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Research article

European market structure for integrated home renovation support service: Scope and comparison of the different kind of one stop shops

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Abstract: While the retrofitting of the building stock seems to be an effective solution to reach the targets for 2049 greenhouse gas emission, the current rate and quality of work is still too low. This article first proposes a state-of-the-art methodology and a brief description of the barriers to renovation. The literature review identifies 26 major issues. Then, the one stop shops (OSS), which are introduced as a solution to these barriers, are described under different aspects according to their business model, the type of project owner targeted and the kind of services they offer with their support. Drawing on previous literature, this article proposes a classification framework. Then a comprehensive benchmark of 63 OSSs in Europe was conducted, allowing for a comparative analysis of the distribution of OSSs models across various countries and territories; it highlights the existing need in all countries, but also the disparity of support being provided. This examination revealed that selecting an appropriate OSS model cannot be solely based on factors like scope, ownership, or the existence of other OSSs. In the final section, a correlation study is made between several criteria (energy consumption and type, urbanization rate, construction date, climatic context, renovation rate etc.) that have been identified as being potentially indicative of renovation activities. The objective of this work is to provide an overview of the current context and emphasize effective strategies to accelerate the pace of renovation. By identifying and addressing the unique needs and challenges in each specific context, the goal is to promote efficient and streamlined renovation processes.

Keywords: business model; energy support home renovation; housing stock retrofitting

1. Introduction

In the current context of global warming, the reduction of energy consumption is one of the central issues in research. Every day, part of the energy used is dedicated to the heating, ventilation and air conditioning (HVAC) of buildings. According to European Commission estimates, buildings in the EU are collectively responsible for 39% of our energy consumption and 35% of greenhouse gas emissions, which mainly stem from construction, usage, renovation and demolition [1].

It is estimated that 75% of the building stock of 2049 is already constructed [2,3] and; yet, more than 35% of the housing stock is older than 49 years [4]. The main driver of energy efficiency in the dwelling sector is the renovation of the energy efficiency of the existing housing stock [5,6]. Additionally, renovation can also be a strategic driver of many transversal aspects.

On the technical side, there are many methods of implementing technical solutions that lead to complex modifications in the interactions of the different parameters within buildings. Changing materials, type of glazing and heating or ventilation systems will alter the building's thermal, hydric, acoustic and lighting balance. [7–9] These modifications have a direct impact on energy consumption and can modify the quality of the ambiance [8]. From an economic point of view, building modernization often enables a reduction of the cost of operating and maintaining systems [9]. Additionally, it can also increase the financial value of the property by more than 20% [9]. To deal with the economic consequences of the recent COVID pandemic, the European Union proposed a resilient strategy to make cities more sustainable, create jobs and improve people's quality of life [10]. Beyond this economic aspect, there are additional societal issues regarding this wave of renovation and the housing affordability crisis [11].

However, the total number of residential buildings renovated in Europe each year represents between 0.4% and 1.2% of the housing stock, for an average energy improvement of 9% [2]. The objective of this paper is twofold: first to provide a state-of-the-art analysis of the barriers to renovation, and, second to explore OSS models.

In practice, introducing an additional actor to facilitate coordination among the parties involved, reevaluating the renovation process, or disseminating information also presents a new set of risks [12].

Due to this, not all obstacles can be eliminated, and practices may differ to suit the target group. For instance, if administrative hurdles are prominent, the creation of facilitation-type OSSs may be necessary. On the other hand, for technical challenges, comprehensive OSS solutions that offer work supervision and monitoring services tend to be more effective [13].

The objective of this work is to present the current context and highlight how to position oneself most effectively to accelerate the pace of renovation. By identifying and addressing the specific needs and obstacles within each context, the aim is to promote efficient and streamlined renovation processes.

This work was carried out during the creation of the I-HEROS OSS. This is part of the plan to reduce CO_2 emissions. In 2011, the General Council for the Environment and Sustainable Development established that on the French territory, greenhouse gas emissions must be divided by 4 until 2049 [13].

2. Energy home renovation barriers

Several documents in the scientific literature indicate that cost-effective energy measures are not always implemented. This gap between optimal implementation and actual implementation is called

the energy efficiency gap or energy paradox [15,16]. The renovation process consists of a series of complex operations that involve many stakeholders or procurers who may be more or less integrated in the project path [5,18]. All of the mechanisms that reduce the efficiency of the results of a renovation, either technical, societal, economic or energetic, can be defined as obstacles to building refurbishment [18,20]. These different barriers are divided into five main categories and summarized in the Table 1.

Table 1. List and referencing of renovation barriers.

Barrier	Reference
Organization of the market	
Fragmented market	[18,20,21]
Disjointed or lack of renovation support	[18,20,22–26]
Lack of time management / Planification	[18,20]
Availability of appropriate materials	[19,24,25]
Lack of or inadequate legislative framework / certifications	[19,22,25,26]
Lack of standardized solution	[21,24,25]
Company size	[19]
Skill and knowledge of professionals	[13–24,21,26]
Customer's lack of trust	[13,21,24,25]
Information	
Information quality	[18,20,23–27]
Information availability	[19,22–27]
Insufficient consideration of the impact of the occupant on the building	[19,25,26]
Insufficient integration of cross-cutting benefits	[12,21–24]
Sociological factors	
Lack of shared goals	[18,20,21]
Other priorities	[18,20]
Inertia to improve the sector	[18,20,24,25]
Decision making	[18,20,22–25]
Personal views	[19,23–25]
Technical	
Difference between expected and actual consumption	[18,20,23,26]
Project complexity	[19,22,23]
Long project duration	[19,21]
Administrative complexity	[19,24,26]
Complexity or lack of technical and managerial skills	[19,22,26]
Financial	
High-cost investments	[18,20,22–27]
Long payback period	[18,20,23–26]
Lake or difficulties of financing mechanism	[21–27]
External risks: energy price fluctuations	[18,22,24,25]

Market Organization: From a homeowner's perspective, the market for proposed services and renovation professionals is often perceived as fragmented and complex. The lack of support and understanding of the overall process can lead to demotivation and mistrust. Poor communication regarding project feedback can further exacerbate this mistrust. From the professionals' point of view, a lack of either qualified employees or materials can serve as barriers to the pace of renovations. The size of companies can also impact their long-term survival. The absence of standardized solutions necessitates a diversification of knowledge, potentially resulting in time loss during project execution. Moreover, the legal and regulatory framework significantly influences renovation incentive policies, market organization, fragmentation, and access to financial resources. The state and governmental authorities play a crucial role in expediting the renovation process.

In a 2021 article, Pardalis et al. described the existing mechanisms for organizing the renovation market, highlighting the importance of OSSs as a key solution [20].

Sociological factors: From a sociological point of view, they play a significant role in the decision-making process, making it challenging to provide accurate information that can facilitate this process. This challenge is further exacerbated in the case of co-ownerships, where not all occupants necessarily share the same objectives, expectations, priorities, or understanding of the renovation project. Additionally, personal affinities can complicate the situation.

Technical: From the owner's perspective, the fragmentation of the market and the legal framework can result in a complex administrative process. Following this stage, the management and organization of the renovation work require specific skills in project management. Additionally, there can be discrepancies between the expected and actual results. These factors are particularly crucial in complex renovation projects, such as historical or classified buildings. Often, owners must adapt a building that was originally designed to meet prior needs to address current issues, techniques, and materials. Failure to adequately consider this aspect can lead to significant disruptions on the construction site, building, and maintenance, including common issues such as ventilation problems, infiltration, or structural weaknesses [8].

Information: The quality and availability of information is a determining factor in the motivation and success of a renovation project. Just like the quality of the communication to the occupants, it allows for the understanding of the technical, financial, organizational. points necessary to the decision making and to the good progress of the renovation process. For example, a poor understanding of the occupants and their habits can lead to the choice of an inappropriate renovation program.

A good communication on the transversal energy improvements can also motivate the decision process and accelerate the renovation process. Therefore, it is important to highlight the benefits in terms of asset enhancement, comfort improvement, financial gains on operations and maintenance.

Financial: The quality and availability of information are crucial factors in motivating and ensuring the success of a renovation project. Similar to effectively communicating with the occupants, it enables a comprehensive understanding of the technical, financial, and organizational aspects necessary for decision-making and the smooth progress of the renovation process. For instance, a lack of understanding about the occupants and their habits can result in the selection of an inappropriate renovation program.

Furthermore, effective communication regarding cross-cutting energy improvements can also enhance the decision-making process and expedite renovations. It is essential to emphasize the benefits in terms of asset enhancement, improved comfort, and financial gains in operation and maintenance.

By providing comprehensive and clear information, stakeholders can make informed decisions and understand the positive impact that renovations can have on various aspects, thereby fostering motivation and facilitating the renovation process.

3. How one stop shop services are a solution to improve renovation rate

An OSS can be described as a virtual and/or physical hub where owners can access all the information and services, they need to undertake their project [27]. In the context of an energy renovation, it provides a comprehensive package of services to assist them in managing all the necessary steps of a renovation project. Irrespective of the specific administrative structure in place, this single access point serves as the interface between the owners and the service providers. [25,29–31].

Various initiatives can effectively address the obstacles of renovation. Some initiatives can be seamlessly integrated into the process, such as Energy Service Companies (ESCOs) or what Mandy de Wilde and Spaargaren. refer to as "strategic intermediaries design services" [30]. Additionally, there are initiatives that are less intertwined with the renovation process, such as specific measures implemented by public authorities. For instance, Germany's Kreditanstalt für Wiederaufbau (KfW) programs address financial concerns, while the Sustainable Energy Action Plan (SEAP) offers comprehensive design solutions.

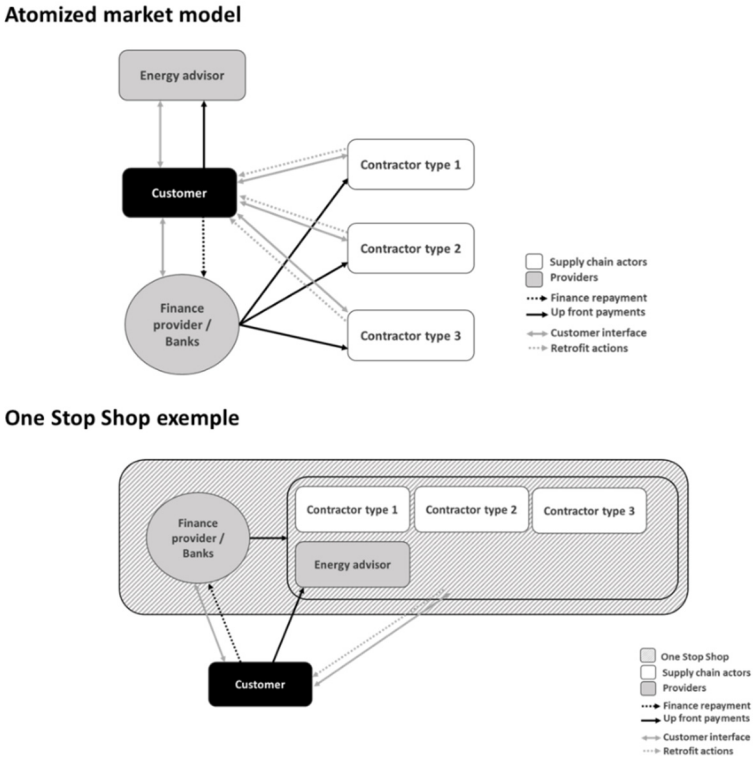

Figure 1. Difference of organization of the renovation market, based on [29] and [33].

This article specifically focuses on the OSS case. When it comes to automating renovation support and expediting the pace of renovation, OSSs prove to be significantly more effective. They are the primary driver for governments when implementing such services [31]. Additionally, even if these

kinds of processes can solve many barriers to the renovation, the use of such complex organizational systems can generate the development of new barriers [12]

Brown et al. proposed a representative example of what an OSS is and how it supports the customer for avoiding risks and failures related to the current market [29,34].

OSS reduce the frequency of interactions between different stakeholders, as well as improve access to services. The level of integration and execution of the renovation process can differ from one structure to another. The key to establishing a successful OSS is to identify the appropriate service packages that align with the specific needs of the territory. Consequently, some initiatives may be more closely aligned with the regulatory framework, while others may be tailored to provide commercial considerations.

3.1. The different types of one stop shop business models and energy services for residential renovation

In the literature, four different types of one stop shop business models have been identified. They proposed different levels of support and operating systems [25,29–31,34].

3.1.1. Facilitation model

The main objective of this OSS is to provide assistance to homeowners and promote renovation. In this model, advisors offer general guidance on the scope of the work or project direction. First, the services focus on raising awareness about the benefits of renovation. As part of this, the OSS may or may not provide a list of local suppliers and service providers. This model is particularly suitable for homeowners who are motivated and capable of organizing and overseeing the project but are seeking a reliable source to find the missing information or guidance.

In a 2021 article, Bagaini et al. [21] proposed a subclassification of the first three types of OSS. In the first category of facilitation, the OSS of the (i) advice type has basic services oriented on counseling. They can either be general or personalized advising according to the occupants' personal or public data. Online platforms are highly suitable for this kind of initiative. (ii) An intermediary OSS with the same objectives can offer homeowners more support regarding financial or technical aspects. This business model works best when aligned with governmental structures, associations or facilitators. The last sub-category of OSS, the (iii) Lender type, specifically offers financial services with the option of organizing a schedule for payments. This aspect can either be handled directly by the companies themselves or by involving bank partners within the OSS. The involvement of financial institutions in providing support can have implications for the responsibility and quality of the services offered, whether they are subcontracted or not. These initiatives can be driven by governments, cooperative structures, or facilitators, depending on the specific context and setup.

3.1.2. Coordination models

In this second model, the OSS is established as an additional component of an existing structure. This service takes a comprehensive approach that includes organizing and facilitating access to all the services available within the territory. The OSS goes beyond providing simple advice and can assume the role of project supervision. However, it should be noted that the responsibility for the successful completion of the work ultimately lies with the companies involved, rather than the one-stop shop.

In the second type of model, the OSS coordination model, Bagaini et al. [21] proposed a segmentation into two categories: connection and cooperation services. In the first case, the (iv) connection model positions itself in the market as a trusted team or network capable of addressing the various needs and aspects of the renovation process. This type of OSS is commonly developed by associations or groups of building professionals, although it can also be led by governments or facilitators. The second type of OSS, the (v) cooperation type, can offer a work realization service. Most often, a team of multi-skilled professionals will join together to provide complete packages of works.

3.1.3. All-inclusive models

In this particular model, the OSS assumes full responsibility for the entire renovation process, starting from the project definition and continuing until the delivery of the completed building. It ensures the full continuity of the renovation journey for the owners. In the event of any differences between the initially planned outcomes and the actual results, the OSS will hold the owner responsible for resolving any issues and addressing any concerns.

For the third kind of OSS, all-inclusive models, Bagaini et al. [21] described two types of subcategories. In the (vii) project management type of OSS, the OSS often acts as a project manager or construction manager's assistant. It subcontracts the work, though it is responsible for the suppliers, companies, and assists in the preparation of the subsidy and financing files. It is also responsible for the deadlines, the guarantees and the quality of the work. This type of OSS is most often carried by professional cooperatives, municipalities or facilitators. The last sub-category of OSS corresponds to the (viii) full implementation model. The operation is very similar to the project management model except that all activities, skills and resources are internalized in the OSS. These are "turnkey" renovation solutions.

3.1.4. ESCO models

In this model, the one-stop shop assumes responsibility for ensuring the smooth progression of the customers journey and the successful completion of the renovation work. Additionally, the OSS is dedicated to achieving specific energy savings targets. Pardalis et al. define this model as a hybrid approach that combines the energy performance assurance typically offered by Energy Service ESCOs with the energy efficiency measures provided by the OSS. [25]. The support to the renovation is mainly performed through specific energy contracts: for example, energy performance contracts or energy supply contracts.

Similar to the all-inclusive OSS models, also provide comprehensive solutions. However, they involve the inclusion of a third party, known as the ESCO, acting as an intermediary between the individual homeowner and the OSS. Through an agreement, the ESCO outlines different measures that the homeowner must adhere to in order to enhance the quality of the renovation process [12]. This approach is particularly well-suited for OSS that handle a large volume of similar projects, such as retail stores, industrial facilities, or municipalities. Additionally, there are various assembly options available within this framework. Brown et al. [33] and Hannon et al [33] detailed some of them in their respective articles.

3.2. The impact of the OSS provider on the structuring of the applied service offer

The organizations or services provided by OSS can also be categorized based on the entities responsible for overseeing the project. The management structure, funding sources, interests, and scope may vary, resulting in different approaches to providing support. As a result, there is a diversity of services offered within different types of OSS models, reflecting the varying approaches and capabilities of the providers [13,35,36].

Government-driven or locally/regional municipality-led: These OSS receive support from either government entities or local authorities. As a result, private actors are assisted by municipalities in carrying out the renovation projects. The financing for these initiatives can be entirely public, sourced from either citizens' taxes or European funds, or partially public. In some cases, certain services are provided by private companies in exchange for compensation, such as project setup and work management. Generally, the motivation behind establishing and managing these OSS is driven by climate-related, social, or energy resource management objectives. Figure 2 illustrates the relationship between the stakeholders for the municipal OSS.

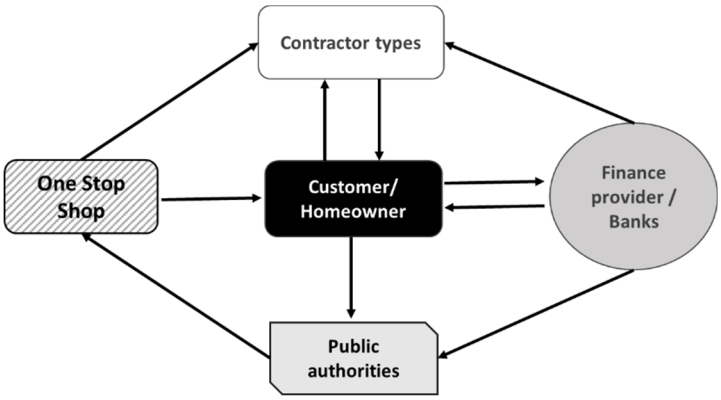

Figure 2. Schematization of the process of a governmental driven one stop shop.

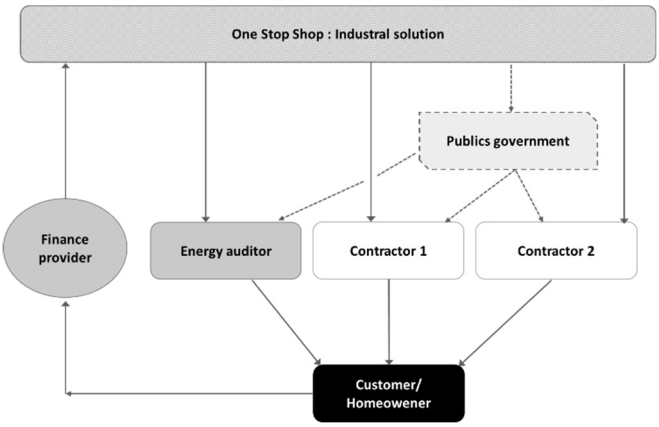

Figure 3. Schematization of the process of an industry driven one stop shop.

Industry driven: An OSS operated by an industry player can be exemplified by a building industry company that has developed a specific technical renovation solution. The focus of this type of OSS is to promote and advocate for their own market solution, aiming to expand their market presence and increase the adoption of their renovation solutions. Since local municipalities often strive to enhance the quality and accessibility of renovation solutions within their territories, they may support and incentivize these initiatives through subsidies or other means. [25,36]. The operating funds of this type of OSS can be diverse. Figure 3 illustrates the relationship between the stakeholders for the industry driven OSS.

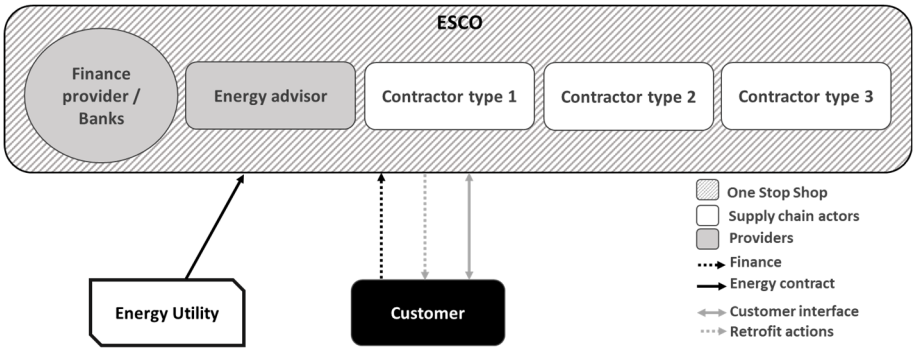

Figure 4. Schematization of the process of an ESCO one stop shop (Brown, 2018).

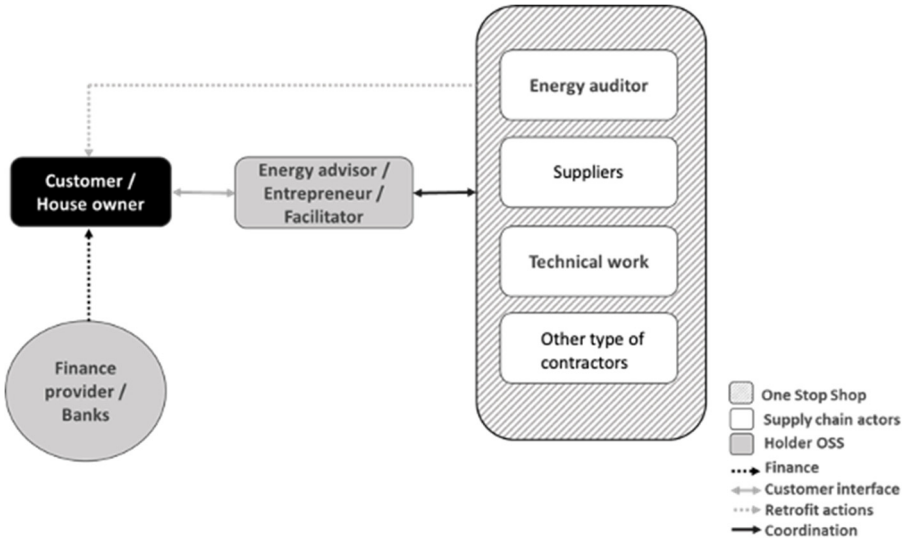

Figure 5. Schematization of the process of facilitators one stop shop [25,34].

ESCO based: Hannon describes ESCOs as companies that provide energy to homeowners [33]. As mentioned earlier, support for renovation projects is primarily facilitated through specialized energy contracts, such as energy performance contracts or energy supply contracts. These models are often intricate and necessitate the involvement of technical partners to rationalize the renovation process. Figure 4 illustrates the relationship between the stakeholders for ESCO OSSs.

Independent facilitators: In OSS operated by facilitators, the level of support or assistance provided can vary significantly. Facilitators act as intermediaries between contractors and homeowners, aiming to streamline the interaction and facilitate the renovation process. Facilitators assist with financial arrangements for projects, participate in specific project tasks, and offer technical or legal advice. Their primary focus is to provide support services for residential renovations. In cases where facilitators are entrepreneurs or consultants, their objective may be to either grow their existing business or expand their service offerings to cater to their clients' needs. Figure 5 illustrates the relationship between the stakeholders for the facilitation OSS.

Cooperative/multi-disciplinary team: The OSS is established by a team of professionals collaborating to enhance their collective expertise. They position themselves in the market as a unified entity providing a range of modular, plug-and-play services tailored to meet homeowners' needs. These teams consist of various building industry professionals, including architects, manufacturers, energy auditors, and more.

According to Bertoldi et al. [13], the main objectives are not necessarily focused on energy or financial savings. Additionally, they can prioritize cross-cutting objectives. The range of services offered extends from basic renovation operations to comprehensive and intricate work programs. Figure 6 illustrates the relationship between the stakeholders for the cooperatives OSS.

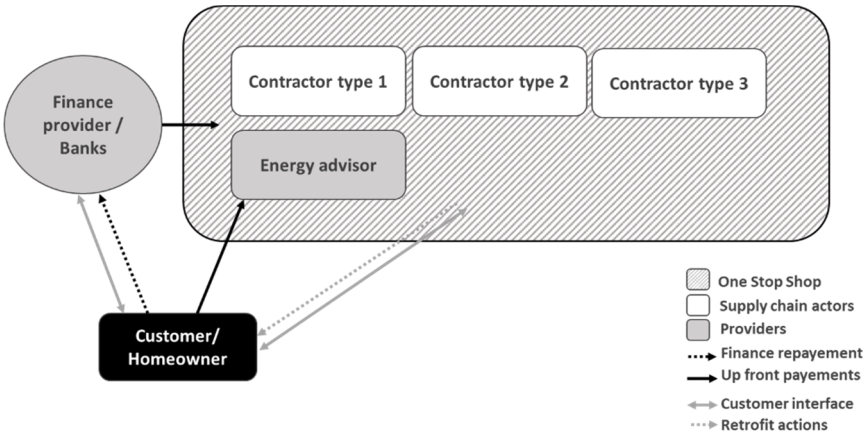

Figure 6. Schematization of the process of cooperatives/ multi-disciplinary team one stop shop [25,33].

Store: This type of OSS is primarily intended for large retail stores or warehouses. Its main objective is to offer and promote solutions, technologies, and building materials. The OSS serves as a point of sale where customers can receive specialized technical advice on practical aspects of construction works. This type of OSS can also correspond to those that Pardalis and Georgios [25] described as complementary business. It attracts cross-sector actors who aim to tap into the renovation market and utilize the OSS to structure their offerings. Examples include insurance companies, utilities, and more.

Digital tool: Pardalis and Georgios described this particular business model as an automated support process. This type of OSS model relies on gathering information from the homeowner and subsequently offers various tailored renovation programs aligned with the project's requirements. [25]. It also serves as a central hub where homeowners can access all the information required for the smooth

execution of their renovation works. Figure 7 illustrates the relationship between the stakeholders for the digital OSS.

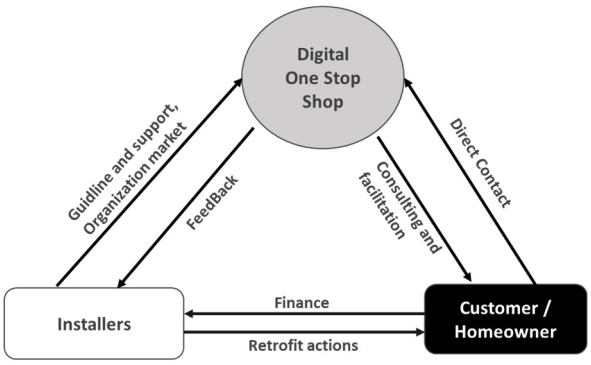

Figure 7. Schematization of the process of digital one stop shop (Pardalis, 2021).

3.3. Scale and scope of the one-stop

Finally, the size and scope of operation also have an impact on the services offered and the type of OSS. Depending on the scale and the number of homeowners within a territory, the support strategies, types of one-stop shops, and funding mechanisms may vary. Additionally, it is possible to have multiple one-stop shops operating within the same territory. In such cases, the services offered by these different entities can be complementary. Taking into account these three factors that can influence the services provided by an OSS, Figure 8 summarizes the organization of the renovation market across the European territory.

The different levels of territories that a OSS can cover are as follows [13,15,29]:

- **European level:** At the European level, there are opportunities for financial support and research initiatives related to an OSS and renovation policies. The objective of these selected projects is to contribute to the reduction of greenhouse gas (GHG) emissions and achieve climate objectives.
- **National level:** National solutions come in various forms, with the most common being services linked to national subsidies to incentivize individuals to renovate. For instance, energy saving certificates are a program that benefits households. Since 2016, certain companies have been able to purchase a portion of energy savings achieved through renovation work from households experiencing energy insecurity [37]. Often on a national scale, due to the large number of households and the size of the territory, OSS often provide either advisory services or financial incentives for renovation projects.
- **Regional scale:** At the regional level, the political framework plays a significant role in determining the pace and approach to renovation. OSS at this scale are better positioned to offer more technical services and to oversee the progress of renovation works. This level often offers a broader range of services, including advice, project supervision, and organization of the professional and material supply chains within the region.
- **Local scale:** OSSs managed by municipalities are prevalent at the local level, as municipalities are key stakeholders within their respective territories. Since this level has the smallest geographical segmentation, it is important to provide complementary services that align with existing offerings in the area.

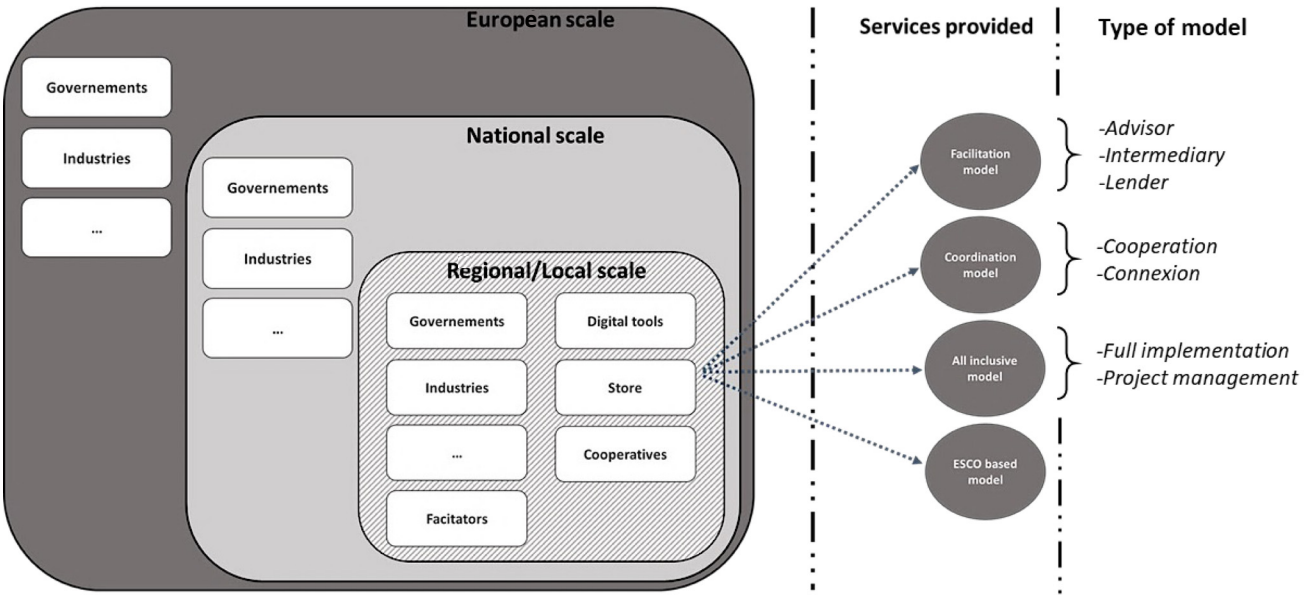

Figure 8. Summary of the organization of the renovation market on the European territory.

4. Benefits of the OSS

OSSs and integrated renovation support services play a crucial role in accelerating the pace of renovation. As described earlier, the various business models of one-stop shops, as described earlier, contribute to reducing barriers in different ways. However, the primary objectives of all OSSs are to serve as intermediaries between homeowners and professionals and/or to organize the renovation market.

By doing this, OSSs help improve the overall organization of renovation projects, streamline the supply of materials, and ensure the proper execution of work techniques, among other benefits. Additionally, the impartiality of the advice provided also enhances the decision-making process, leading to better outcomes.

4.1. Business model 1: Facilitation model

The facilitation model effectively addresses certain barriers in the renovation process. By focusing on the orientation stage, this model particularly helps both information and social barriers. Having a single point of contact and easy access to information significantly reduces information barriers.

For instance, a notable example of the facilitation model is the national-scale project "France Rénov" led by the National Housing Agency in France. Another approach is the purchase of energy savings by distribution companies. In addition to addressing information barriers, the facilitation model aims to raise awareness about the benefits of energy savings and reduce social barriers. However, a lot of other barriers remain, which can lead to the decision to not implement the energy renovation process [29].

4.2. Business model 2: The coordination model

The coordination model effectively eliminates multiple barriers in the renovation process. By providing comprehensive support throughout all stages of the renovation, the OSS helps overcome political/institutional, social, and market barriers. Through the establishment of a reliable network, the coordination model bridges the gap between the fragmented supply chain and the demand side. Acting as a single point of contact, the OSS significantly reduces market barriers. This an integrated approach enhances coordination, streamlines communication, and fosters trust, resulting in a positive impact on the renovation process [29].

The coordination model significantly contributes to achieving good quality renovations and realizing the estimated energy savings. It effectively reduces the stress, disruption, and issues typically associated with renovation projects [28]. This has impact on addressing social barriers.

The I-HEROS OSS in Toulouse fits perfectly into this category, which aligns perfectly with this approach. Operating at multiple levels, it leverages existing support channels within the territory to guide occupants based on their specific needs.

Additionally, the coordination model offers advantages for the supply side of the renovation industry. First, the OSS serves as a lobbying group for suppliers, facilitating connections between suppliers and customers, as well as fostering collaborations and knowledge transfer among suppliers themselves. This coordinated collaboration encourages the exchange of expertise, skills, and innovations, leading to positive outcomes [29].

4.3. Business model 3: The development model

The development model has a notable impact on various barriers, including economic, social, technical, and market barriers. By ensuring the achievement of high energy savings and facilitating access to financial support, it effectively reduces social and economic barriers. Homeowners become more aware of the benefits of renovation, making the decision-making process easier and reducing the stress, disruption, and hassle typically associated with renovation projects [29].

One of the key advantages of the development model is its ability to mitigate market fragmentation and push trust among stakeholders. With limited influence from multiple stakeholders, the model promotes a more cohesive and coordinated approach, reducing information discrepancies, and increasing trust; this positively affects market barriers.

5. Study and exploration of different case studies in Europe

5.1. The 63 OSS projects identified

This part focuses on different case studies of OSS in Europe and the type of business model associated with them.

A benchmark of existing OSSs in Europe identified 63 case studies has been produced. This exercise illustrates the functioning and the articulation of the different OSSs between them. There can be different OSSs in the same territory that respond to different problems and complete each other. This is most apparent in the western European regions where the number of identified cases is highest.

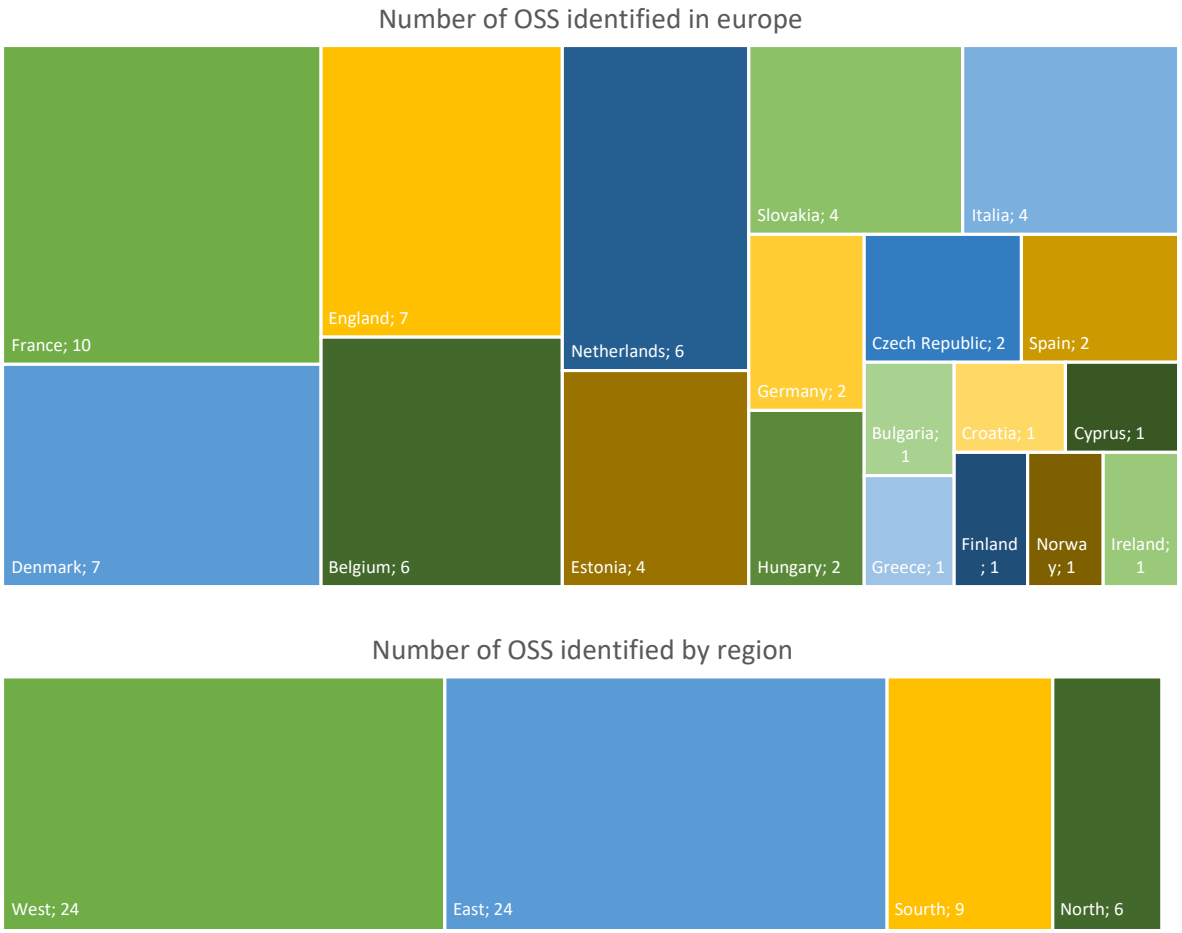

Figure 9. Location of identified OSS across the Europe.

All 63 OSSs studied come from research projects [38], with documents provided by the European Union [12,39], the ADEME (French Association for the Environment and Energy Management) [39] and by the results of the study during the setting up of the I-HEROS OSS.

By cross-referencing the information in the literature, we have proposed a classification of one-stop shops into four types of business models corresponding to seven types of support services. Finally, the last level of segmentation of the renovation market identified is the field of application: local, regional, national, or European. The benchmark study revealed that different OSS can be present in a single territory.

Therefore, the services offered by the different types of business models are complementary. Generally, the greater the scope of the OSSs, the less operational the service is.

The benchmark was based on comparison criteria and tables similar to those used by the framework of Cicmanova and Maraquin. [39] and Bertoldi et al. [13]. Based on the services provided, the study of the customer path, leads to the selection of an OSS class.

One of the conclusions of these same authors is the lack of maturity and resources/ambition for coordination and facilitation models. However, the graph in Figure 10 shows that the different types of OSSs are represented in almost equal numbers across the territories. This clearly demonstrates the existing need and the interconnectivity of the need for support in renovation.

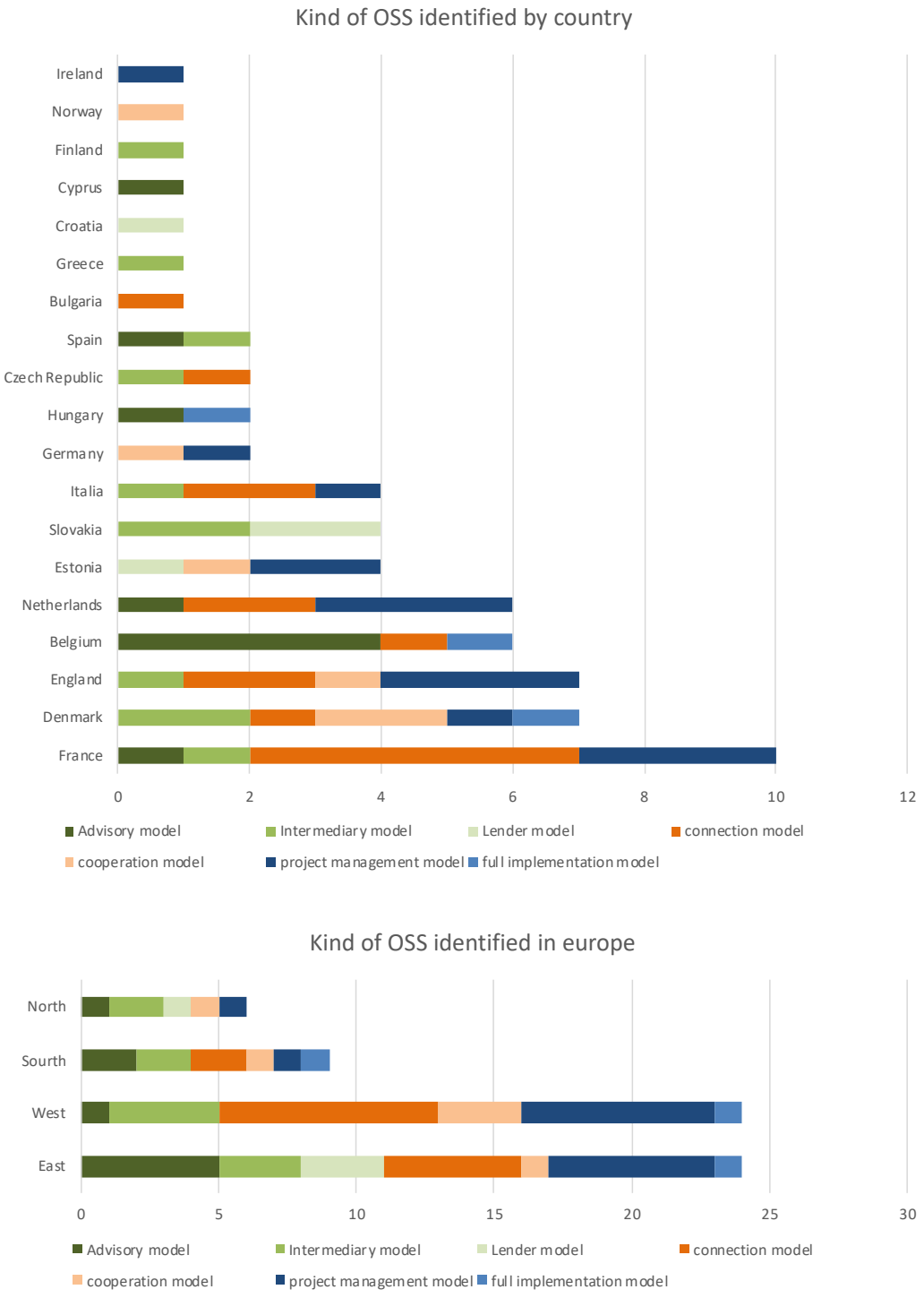

Figure 10. Distribution of the types and business models of one stop shop in Europe.

The majority of identified OSS are located in Eastern and Western Europe, covering a wide range of territories. All types of OSS models are represented in these regions. The most prevalent models found are connection, advice, and project management models. In Eastern and Southern Europe, the majority of one-stop shops operate under facilitation models, often functioning as either lenders or

intermediaries. In Northern Europe, the majority of OSS reported are of the coordination or facilitation type, with either intermediate or cooperative structures.

It is also interesting to observe the nature of the OSS according to their type. The more facilitation-type activities they have, the larger is their geographical coverage. They are also frequently financed by government entities. Inversely, the more support and follow-up services they provide, the more private they will be, and the more limited their number of renovation projects. The most advantaged countries are those with a flexible governmental context, allowing for both extremes [28].

Several factors may contribute to the variation in market organization in Europe, such as the level of building consumption and density in a particular territory [42], as well as the type of governance structure in place [43]. While the majority of identified OSSs are located in Western Europe, variations can be observed in their operations within these regions. When comparing the annual renovation rates to European data, the rates remain relatively similar in magnitude [2].

This points up the disparity of support needs in the different European territories and the impact of cross elements. The selection of a OSS model cannot be solely based on factors like scope, project ownership, or the presence of other existing one-stop shops. It should also take into consideration the opportunities and specific needs within the region into consideration.

5.2. What other elements affect the selection of a one stop shop model

Zimmermann and Feiertag's book [43] explained the importance of territorial governance issues and how they can affect the development of an urban planning strategy. The article by Foster and Saleh illustrated these disparities through their study of urban planning policies on the circular use of buildings in different European countries [44]. For this specific example, western and northern Europe are way more dynamic.

On another matter, Betti and Gianni, through several indexes of living standards, described that there are important variations of poverty on the European ground that can exceed 15% of variation [45]. This can be also an element of explanation on the difference of management linked to the accompaniment of the renovation.

For instance, the findings of the European LOCATE project have revealed variations in the overall energy consumption mix, residential consumption patterns, and access to renewable energies across different countries [42]. Additionally, differences in climate conditions have resulted in varying expectations for comfort and corresponding architectural strategies [46].

For example, Manzano et al. propose a review of bioclimatic architectural strategies and issues. This article highlighting the significant influence of climate on construction methods. Furthermore, the characteristics of residential building stocks can also differ among countries. For example, Marinova et al. provided insights into the ratio of collective housing to individual housing by region and the materiality based on the age of the building stock [47].

These factors are unique to the historical context of each territory, and as a result, the renovation solutions will not be necessarily identical. These differences inevitably give rise to diverse needs in terms of renovation works and guidance. Considering the diverse and heterogeneous nature of these territories, the strategies for establishing OSSs must be adaptable.

Taking this analysis into account, one approach to assess the replicability of a OSSs could involve examining the similarity of dynamic criteria associated with renovation within a specific territory. These criteria could include quality of life, energy accessibility, territorial governance, climate

conditions, energy consumption, patterns, urbanization levels, and more. By evaluating these factors, it becomes possible to gauge the feasibility of replicating a successful OSS model in a different location.

According to the Pardalis and Georgios Swedish study, enhancing the energy-saving renovation market requires considering the current market conditions while also developing strategies to facilitate its evolution. Given that the OSS market already exists and is well-established, one approach to expediting the renovation process would be to implement targeted initiatives. This could involve identifying critical residential properties based on specific criteria and offering specialized support programs tailored to their needs. By focusing efforts on these key dwellings, the pace of renovation can be significantly accelerated [25].

6. Criteria for renovation impacts

As previously discussed, the low renovation rates can be attributed to various barriers, and OSS offer a potential solution to overcome these obstacles. Additionally, we have demonstrated that the adoption of a renovation strategy should be linked to the specific needs of each territory, which accounts for the divergent support strategies employed by an OSS.

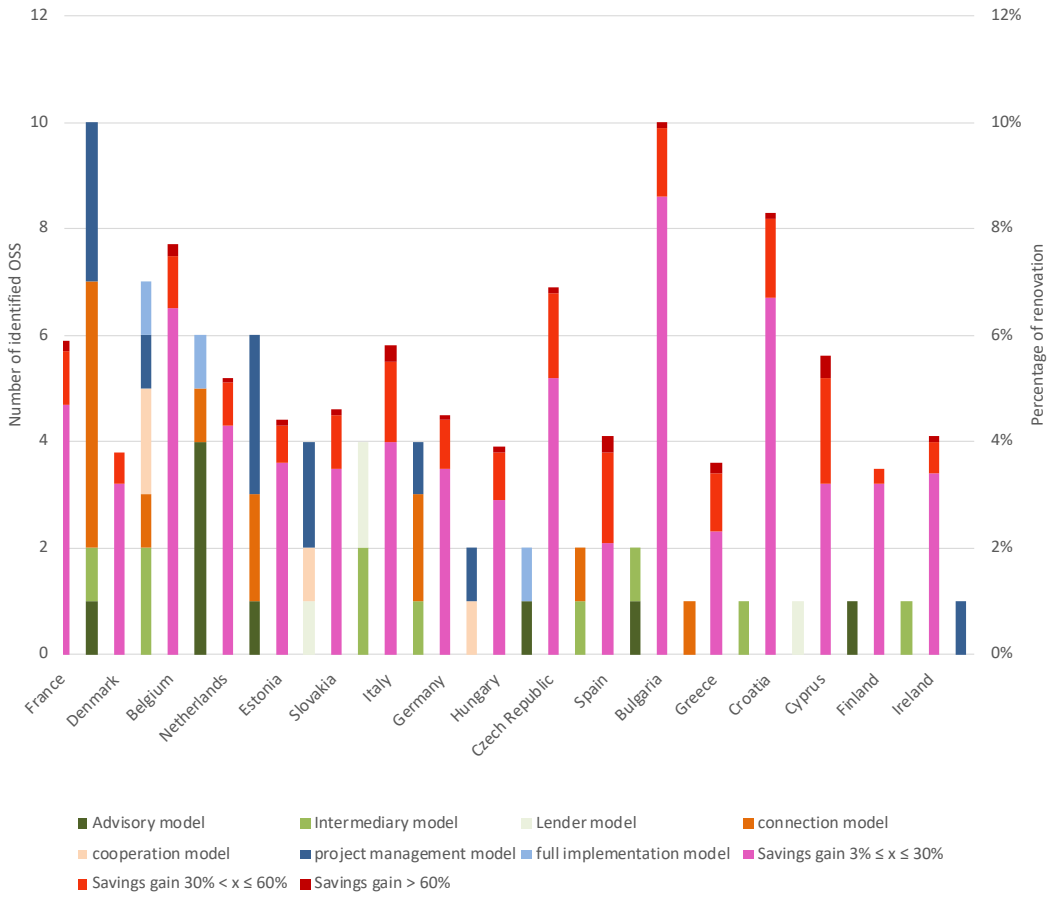

Figure 11. Renovation rate by European country.

Table 2. Description of the indicators selected for the correlation matrix.

Data type	Various indicators						Source
Energy renovation in residential buildings	Below threshold energy renovation: Savings gain < 3%	Light energy renovation: Savings gain 3% ≤ x ≤ 29%	Medium energy renovation: Savings gain 29% < x ≤ 60%	Deep energy renovation: Savings gain > 60%			[2]
Repartition of the years of residential construction	Share of construction before 1945 (%)	Share of construction betwen 1945–1980 (%)	Share of construction betwen 1981–2000 (%)	Share of construction after 2001 (%)			[48]
Share of final energy consumption in the residential sector by type of end-use	Share of final energy consumption (%): space heating	Share of final energy consumption (%): space cooling	Share of final energy consumption (%): water heating	Share of final energy consumption (%): cooking	Share of final energy consumption (%): lighting and supplies	Share of final energy consumption (%): other end use	[49]
Share of fuels in the final energy consumption in the residential sector	Share of solid fossil fuels in final energy consumption (%)	Share of natural gas in final energy consumption (%)	Share of oil and petroleum products in final energy consumption (%)	Share of renewables in final energy consumption (%)	Share of electricity in final energy consumption (%)	Share of heat in final energy consumption (%)	[49]
Electricity price	Electricity price (€/kWh)						[50]
Climate	Average heating degree days 1979–2022	Average cooling degree days 1979–2022					[51]
Population structure, by urban–rural typology	Predominantly urban regions (%)	Predominantly intermediate regions (%)	Predominantly rural regions (%)				[52]

By analyzing data from the European Union, we compared the renovation rates of different countries with various territorial indicators (Table 2 and Figure 11). Through this analysis, we identified the factors that carry the most significant weight and exhibit strong correlations. Focusing on these key factors within the OSS would result in an enhanced efficiency and effectiveness in

addressing the renovation challenges. This work also sheds light on the factors that could accelerate the pace of renovations in their respective territories.

When comparing the renovation rates of various countries and the presence of OSSs in their territories, it becomes evident that advisory models prove effective for minor actions, while a network of interconnected OSS at different levels can yield more substantial results in terms of deep renovations. Figure 11 also indicates that the mere presence of a OSS cannot entirely account for its effectiveness. In fact, there are instances where only a few OSSs have been identified, yet the renovation rate surpasses that of other countries (e.g., Bulgaria, Finland, Croatia, etc.).

Additionally, Figure 11 also reveals an imbalance between the number of identified OSSs and the corresponding renovation rates for each country. Renovation rates aimed at achieving energy savings between 3% and 30% do not proportionally correlate with the number of OSSs identified, whereas for operations exceeding 30%, they show greater significance. This suggests that the OSS models identified might not be as effective for renovations falling between 3% and 30%.

Moreover, variations in the types of models identified for different countries indicate that regions adopt diverse approaches for renovations exceeding 30%.

Correlation refers to the relationship or dependence between variables. When the distribution of data points of one variable in relation to another follows a linear pattern, the variables are considered to have a linear correlation. The strength and direction of this relationship can be quantified using the Pearson correlation coefficient. This coefficient is derived from the covariances of the variables divided by the product of their standard deviations. A coefficient close to either 1 or –1 indicates a strong positive or negative correlation, respectively, implying a proportional or inverse relationship between the variables. The Figure 12 details the correlation between the indicators selected in Table 2.

For buildings constructed before 1980, there is a stronger correlation between the consumption of heating (0,6), hot water (0,33), and lighting (0,16). Additionally, heating consumption represents a higher proportion compared to lighting or hot water consumption across all categories. From an energy standpoint, the main correlation with heating usage is gas (0,53). These buildings from the pre-1980 era hold significant potential for renovation.

A notable correlation between different energy consumption categories can indicate the potential for comprehensive renovation projects. Energy consumption is also closely tied to climatic conditions (more than 0,5). There is a correlation observed between electricity usage in urban areas and the demand for air conditioning. Urban areas show a higher share of electricity consumption (0,18), particularly in newer buildings (0,32). Additionally, the use of renewable energy sources is more prevalent in rural areas (0,52).

In the context of renovation, the primary correlations are observed between lighting and heating consumption. While there is a decrease in the correlation between heating consumption and energy efficiency improvements, there is an increase in the correlation with air conditioning consumption. As a result, it is crucial to pay attention to renovation methods to prevent a deterioration of thermal comfort and the reliance on air conditioning.

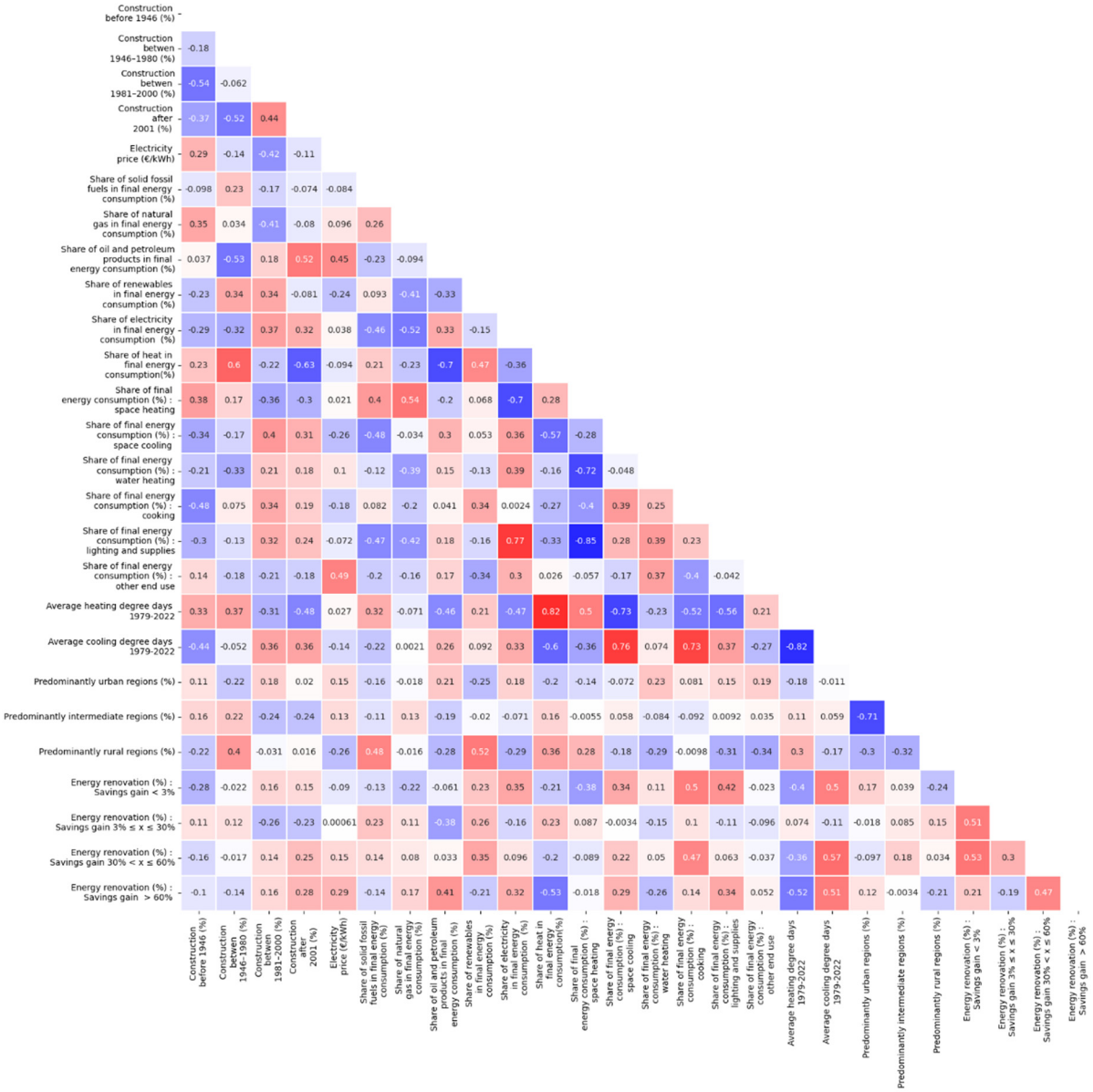

Figure 12. Correlation matrix between renovation rate and territorial characteristics.

7. Discussions

The first section of this article provides a comprehensive summary of the existing literature on the topic of renovation disincentives. Additionally, it includes diagrams of the different OSS options available in the renovation market. This work serves as a state-of-the-art review of current practices, focusing exclusively on OSS solutions. While certain authors do reference alternative approaches that focus on specific aspects of the renovation process, OSS stand out as the most effective remedies [20,36]. Therefore, to further advance this work, integration of systems beyond OSSs could be explored. While an OSS proves highly effective in the context of overall renovation efforts, there is potential for incorporating specific targeted operations, as discussed in the preceding section. For example, incorporating disparate segments into an OSS, rapid and efficient outcomes can be ensured.

Furthermore, the establishment of new OSSs can give rise to the emergence of additional challenges in the field of renovation. Therefore, conducting a comprehensive examination of these new obstacles would be of great interest. For instance, how can we ensure that the digitalization of these services is accessible to all [53,54]? Additionally, how can we explore alternative business models to reduce reliance on public funding, without compromising the integrity or quality of the advice provided?

The objective of the remaining sections is to compare the theoretical assumptions identified in the literature with the actual operations of OSS, focusing on the existing initiatives in Europe. One limitation of this study is the reliance on referencing projects associated with national or European funding programs. Consequently, smaller-scale initiatives, towns without access to such programs, or OSS models not subject to European directives are not considered in this benchmark. While our research demonstrates the effectiveness of these OSS for large-scale renovations, questions remain about their support for operations that do not achieve energy savings of <30%. Figure 11 illustrates this concern. Although the number of OSSs surveyed does not adequately represent the quantity of renovations between 3% and 30%, it is more representative for renovations below 30%. Another avenue for improving this work could involve conducting a more in-depth analysis of the identified OSS benchmarks. Creating a comprehensive list of active and methodology OSSs and examining their respective challenges and successes would be instrumental in refining existing solution.

The final point of discussion revolves around the quality of the data utilized to characterize the territories and estimate variations in the support requirements across different cities. This analysis relies on indicators provided by the European Union, making it intriguing to compare these outcomes with other demographic and geographic data to validate the results.

8. Conclusions

This article details the current state of the structure of the renovation market in Europe, its problems, its solutions, and its challenges for understanding or building up a support service for housing stock. While the renovation of the housing stock seems to be an effective solution to reach the 2049 greenhouse gas emission targets, the rate and quality of the work done until now is still too low.

First, this article proposes a state-of-the-art and a brief description of the barriers to renovation. The literature review identifies 26 major issues, classified into five categories: sector organization, information, sociological, technical, and financial. These obstacles are mainly due to human and logistical factors in the renovation process.

The following section highlights OSS as a viable solution to these challenges, providing a virtual and/or physical hub where owners can access comprehensive information and services required for their renovation projects. While there are alternative approaches to integrating a renovation support system, OSS emerges as the most effective solution.

Drawing on previous literature, this article proposes a classification framework, to depict the distribution of these OSSs across different territories. The classification takes into account their scope of operation (local, regional, national, or European), their ownership (governmental authorities, associations, cooperative industries, stores, individual or multiple facilitators), and the types of services they offer (advisory, intermediary, lender, connection, cooperation, project management, all-inclusive services).

A comprehensive benchmark of 63 OSSs in Europe was conducted, allowing for a comparative analysis of the distribution of OSS models across various countries and territories. This examination

revealed that selecting an appropriate OSS model cannot be solely based on factors like scope, ownership, or the existence of other OSSs. It necessitates a consideration of the unique opportunities and needs present within each region.

This study has also emphasized the necessity to diversify our support methods, as the majority of existing literature concentrates solely on government-driven or nationally directed initiatives. Additionally, we have demonstrated in this article that while such initiatives are effective in ambitious renovations, they might not accurately represent the majority of renovations undertaken thus far

Factors such as urban planning conditions, prevailing governance structures, climate characteristics, and the existing built heritage play a significant role in determining the most suitable OSS model for a particular region. Each locality presents its own set of distinct circumstances that must be considered when designing and implementing an effective renovation support system.

Furthermore, we have observed a significant number of one stop shops and support services in countries with cold climates, where there exists a high potential for energy savings. It is equally important to explore regions with lower heating consumption levels.

In the final section, a comparison is made between several criteria that have been identified as potentially indicative of renovation activities. These criteria include energy consumption and type, urbanization rate, construction date, and climatic context. These factors are then compared with the renovation rate to establish any correlations or patterns. This study report contributes to the broader understanding of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU [2].

Use of AI tools declaration

The authors declare that they did not utilize Artificial Intelligence (AI) tools in the creation of this article.

Conflict of interest

All authors declare no conflicts of interest in this paper.

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Appendix

Table A1. Benchmark of European one-stop shops and their management.

			Facilitation model			Coordination model		Developement model	
			Advisory model	Intermediary model	Lender model	Connection model	Cooperation model	Project management model	Full implementation model
France									
SEM ile−de−france Energie	1	Ile−de−France				1			
Renovation nouvelle aquitaine	2	Nouvelle Aquitaine Region (Bordeaux)		1					
Picardie pass renovation	3	Picardie région (individual houses)/ Hauts−De−France (Condomniums)						1	
Oktave	4	Alsace Champagne , Ardenne Lorraine region (strasbourg)						1	
Bordeaux Métropole Energies (Facirénov)	5	Bordeaux						1	
Région Normandie OSS	6	Normandie				1			
Brest Métropole OSS (Tinergie)	7	Brest Region				1			
Espace−info Energie	8	Toulouse Metropole	1						
Energiesprong	9	different regions in France, Ile−de−France				1			
AREC Occitanie	10	Occitanie Region				1			

Continued on next page

			Facilitation model			Coordination model		Developement model	
			Advisory model	Intermediary model	Lender model	Connection model	Cooperation model	Project management model	Full implementation model
Belgium									
Homegrade	11	Brussels Capitol region	1						
Huisdokter	12	Limburg	1						
Renowatt	13	Liege				1			
Vlaams energiebedrijf	14	Flanders, Antwerp	1						
CLEAR	15	Brussel	1						1
Germany									
Energiesprong managed by DENA	16	Berlin						1	
Bauteam Hamburg	17	Hamburg city					1		
Denmark									
Frederikshavn OSS	18	Frederikshavn Municipalty						1	
CLEAN Green Business Growth	19	4 cities, Region Syddanmark				1			
BedreBolig	20	Denmark		1					
BetterHome	21	Denmark					1		
CleanTech	22	Denmark							
ProjektLavenergi By ADSBOLL	23	South Denmark, mainly Kolding							1
Sustain Solutions	24	Denmark					1		
Zerohome Program	25	Sonderborg		1					
Finland									
ENRA concept	26	Helsinki		1					

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			Facilitation model			Coordination model		Developement model	
			Advisory model	Intermediary model	Lender model	Connection model	Cooperation model	Project management model	Full implementation model
Norway									
Bolig Enok	27	Oslo					1		
Estonia									
TÜ Energiaühistu	28	Tallinn						1	
Tartu Regional Energy Agency	29	Tartu					1		
Vaxjo OSS	30	Kronoberg						1	
KredEx	31	Tallinn			1				
Hungary									
RenoHUb	32	Budapest	1						
Projekt Doktor	33	Budapest							1
Netherlands									
Center for sustainability	34	Amsterdam				1			
Reimarkt	35	Bergen op zoom				1			
WoonWijzer−Winkel Rotterdam	36	Rotterdam, Limburg						1	
Haarlemse Huizenaanpak	37	Haarlem	1						
Stroomversnelling	38	Several locations, Amsterdam						1	
Slim Wonen in Leeuwarden	39	Leeuwarden						1	
Slovakia									
EBRD credit lines	40	Various places in Bulgaria (also Slovakia), Sofia			1				

Continued on next page

			Facilitation model			Coordination model		Developement model	
			Advisory model	Intermediary model	Lender model	connection model	cooperation model	project management model	full implementation model
FinEERGo−Dom	41	Sofia, but also in other countries like Poland, Latvia, Romania, Slovakia and Austria		1					
EEE Consortium	42	Sofia		1					
Rhodoshop Programme	43	6 municipalties from the Rhodope region.			1				
Cyprus									
Aradippou Municipality One Stop Shop	44	Municipality of Aradippou, Larnaca district	1						
Czech Republic									
SMART CITY	45	Litoměřice							
Litoměřice	46	Litoměřice city		1					
Italia									
Infoenergia	47	Province of Trento				1			
Project Development Assistance for Local Authorities in Piemonte	48	Piemonte region		1					
Mantova OSS	49	Mantova city						1	
Superhomes	50	Tipperary city				1			
England									
Retrofit Works	51	London		1					

Continued on next page

			Facilitation model			Coordination model		Developement model	
			Advisory model	Intermediary model	Lender model	connection model	cooperation model	project management model	full implementation model
Ecofurb(collaboration with Retrofit works)	52	London						1	
Allenergy's Affordable Warmth Service	53	Argyll & Bute region, Scotland				1			
Tighean Innse Gall	54	Western Isles						1	
RenovationUnderwriting	55	London				1			
People Powered Retrofit	56	Manchester					1		
Greece									
Energy Communities	57	Attica		1					
Spain									
Officina de l'energia	58	Valencia		1					
Energy Housing	59	Spain	1						
Assessment Tool (ENERHAT)	60	Spain							
Ireland									
Energy Communities Tipperary Cooperative	61	Nenagh						1	
Croatia									
KLIK Energy Cooperative	62	Križevci			1				
Bulgaria									
IZGREI BG	63	Plovdiv				1			

	Energy renovation in residential buildings (average 4 years)				Repartition of the years of residential construction				Electricity price	Share of fuels in the final energy consumption in the residential sector					Share of final energy consumption in the residential sector by type of end-use						Climate		Population structure, by urban–rural typology		
	Energy renovation (%): "below Threshold"	Energy renovation (%): "Light"	Energy renovation (%): "Medium"	Energy renovation (%): "Deep"	Construction before 1946 (%)	Construction betwen 1946–1980 (%)	Construction betwen 1981–2000 (%)	Construction after 2001 (%)	Electricity price	Share of solid fossil fuels in final energy consumption (%)	Share of natural gas in final energy consumption (%)	Share of oil and petroleum products in final energy consumption (%)	Share of renewables in final energy consumption (%)	Share of electricity in final energy consumption (%)	Share of heat in final energy consumption(%)	Share of final energy consumption (%): space heating	Share of final energy consumption (%): space cooling	Share of final energy consumption (%): water heating	Share of final energy consumption (%): cooking	Share of final energy consumption (%): lighting and electrical	Share of final energy consumption (%): other end use	Average heating degree days 1979-2022	Average cooling degree days 1979-2022	Predominantly urban regions (%)	Predominantly intermediate regions (%)	Predominantly rural regions (%)
Austria	0,063	0,033	0,017	0,002	25,5	40,1	22,7	11,7	0,225	0,3	21,3	13,9	29,5	23,2	11,8	69,8	0,0	14,3	2,6	10,2	3,1	3 659	17	34,8	20,8	44,5
Belgium	0,078	0,065	0,010	0,002	37,1	38,2	16,5	8,2	0,338	0,4	38,7	32,3	8,3	20,2	0,2	72,7	0,1	11,7	1,7	13,2	0,6	2 772	15	67,7	23,6	8,6
Bulgaria	0,101	0,086	0,013	0,001	10,5	55,4	25,5	8,6	0,109	4,2	4,0	0,9	36,1	41,0	13,9	54,5	0,5	17,1	8,3	19,7	0,0	2 629	128	17,7	44,8	37,5
Croatia	0,134	0,067	0,015	0,001	13,6	42,5	23,6	11,0	0,135	0,1	21,3	4,6	46,0	22,9	5,0	68,2	1,9	10,2	6,7	13,1	0,0	2 438	112	18,0	25,3	56,7
Cyprus	0,099	0,032	0,020	0,004	3,0	24,6	36,1	34,1	0,261	0,0	0,0	30,1	27,3	42,6	0,0	37,2	10,2	22,7	7,9	20,0	2,0	778	580	0,0	100,0	0,0
Czech Republic	0,067	0,052	0,016	0,001	19,0	37,1	20,5	7,7	0,306	8,9	26,0	0,7	31,6	19,2	13,7	68,4	0,1	16,5	6,2	7,2	1,7	3 449	16	24,0	43,0	33,0
Denmark	0,036	0,032	0,006	0,000	34,1	44,6	14,0	7,2	0,456	0,0	13,7	4,1	23,9	21,8	36,6	58,3	0,0	22,7	1,8	16,7	0,5	3 380	1	21,9	48,8	29,2
Estonia	0,068	0,036	0,007	0,001	17,0	47,1	22,8	9,4	0,206	0,1	5,9	0,7	42,0	18,2	33,1	72,1	0,0	11,6	4,9	11,4	0,0	4 338	5	39,6	12,4	48,0
Finland	0,064	0,032	0,003	0,000	9,6	48,7	29,7	10,7	0,195	0,1	0,5	5,0	30,9	35,8	27,7	63,6	0,2	16,4	1,4	12,5	5,8	5 656	1	28,7	30,6	40,7
France	0,074	0,047	0,010	0,002	28,7	37,0	23,9	10,4	0,209	0,1	27,8	11,1	22,0	35,9	3,2	62,9	0,6	12,0	5,9	18,6	0,0	2 446	41	35,0	35,1	29,9
Germany	0,054	0,035	0,009	0,001	24,3	46,5	23,1	6,1	0,328	0,5	37,5	22,5	14,0	18,8	6,6	67,1	0,2	16,7	5,9	9,0	1,1	3 159	16	41,5	42,1	16,4
Greece	0,053	0,023	0,011	0,002	7,6	47,8	29,1	15,5	0,231	0,1	10,3	30,0	23,4	35,0	1,2	57,1	4,2	13,9	8,0	16,7	0,0	1 653	274	46,7	10,6	42,7
Hungary	0,050	0,029	0,009	0,001	20,3	48,3	21,7	9,7	0,095	0,9	50,7	1,3	21,6	17,5	7,9	63,7	0,2	16,3	6,7	13,2	0,0	2 822	80	17,5	36,0	46,6
Ireland	0,039	0,034	0,006	0,001	13,3	22,9	20,7	22,0	0,274	11,6	18,8	43,0	2,6	24,0	0,0	60,8	0,0	19,7	2,2	16,4	0,9	2 833	0	27,6	0,0	72,4
Italy	0,080	0,040	0,015	0,003	20,7	51,4	19,8	7,9	0,312	0,0	52,0	6,1	20,5	18,6	2,8	65,4	0,7	12,2	6,8	13,6	1,3	2 007	189	36,6	43,1	20,2
Latvia	0,054	0,034	0,009	0,000	22,7	46,6	24,3	5,1	0,224	0,1	9,8	4,8	40,7	13,5	31,1	64,2	0,0	18,8	7,2	9,1	0,6	4 157	6	49,9	13,0	37,1
Lithuania	0,051	0,029	0,007	0,002	13,5	49,6	28,9	6,2	0,150	2,4	12,2	3,8	34,0	18,3	29,3	69,0	0,0	9,2	6,4	15,4	0,0	3 981	9	26,8	31,1	42,1
Luxembourg	0,043	0,023	0,004	0,001	21,8	31,5	21,6	14,0	0,202	0,1	52,1	27,4	4,2	16,3	0,0	81,0	0,5	7,5	3,3	7,8	0,0	3 021	22	0,0	100,0	0,0
Malta	0,100	0,024	0,006	0,001	13,0	23,2	23,4	8,7	0,129	0,0	0,0	14,7	13,3	72,0	0,0	19,4	12,3	25,1	13,1	29,2	0,8	534	580	100,0	0,0	0,0
Netherlands	0,075	0,043	0,008	0,001	18,9	41,9	26,4	9,5	0,060	0,0	67,9	0,4	5,9	22,8	3,0	60,9	0,3	17,4	2,1	19,2	0,1	2 809	10	72,4	27,0	0,6
Poland	0,089	0,070	0,015	0,000	19,1	43,0	22,7	11,4	0,146	24,6	18,2	2,9	24,8	12,2	17,2	63,3	0,0	17,2	8,6	10,9	0,0	3 505	16	28,1	38,6	33,3
Portugal	0,088	0,060	0,013	0,001	10,7	37,1	36,0	16,3	0,207	0,0	9,8	14,9	36,3	39,0	0,0	30,5	0,9	17,9	31,4	19,4	0,0	1 233	184	48,9	17,1	34,0
Romania	0,134	0,093	0,013	0,001	11,2	59,1	19,0	8,0	0,236	0,6	34,3	3,4	38,2	14,6	8,9	62,2	0,3	13,8	9,8	13,9	0,0	3 087	82	10,6	43,9	45,5
Slovakia	0,051	0,035	0,010	0,001	8,2	52,6	21,5	5,8	0,180	2,0	41,7	0,2	22,8	18,4	14,9	73,1	0,1	12,3	4,3	10,2	0,0	3 354	31	11,2	38,4	50,3
Slovenia	0,054	0,031	0,013	0,001	21,3	45,0	25,0	8,7	0,139	0,0	9,8	12,4	41,6	29,1	7,0	62,0	0,6	16,2	4,1	17,2	0,0	2 971	35	0,0	56,2	43,8
Spain	0,130	0,021	0,017	0,003	11,1	43,0	24,7	18,5	0,307	0,3	23,9	16,9	15,7	43,2	0,0	40,7	0,0	19,4	7,8	32,1	0,0	1 812	207	59,2	33,5	7,4
Sweden	0,080	0,043	0,007	0,001	24,3	47,7	12,3	4,6	0,253	0,0	0,3	2,8	12,7	50,8	33,4	55,6	0,0	14,1	1,6	20,5	8,2	5 316	0	22,1	61,8	16,2

Figure A1. Territorial indicators by European country.