO2 equivalent reduced, it is confidential, sorry."

4. How has the aid influenced the behaviour and attitudes of employees and other stakeholders in the company in terms of environmental conservation?

"*As far as employees are concerned I don't know, but as I said, this same company already did a FES-CO2 project in the first call, and thanks to that the project was well known, which gives value to the owner of that plant and its products.*"

5. Have there been any positive or negative side effects on the local economy or quality of life in the community due to the aid?

"*Usually it's the other way around; the local community doesn't really see an incentive for these plants to be around because they understand that they can generate truck traffic, odours or pollution, but sometimes they don't understand that the fact that this plant exists may be preventing nitrate contamination of groundwater from the application of slurry to the soil.*"

6. Has the company received any additional support from the government or other entities in relation to the project and its implementation?

"*This is unknown to me.*"

Of all the responses, the fifth is the most relevant to this section. According to the company's response, for their particular case of activity, there is a lack of knowledge on the part of the local community as to why the plants exist, as well as the environmental benefits they entail. These results are consistent with the fact that the Climate Projects are awarded at state level, with little involvement of the Autonomous Communities, let alone the Local Authorities in this process. Taking all this into account, it is possible that there is a lack of involvement of the local communities in the Climate Projects, and this may result in a lack of information and ignorance of the neighbours of the activities that may be taking place in their municipality.

Continuing with the second source of information, there is an uneven distribution of emission reductions due to Climate Projects among the 17 Autonomous Communities, where there were most often in Cantabria, Murcia or the two archipelagos (see *Figure 9*). These figures differ

from the distribution of the number of Climate Projects signed by each Autonomous Community (see *Figure 10*), showing that the volume and budget allocated to each Project can have a more or less significant impact on the number of emissions reduced, depending on their size.

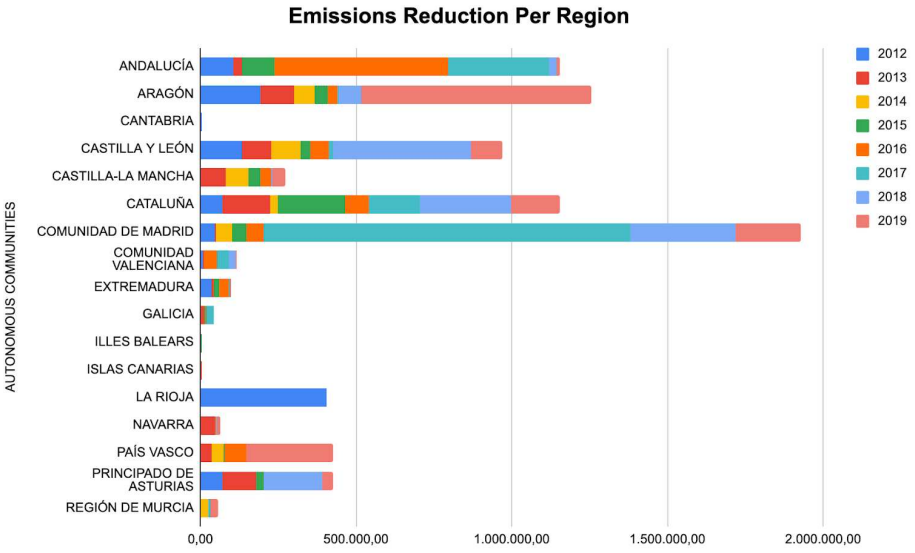

***Figure 9**: Climate Projects Emissions Reductions over Time by Region.*

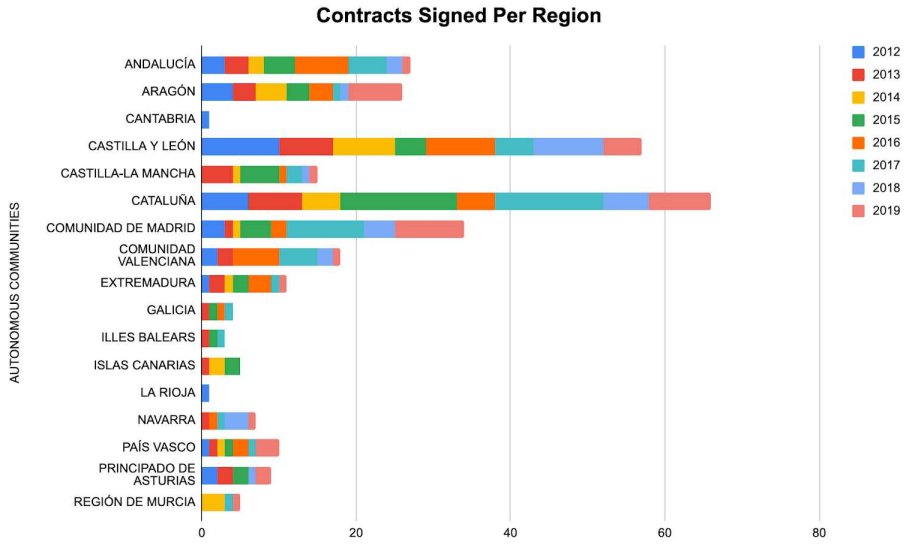

***Figure 10**: Climate Projects Contracts Signed over Time by Region.*

These two figures are related to the data extracted from the Greenhouse Gas Inventory, in its 2019 series (*MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO*, 1990), where there is an annual distribution by Autonomous Community of the tonnes of CO2 equivalent emissions (see *Figure 11*). There is a correlation between the three graphs, with the most emitting regions generally being the ones that have signed the most contracts and reduced emissions the most, and vice versa.

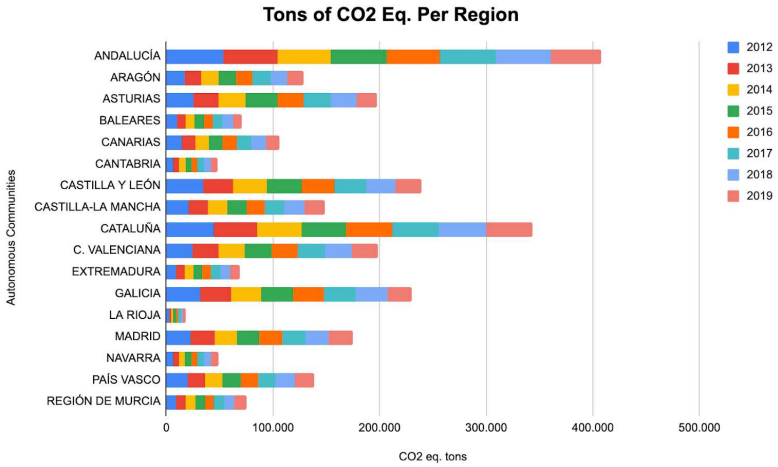

***Figure 11**: Regional CO2 eq. Emissions over Time.*

Taking into account all the data obtained, there is a clear lack of participation of local communities, as the State Administration is directly in charge of managing the Carbon Fund and awarding Climate Projects. Within the qualitative analysis carried out by the Ministry, "communication" is one of the aspects to be improved in the interviews conducted by the Ministry with the participating entities. This leads to the conclusion that "Some of the participants have asked for better communication: telephone attention, the right to reply, more technical support, more publicity of the calls for proposals". This goes hand in hand with the data extracted directly from the questions asked to the company Ecoterrae.

C.2.3. Monetary valuation of nature

The FES-CO2 establishes two modalities for the valuation of the price per tonne of CO2 equivalent reduced and verified in projects receiving financial support from the FES-CO2.

Modality 1 allows applicants to propose the price at which they would be willing to sell verified emission reductions to the Fund, provided that the price offered does not exceed €9.70/tCO2e. The price offered by applicants is a factor that influences the score given to the project in the

economic efficiency indicator that is part of the assessment criteria. Projects scoring 8 points or more on the innovation criterion will receive a 30% premium on the price offered.

Modality 2 establishes a fixed purchase price for the verified emission reductions of the projects selected under the call. The purchase price in this case will amount to €9.70/tCO2e (FONDO DE CARBONO PARA UNA ECONOMÍA SOSTENIBLE (FCPJ) (FES-CO 2)).

According to data published by the Ministry and related to Modality 2, for the calls from 2012 to 2014, the price set was 7.10 €/tCO2e; while for the calls from 2015 to 2019, the price was 9.70 €/tCO2e. For the recent 2021 call, the price was also set at €9.70/tCO2e (Convocatoria 2021 Del FES-C02 Para La Selección de Proyectos de Reducción de Emisiones Ubicados En Territorio Nacional).

C.2.4. Hybrid Governance

For the Climate Projects mechanism, identifying compliance or non-compliance results from looking at Climate Project awards, as well as the evolution of the price per tonne of CO2 equivalent.

Figure 12 shows how in the 2018 and 2019 calls for proposals there are two very significant gaps of unmet emission reductions due to lack of budget. It is paradoxical that with the potential to reduce more than one million tonnes of CO2 equivalent in each of the last two calls at a cost of less than one fifth of the value of the CO2 emission allowances subject to the trading scheme, it is not implemented due to lack of funds. The principle of qualitative complementarity is not being complied with at all, as the administrations are not taking advantage of the lack of budget in the last calls for proposals. The lack of budged could have been complemented with extra measures from other instruments that would enhance hybrid governance, but further research is needed to make such statement.

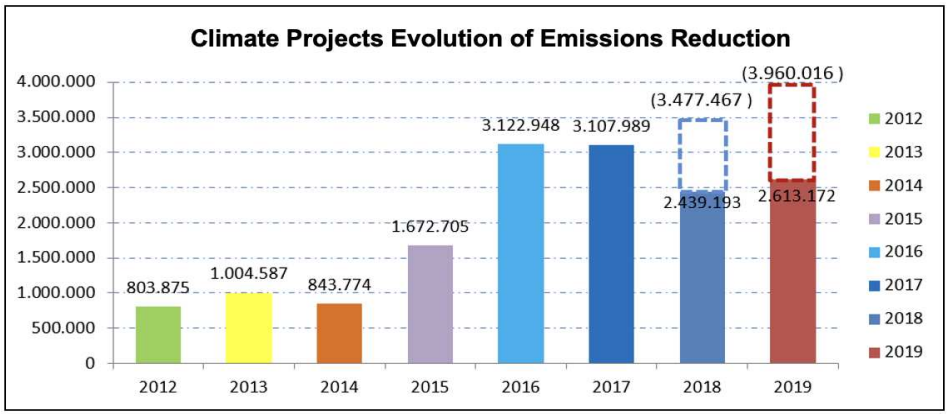

***Figure 12**: Climate Projects Emissions Reductions Over Time. Source:* FONDO DE CARBONO PARA UNA ECONOMÍA SOSTENIBLE (FCPJ) (FES-CO2) Evaluación y Balance de La Iniciativa de Proyectos Clima Mayo 2021 Oficina Española de Cambio Climático (OECC) Ministerio Para La Transición Ecológica y El Reto Demográfico, n.d.

It is also important to note that while emission allowances under Directive 2003/87 allowance trading scheme are priced at over €80.87/t (*Precios CO2 - Sendeco2*), the latest call for Climate Projects values each tonne at €9.7/t.

If we were to take into account all GHG emissions published by the annual Inventory and multiply the number of tonnes by €9.7/t, Spain's total annual GHG emissions would be valued at €2,793M, a very low figure compared to other valuation criteria such as Directive 2003/87. With all this information it is concluded that the hybrid governance is not being implemented within this instrument.

C.3. Effectiveness of this instrument in achieving environmental protection goals in Spain

The environmental objectives linked to this market mechanism would be the reduction of 26% of greenhouse gas emissions linked to diffuse sectors in 2030, compared to 2005 emission levels; together with the binding objective at European level of reducing emissions in 2030 compared to 1990 by at least 55%.

Taking into account the report published by the ministry analysing the effectiveness of this mechanism (FONDO DE CARBONO PARA UNA ECONOMÍA SOSTENIBLE (FCPJ) (FES-CO2) Evaluación y Balance de La Iniciativa de Proyectos Clima Mayo 2021 Oficina Española de Cambio Climático (OECC) Ministerio Para La Transición Ecológica y El Reto

Demográfico), referred to in *Figure 12*, if the Climate Projects funding had not run out of budget, 3.96 million tonnes of CO2 equivalent would have been reduced in 2019. According to data from the National Greenhouse Gas Inventory Report, 313.83 million tonnes of CO2 equivalent were emitted in 2019.

Currently, in Spain, 67% of total emissions correspond to diffuse sectors, i.e. sectors that can potentially reduce their emissions through Climate Projects (Inventario Nacional de Gases de Efecto Invernadero (GEI)) The proportion of emission reductions, as well as the future potential, linked to the low cost of acquiring credits, makes this mechanism useful and effective when it comes to enforcing Spain's environmental objectives at the international level. The lack of financial resources has been identified as one of the current obstacles that could slow down the development of this mechanism, as it requires direct allocation of credits by the Central Administration, which entails accounting costs.

D. Final Results

Considering the results presented above for the three mechanisms that have been studied, *Table 4* below summarises the results obtained for each mechanism.

***Table 4**: Assessment results of the effectiveness for the three studied mechanisms.*

	Design & Objectives	**Local Communities**	**Monetary Valuation**
Nature Conservation Banks	F	F	-
Carbon Footprint Register	T	F	T
Carbon Fund (FES-CO2)	T	F	T

It is evident from the data in *Table 4* that the participation of local communities has not been carried out at acceptable levels, as none of the three mechanisms has achieved a satisfactory result in this area.

VI. CONCLUSION

A. Study limitations

This section will outline and discuss the limitations of this study. Despite employing multiple data collection and analysis techniques, certain constraints must be acknowledged to allow for a full interpretation of results obtained.

One key limitation of the study is data availability. Although various government reports and documents were collected for analysis purposes, some data pertinent to analysis was unavailable. Furthermore, Ecoterra provided limited information which made it hard to fully comprehend their participation process in FES-CO2, making its interpretation less reliable due to a lack of accurate information or data.

Another limitation is the selection of criteria used in the analysis. Although relevant and meaningful criteria were selected for the study, other criteria important for assessing the effectiveness of market mechanisms could have been considered. For example, the assessment of equity and environmental justice in the application of these mechanisms could have been included.

The limited temporal scope is another key limitation of the study. Analysis focused on current and short-term results of market mechanisms without considering long-term effects of implementation; as it takes time for their effects to become visible, longer-term analysis could provide more complete evidence of their effectiveness.

Furthermore, this study focused solely on Spain and the implementation of market mechanisms there, which limits its generalisability to other contexts or countries. While many criteria used during analysis could apply in other nations as well, unique features may impact effectiveness of market mechanisms within each individual nation.

Overall, although multiple methods were utilized to collect and analyze the data in this study, some limitations should be acknowledged in its interpretation of results. This includes unavailability of some data points, selection of specific criteria during analysis, temporal scope

limitations, geographical restrictions, as well as influence from personal biases that must all be taken into consideration when interpreting them.

B. Summary of the results, implications for policy and practice and recommendations for future research

In the course of the thesis, and especially in the results and discussion section, we have tried to answer the proposed research questions. This section will elaborate the final conclusions of the answers to the research questions.

As seen in previous sections, the three main market mechanisms for environmental protection that have been developed and implemented in Spain are the Nature Conservation Banks, the Carbon Footprint Registry and the Climate Projects of the Fund for a Sustainable Economy.

Within the nature conservation banks, it is shown that the legal development has not yet been developed, generating a situation of legal uncertainty in this regard. Furthermore, there are few examples of the implementation of these systems in Spain and therefore the economic valuation of environmental credits is not clear. The fact that in other countries it has been a measure with a certain degree of success in improving environmental conditions suggests that new lines of research should be opened in these few examples in Spain, as well as putting pressure on the Spanish authorities in charge of developing and approving the regulations, since without a solid legal basis, it is difficult to develop a mechanism like this successfully.

On the other hand, the Carbon Footprint Registry has a clear and transparent legal development, which has allowed a high degree of legal certainty and participation to grow exponentially over the years, but still far away from a complete participation of local communities. Furthermore, although there is a valuation of environmental credits, this is not transparent as negotiations are carried out between companies and there is no public register of transactions. Future lines of research should aim to fill the knowledge gap where it is needed: in this case, public accounting and registration of transactions. Studying whether improving the efficiency of this type of mechanism by making more information available (public price registry) would further improve this promising and growing instrument.

Lastly, there are the Climate Projects of the Carbon Fund for a Sustainable Economy. In this case there is also clear legislation, but there is again a lack of real participation and empowerment of local communities. In contrast to the two previous mechanisms, there is no capacity to negotiate the price and a high potential for emission reductions has been observed which has not been able to be satisfied due to the lack of funds. The line of research and recommendations is linked to the creation of a market where agents are free to negotiate prices transparently and offer proposals to acquire the environmental credits as long as the specifications of the Administration are met. This could lead to a more efficient allocation of resources, thus lowering the price of environmental credits, which, with a smaller budget, could reduce further emissions by allocating resources more efficiently.

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