Public versus private one-stop-shops for energy renovations of residential buildings in the EU

Georgios Pardalis
Built Environment and Energy Technology
Linnaeus University
SE-351 95 Växjö
Sweden
georgios.pardalis@lnu.se

Krushna Mahapatra
Built Environment and Energy Technology
Linnaeus University
SE-351 95 Växjö
Sweden
krushna.mahapatra@lnu.se

Brijesh Mainali
Built Environment and Energy Technology
Linnaeus University
SE-351 95 Växjö
Sweden
brijesh.mainali@lnu.se

Keywords

one-stop-shops, private, public, business models, success potential

Abstract

The current rate of residential building renovations in Europe is inadequate and attributable to the lack of integrated solutions in the market supported by appropriate business models. One-stop-shop (OSS) offers an innovative business approach, and it is acknowledged by the European Commission, in the Directive 2018/844/EU, as a transparent advisory and facilitating tool for the establishment of services relevant to energy efficiency renovations for buildings. This paper evaluates two different delivery mechanisms of OSS, namely public-driven and private-driven, using six examples of OSSs business models currently operating in five European countries. The study is based on document and records-based research, and the analysis of data is done through a standardized blank profile for each OSS including parameters based on the deliberations of Osterwalder and Pigneur's business model canvas. A comparative analysis of the models has been conducted to identify repetitive patterns, commonalities, and differences between them. The study has shown that the examined OSSs are still in a developing stage, struggling to achieve enough scale, which indicates the need to lower their costs, reorganize their models and streamline the value chain to become attractive to their targeted customer segments. Public-driven OSSs appear to be, for the nonce, better positioned in the market and their reliance on public money allows them to achieve some expansion of their activities, even if this cannot be considered a sustainable business solution in the long run. Private-driven OSSs need to work harder to strengthen their position in the market and increase their attractivity. Towards that direction, the contribution of policy interventions and re-adjustment of existing financing mechanisms could be further examined.

Introduction

BACKGROUND

Buildings in the EU are responsible for 40 % of energy consumption and 36 % of GHG emissions [1]. The vast existing building stock has significant energy efficiency potential, and therefore, they should be given increased attention to meet the energy-saving targets at the EU and national level. The COVID-19 crisis has brought the buildings to the spotlight as people spent most of their time indoors for office work, education, shopping, and entertainment. Therefore, redesign and renovation of older buildings are essential to provide a good indoor environment. Currently, only 11 % of the EU existing building stock undergoes some level of renovation every year, but such renovation works are usually not connected to the energy performance of the buildings. The current weighted energy renovation rate is between 0.4 % and 1.2 % of the building stock in some Member states, while in others, energy renovations are virtually absent [2]. To promote energy renovation of buildings, the European Commission has called for action to stimulate new investments in energy efficiency via the updated Energy Performance of Buildings Directive (EU) 2018/844 [3], the revised Energy Efficiency Directive (EU) 2018/2002 [4], and the EU "Renovation Wave" strategy [5]. A main aim of these actions is to provide affordable energy

efficiency solutions, particularly to low- and medium-income households, and thereby at least double the current annual rates of renovation [2].

The inadequate rate of renovations at present is, in most cases, attributable to the lack of integrated solutions in the market supported by appropriate business models. The traditional business models that exist in the market are characterized by a fragmented renovation value chain in which different actors deliver separate fractions of the renovation work [6]. Innovative business models for comprehensive renovation of the buildings have already been proposed [7], but their adoption is very slow. Such a business model is the One-Stop-Shop (henceforth referred to as OSS) business model in which a single actor coordinates or collaborates with other actors in the value chain to offer comprehensive energy renovation packages. OSS has been advocated by the European Commission as an important element of the "Smart financing for smart buildings" initiative [8] and the revised Energy Performance of Buildings Directive (EPBD) as part of the Directive 2018/844/EU [3]. According to Article 20(2) of the latter "Member States are required to facilitate access to appropriate mechanisms for accessible and transparent advisory tools, such as one-stop-shops for consumers and energy advisory services, on relevant energy efficiency renovations and financing instruments." The current knowledge about this business structure is somehow limited, as not many demonstration projects operate in the EU market.

This paper evaluates two different ownership types of OSS business models for energy renovations of residential buildings in the EU, using examples of public and private-driven OSS currently in operation. The analysis of those models is carried out based on the business model canvas of Osterwalder and Pigneur [9] to identify repetitive patterns, strengths, commonalities, and differences.

REVIEW OF EXISTING RESEARCH ON ONE-STOP-SHOP

The general objective of the OSS concept is to replace the fragmented renovation process with an integrated and holistic approach [10]. In this homeowner-central service model, a single actor, in coordination or collaboration with other actors, takes the responsibility of the whole renovation and serves as a single point of contact with the homeowner [6]. This bridges the gap between the fragmented supply-side and demand side, which reduces the complexities and non-monetary costs the homeowners deal with during the renovation process [11-13], e.g. the management of various actors involved in the renovation [14]. The provision of tailored information from a single source may overcome the informational barriers [15], but the trustworthiness and reliability of such advice should be verified by an independent party. Also, closed coordination/cooperation among the supply-side actors is likely to improve the cost and time efficiency of integrated renovation projects. Thus, OSS business model is considered beneficial for supporting the renovation decision-making process and thereby, enable the implementation of more extensive renovations [15].

In OSS, individual household characteristics and socio-economic considerations are considered to provide homeowners with renovation solutions that incorporate their individual needs and priorities [14, 16]. Additionally, supporting and involving homeowners through the whole renovation process makes them more engaged. The quality assurance offered by OSS increases the attractiveness of the service as it minimizes the perceived risks and uncertainties and creates a feeling of trust between the homeowners and the providers of the service [16]. Moreover, OSS may overcome the financial barriers to energy renovation through increased access to capital, grants, or loans, and the existence of a single contract and contact point minimizes the potential for unreliable repayment [17]. Since the OSS manages the whole renovation process, the high transaction costs related to renovation [11-13]are minimized. OSS can also guide the homeowners to identify the most financially viable renovation package and provide own or third-party financial solutions depending on the household need [18]

Despite the obvious advantages that OSS has, there are also some disadvantages worth mentioning. Renovating a dwelling through an OSS leaves the homeowner with a limited scope to interfere in the process and select their preferred suppliers. Furthermore, there might be a limited portfolio of renovation solutions to choose from depending on what the OSS provider offers according to its capacity and network of collaborators [19]. Additionally, conflicts of interest may arise between the different disciplines involved in the OSS, while having a single point of contact might introduce project biases [19]. Moreover, conflicts between homeowners and the OSS have an impact on the entire project, as opposed to only on each individual service in the traditional renovation model [19].

TYPES OF ONE-STOP-SHOP BUSINESS MODELS

Earlier studies have identified four types of OSS business models [18, 19], namely facilitation model, coordination model, all-inclusive model (or development model as referred in [20]) and ESCO-type model. The main difference between these models is the level of support provided by the OSS provider in the overall customer journey and the risk the OSS must take regarding the results of the renovation work. The facilitation model aims to raise house owners' awareness of the benefits of energy renovation, provide general information on the measures to be adopted, and suggest potential supply-side actors that could deliver the renovation work [20]. Hence, this model is suitable for self-motivated homeowners seeking information/advice from a trustworthy source [21]. This model exists or being developed in various European municipalities, but its impact on the renovation of privately-owned buildings is limited [20]. In the coordination model, the OSS provider provides relevant information to the homeowner and coordinates the different supply-side actors to deliver the renovation. The homeowner signs contracts with different supply-side actors, and therefore, the OSS provider does not take any risk towards the renovation work. In the all-inclusive model, the OSS provider takes the full responsibility and risks of the complete renovation but does not sign any contractual agreement regarding the level of energy savings. The ESCO model is similar to the all-inclusive model but includes guaranteed energy savings. This model has been in multi-family residential buildings [22, 23], it is still a model whose application parameters are still being investigated [24] for the detached house segment.

DELIVERY MECHANISM OF ONE-STOP-SHOP

Existing OSSs that are in operation are often a combination of the different types that have been described in the previous section. Those types should not be considered in isolation; instead,

combining different types can provide a more potent business model that can better meet the challenges of the renovation market and the needs of homeowners. Laffont-Eloire et al. [7] and Pardalis [21] have identified the various ways in which OSS is currently delivered in the market. The delivery mechanism of OSS can be: (i) OSS supported by digital tool; (ii) OSS provided by a multi-disciplinary team; (iii) OSS provided by contractors cluster cooperation; (iv) OSS provided by a joint venture of retailers with industry and contractors; (v) OSS provided by an entrepreneur; (vi) OSS provided as a complementary business; (vii) OSS supported by a step-by-step approach; (viii) OSS provided by Public-Private Partnerships and semi-public entities; (ix) OSS with home-based financing. Even if the OSS business models may differ in terms of type and delivery mechanism, they are found in two types of ownership, namely, public-driven and private-driven.

Methodology

This paper is based on a document and records-based research approach [25], collecting information from OSS providers' websites, webinars conducted by them, insider knowledge (in some of the cases), and presentations of their business model in scientific and business seminars and forums. The limitation of this method is that there may be missing or incomplete information on some business models, and some information may be tentative and own subjective interpretation. Relevant parameters to describe the way those providers deliver their OSS business model have been collected in a standardized blank profile to provide a systematic data format for the presentation (Table 1). The parameters are mainly based on the deliberations of Osterwalder and Pigneur [9] and their business model canvas.

In total six OSS business models are examined (three public and three private) currently operating in five different European countries (France, Ireland, Spain, Sweden, and United Kingdom). Those six OSS business model do not cover the whole amount of the currently operating OSS in the EU, but they are representative of the different types of OSS and its delivering mechanisms. After collecting information on these business models, a comparative analysis was conducted to identify repetitive patterns, commonalities, and differences between them.

Results and analysis

PUBLIC OSS BUSINESS MODELS

Oktave (France)

Oktave is a semi-public, ESCO-type OSS, founded by Grand Est Region and the French Environment and Energy Management Agency (ADEME), and it operates in the French region of Alsace. The aim of this OSS is to increase the number of deep renovations in an effort to reduce greenhouse gas emissions by a factor of four to meet the regional 2050 target set by the Regional Climate Air Energy strategy and enforced by France's Energy Transition for Green Growth Act. The OSS provides homeowners with a specialized independent renovation advice service, where the building owner deals with a central point of contact, which compares and evaluates individual offers by suppliers, to provide a holistic solution fitting the needs of each specific customer. The customer segment of Oktave consists of owners of single-family houses, but more specifically to those homeowners having fully or nearly paid mortgages, homeowners with high annual household income, and first-time buyers.

Oktave delivers its service following a four steps approach. In the first step, initial contact is established, and an Oktave's advisor makes an on-site visit to gather information about the dwelling to suggest the appropriate measures. A renovation plan is discussed and outlined based on the needs and financial capacity of the homeowners. Following this, a contract is signed, specifying the related terms and cost. In the second step, the Oktave advisor collects offers from relevant building professionals and compiles the most appropriate renovation package. The homeowner agrees on a renovation and financial package suggested by the advisor. In the third step, the renovation begins, and during the process, the advisor supports the homeowner in project management-related issues if needed. A blower-door test is used to control the general quality and performance of each renovation. The final step is the "post-work care", in which the advisor stays in contact with the homeowner and ensures the technical and financial plans work as intended.

Oktave generates revenue through a fixed fee as compensation for the technical support in the form of a service package billed to the customer and an annual fee from building professionals that want to participate in the bidding process for the renovation. Its costs are divided into labour costs (for advisors,

Table 1. Parameters of the business models' profiles and their description.

PARAMETER	DESCRIPTION
Value Proposition	Products, services, features, benefits creating value for the customers
Customer Relationships	The intensity of the customer-provider relationship, channels to reach the customers
Customer Segment	Typical customer group that the product/services is directed to
Activities and Capabilities	The most important activities a company needs to conduct to provide the offer and necessary related resources
Revenue Streams	Type of streams a company generates revenue with
Costs	Most important expenditures that the company incurs in for the provision of the offer
Maturity	Stage a company is situated in with regards to how elaborated and integrated a business model is
Main Strengths	The most important strengths that make the business model work successfully

administrative personnel etc.), costs for the development and maintenance of the information system through which the collaborating professionals acquire information regarding each renovation and place their bids, and communication costs. So far, more than 300 houses have been renovated through Oktave, and the company slowly expands to multi-family residential buildings and tertiary buildings (with a goal to increase the number of its supported renovation projects up to 1,000 per year in the years 2021/2022). The main strengths of the OSS offered by Oktave are tailor-made support to the customer, support with a financial plan that combines potential grants, tax rebates, low-interest loans, and project management assistance throughout the renovation process. Moreover, Oktave provides personalized post-renovation care for two years and access to qualified and experienced professionals who are trained by Oktave to guarantee that the renovation outcome in each project will meet the goals set for energy performance.

Hauts-de-France Pass Renovation (France)

Hauts-de-France Pass Renovation (formerly known as Picardie Pass Renovation) is a coordination type of OSS delivered by a state-owned company (Regional Public Service Company for Energy Efficiency SPEE). The regional council of the Hauts-de-France region in France has the management of SPEE, which is an integrated service for the energy renovation of residential buildings, which offers advice, dedicated customer support, and financing of thermal retrofit projects of private homeowners. The company promises to support its customers all along the process of renovation of their dwelling. The philosophy with which the company offers its services is summarized in continuous follow-up during all the phases of renovation. In the planning stage, the OSS performs an energy audit of the buildings, and provides to the customer information and personal advice on the measures to be adopted. Additionally, the OSS assigns a work program operator who is going to supervise the whole renovation from its start-up to the final delivery. Moreover, the company offers a post-renovation follow-up for a period of five years, during which it offers support for potential required maintenance and tracking of energy consumption and eco-coaching to the owner(s) of the building. The company also offers to its customers loans (the SPEE got the authorization from the French Bank institution to deliver loans to homeowners, while in France, in principle, only banks are allowed to give loans) and public grants to finance their renovation project. In the case of a loan delivered by SPEE, the owner will repay an amount less than or equal to the post-renovation energy savings. According to the company's representatives, it is difficult to ensure that the energy savings will be equal to the monthly loan repayment, but this is calculated in a way to be close to the estimated (calculated) energy savings. The average final energy consumption reduction achieved is 56 % against their set target of 50–75 % reduction on final energy consumption. This loan on energy savings is granted at an interest rate of 2 %, given over 15 years for equipment, and up to 25 years for building insulation works. It should be emphasized that the OSS does not bear any financial risk and no risk for the final energy performance of the building post-renovation.

Hauts-de-France Pass Renovation delivers its service to multi-family housing buildings and single-family houses. The company generates revenue via a standard fee for the assistance offered throughout the renovation (€1,550 for individual houses and €750 for apartments in multi-family residential buildings, including all taxes). A part of this invoice (€350) is directly paid by the customers, while the other part is included in the renovation works financial plan. Regarding costs, these are divided into labour costs (for advisors, administrative personnel, etc.) and costs for advertising the service. In the case of a third-party financing for the renovation, the companies delivering the renovation works are paid directly from the work program operator that Picardie Pass Renovation has assigned to the project. Until September 2019, Hauts-de-France Pass Renovation has delivered 319 complete renovations (317 single-family houses and 2 condominiums with 268 apartments in total) and has planned to deliver 234 renovations of single-family houses and 3 condominiums (with 327 apartments). The Hauts-de-France Pass Renovation model was also the basis for the development of SuperHomes model, described in the next sub-section. The main strengths of this OSS are the continuous follow-up during the whole process of renovation, the personalized way each project is treated, and the provision of access to reliable financing with favourable terms for the beneficiary.

SuperHomes (Ireland)

SuperHomes is a coordination type of OSS owned by the Tipperary County Energy Agency in Ireland. SuperHomes aims to provide to owners of single-family houses an integrated deep renovation service, with a goal the dwelling to reach an EPC A3 rating post-renovation (low energy building). According to TEA [26], SuperHomes also aims to provide a significant financial support package to homeowners, including (i) a public grant to incentivise renovation works and (ii) a loan covering the remaining cost, which can be paid back over a five-year period. The host organization, TEA, provides a professional project management service to the homeowner, including selecting contractors and subcontractors who will carry out the renovation work. Additionally, TEA offers a post-renovation inspection of the work quality and a post-occupancy evaluation. Moreover, it processes public subsidies for deep energy renovation, simplifying the process for the homeowner. SuperHomes is in collaboration with the Sustainable Energy Authority of Ireland (SEAI), which is the provider of subsidies for homes completing a deep energy renovation.

SuperHomes delivers its service through a set of standardized processes. At first, the homeowner expresses interest and applies for the service through the SuperHomes' website. If the project is deemed feasible, an on-site evaluation is carried out at the cost of €475. The evaluation includes an air infiltration test. Then, SuperHomes advisor designs a package of suggested measures to achieve an EPC-A rating and proposes it to the homeowner. Some measures are mandatory within the scheme (air to water heat pump, advanced ventilation, airtightness improvement, and insulation to a high standard). The rest of the measures are tailored to the specific dwelling and the incentives of the homeowner. The OSS provides a cost estimation for the renovation to the homeowner, calculated based on the cost of services provided from a pre-approved panel of qualified contractors and sub-contractors. If the homeowner wishes to proceed, TEA accesses subsidies on behalf of the client. TEA undertakes the project management and quality assurance of the various contractors and installers. A post-renovation audit

is carried at the end of the works by TEA, and this is subject to further audit by the subsidy provider SEAI. A post-occupancy evaluation is carried out for up to three years by TEA.

SuperHomes generate revenue from the pre-renovation evaluation fee that charges to interested customers (and which in the case of an agreed renovation is included in the final price) and from the project management and professional fees for its service, which are included in the total cost of the works for the homeowner. Its main costs consist of labour costs for advisors, administrative personnel etc., and costs for communication and outreach. Since its beginning, in 2015, SuperHomes has renovated over 300 houses, with almost 33 % applying homeowners accepting the renovation package proposed to them. The main strengths of SuperHomes' OSS are the elimination of non-monetary costs connected to the renovation, for the customer, through customer-oriented project management activities and the dedication of SuperHomes to provide their customers with renovations aiming to achieve high energy efficiency standards. Moreover, the opportunity for the customer to have access to subsidy schemes and the handling of this process from the OSS is a great selling point for the service.

PRIVATE OWNED ONE-STOP-SHOPS

SiRE (Spain)

SiRE is mainly a coordination type OSS, acting as a meeting point for all actors involved in the renovation process, including administration, construction workers, suppliers, and citizens. SiRE also provides citizens with advice, information, and knowledge on how to reduce their energy bills through energy renovation. This OSS, which currently operates in the Madrid region, was founded by the Spanish national association of renovation companies (ANERR), aiming to increase interest in energy efficiency by bringing the fragmented supply chain together and professionalise the sector. The main aim of SiRE is to boost energy renovations through the information and training of professionals. Homeowners can contact SiRE to ask for general information and explore their renovation options, often without having a concrete idea about what they need to renovate in their property. For other property owners, SiRE provides a platform where they can ask for hands-on solutions, including an estimated budget for a renovation project, as well as, financial solutions.

SiRE delivers its service in a four-step approach. In the first step, potential customers visit the platform's website, fill out a basic form about their needs and receive some initial information about the process. Following that, the customer is contacted by a specialist within two working days. In the second step, the customer receives a questionnaire with questions related to the project. With that questionnaire, the professionals involved in SiRE make an initial diagnostic about the renovation needs of the building and select suitable installers taking into consideration the financial ability of the customer. The questionnaire is complemented by a phone call. This first interaction and expectation check enables a more aligned process, which improves the experience for associate companies as well as the customer. Following that, the SiRE team suggests a financial solution for the specific project and provides information about private and public funding options. In some cases, ANERR's associates help to facilitate a financial solution with better conditions for the customer. In the third step, the customer receives all the gathered information and decides on whether the renovation will be carried out. In the case of positive answer, the renovation is implemented in step four, and ANERR keeps in contact with the customer throughout the process. In addition, SiRE offers energy advice to the public upon request.

SiRE's service mainly targets multi-family buildings, but single-family house owners can also get the service. This OSS generates revenue by retrieving an overhead cost for every contracted work, which amounts to over 6% of the total renovation cost. The fee is paid by the company that wins the work through the SiRE model. Companies that are involved in the offering process but not selected do not have to pay anything. SiRE's costs are divided into labour costs (for advisors, administrative personnel, etc.) and costs for communication and marketing of the service. As of June 2019, SiRE has delivered 140 renovations, with 74 of the being in multi-family residential buildings. In the same period, the OSS additionally received 300 contacts for renovation (which represents less than 1 % of potential customers). From those, 10 % received a renovation proposal and only 5.8% decided to renovate their property. The main perceived strengths of SiRE are considered its constant effort to promote the benefits of energy renovation measures and the provision of advice for the renovation process, as well as, the free of charge renovation service for the customer. In addition to these, SiRE provides an assessment of the building performance and building owner's financial capability which allows an accurate recommendation of measures at a cost that is suitable for the customer. Based on that, suitable professionals are recommended to deliver the work, while the customer also gets advised on supporting financing opportunities. Furthermore, SiRE offers awareness-raising activities (workshops, seminars etc.), including information and training days for citizens and professionals.

RetrofitWorks (United Kingdom)

RetrofitWorks is an all-inclusive OSS provided by a multi-disciplinary team. The OSS was developed in response to the Green Deal Policy launched by the UK government. SMEs active in the renovation market believed that they were losing customers due to the Green Deal policy process. In response to that, they took the decision to collaborate and generate a delivery model where the Green Deal policy could operate but not dictate the process. The aim of this OSS is to deliver to its customers a reliable and high-quality renovation service. The model works in a cooperative manner, including professionals from a variety of disciplines (installers, energy auditors, trade associations etc.).

The RetrofitWorks service involves four main steps. In the first step, and after the interested building owners establishes contact with the OSS, an on-site survey of the residential building is conducted, following which three quotes are generated from the local SME companies via a software portal. RetrofitWorks members use the web portal to share renovation projects and ensure they have sufficient information to come up with a reliable quote. The customers have access to the quotes via the same web portal. The selected quotes formulate a renovation package, and a contract is generated through the RetrofitWorks portal. This contract is signed between the homeowner and RetrofitWorks. In the final step, the renovation begins, and RetrofitWorks supervises the installation of

measures and ensures that all works included in the contract are going to be delivered.

RetrofitWorks service mainly targets multi-family buildings and single-family houses, but the model extends its services to the community and commercial buildings. The model generates revenue mainly through membership fees from cooperating organizations and from fees (borne by the house owner) connected to the use of the RetrofitWorks services. On the other hand, the cost structure of the model is a bit more complex. The cost of renovation services is generally incurred through membership fees and for the use of the RetrofitWorks services. A small percentage is added to the cost of the work for every job. That percentage is agreed for each scheme by all the involved organisations. RetrofitWorks also takes on some administration and customer care services, so member costs are further reduced by no longer having to provide these services. As the model works in a cooperative structure, the percentage fee goes back into providing member services for the benefit of the member organizations. According to the records examined, RetrofitWorks has so far completed four projects and has four more ongoing projects. Two of the completed projects involved retrofit measures for 249 residential buildings. The main advantages of the model are summarized in the fact that the customer has to select one of the three different quotes generated from the energy survey, the delivery of renovation works from installers that are quality vetted and referenced, and the advice RetrofitWorks offers on the best grant scheme based on customer's financial situation. Additionally, RetrofitWorks ensures the quality of the work from the installers through supporting training schemes for its member organizations.

Klimatfastigheter Småland AB (Sweden)

Klimatfastigheter Småland AB is a start-up company offering an all-inclusive OSS type based in Kronoberg province in Southeast Sweden. The company was created by local entrepreneurs based on the market gap analysis and findings of academic research conducted at Linnaeus University. The aim of this OSS is to provide customers with an integrated energy renovation service based on their desires and financial ability. Klimatfastigheter Småland AB does not offer any financial support to the customers, but it provides them with dedicated project management and service throughout the renovation in collaboration with well-known local companies working in the field. Moreover, the OSS offers a post-renovation audit and provides guarantees on the works delivered.

Klimatfastigheter Småland AB delivers its service through a set of standardized processes throughout all the stages of a renovation (from pre-renovation audit and planning up to post-renovation audit). At first, there is a series of meetings with potential customers and on-site visits where an energy advisor collects actual data for the heating performance, physical conditions, and energy use of the dwelling. The analysed data set the base for the proposal of the measures to be adopted per dwelling. The emphasis on those measures is on being energy cost-saving and having clearly defined payback times. Average cost estimation for the whole renovation is given to the customer, and upon agreement, the OSS invites sub-contractors to deliver the renovation work. The selection of those sub-contractors is made from a pool of artisans active in the renovation market in the broader area of the province. The sub-contractors are asked to provide the OSS with the best possible price for their services since the OSS bears all the risks for the project. For its part, the OSS takes care to choose sub-contractors that have a good reputation in the market and record of successful projects delivered to ensure, as much as possible, the quality of the works to be delivered. Then, the OSS returns to the customer with a fully costed proposal for the renovation, and the customer decides to sign a contract or not for the renovation. During the execution phase of the renovation, the OSS is responsible for coordinating the works, and upon delivery, it performs a post-renovation audit to ensure that all the works have been carried out according to what has been included in the contract. In the case of failures, the OSS bears the risk of restoring the works that have not been performed properly.

Klimatfastigheter Småland AB's service mainly targets medium to high-income owners of single-family houses living in urban and sub-urban areas. This segment is prioritized since currently there is no specific government subsidy or incentive to promote deep renovation, and those renovations are dependent on homeowners' own savings. This OSS generates revenue through the difference between the negotiated price for the services provided by collaborating actors, and the price that the customer is given. If, e.g. a renovation costs €20,000 (without the OSS being involved), Klimatfastigheter comes and negotiates the price by providing guarantees for future projects to the artisans delivering the renovation works, achieving an overall price discount of e.g. 25 %. Then, the OSS offers to the homeowners a lower price than this they could negotiate (e.g. 7.5 % lower compared to the €20,000 of cost in our example), and the difference (€3,500 in our example) constitutes the remuneration of the OSS for its services. The main costs of this OSS are communication/outreach costs and IT-related costs. The administrative costs are included in the final cost of each renovation. Since its beginning in late 2019, Klimatfastigheter Småland AB has delivered only a handful of renovation and has been contacted by several other customers. The current COVID-19 pandemic has posed certain challenges to the viability of this OSS since potential customers own savings are affected due to increased unemployment and loss of income. Moreover, in that situation very few homeowners enter the process of getting a loan to renovate their dwelling. That creates the need for Klimatfastigheter Småland AB to further redefine its model. The main perceived strengths of Klimatfastigheter Småland AB are considered its dedicated and customer-oriented support which relieves the house owner form the stress of finding the appropriate artisans to per-form the various renovation works, and the coordination of the renovation project. More-over, the fact that the sub-contractors are local allow the development of local economies of scale who are benefiting the local professionals and communities. In addition, guaran-teeing the works delivered, reassures homeowners about the quality of the renovation.

Discussion

The six examined OSS have been launched during the last six years, with Hauts-de-France Pass Renovation being the oldest and Klimatfastigheter Småland AB being the most recent of the examined OSS. A similarity of those OSS lies in the fact that they still struggle to achieve enough scale, which indicates the

Table 2. Key activities offered by the examined OSS.

Ownership type	Public-driven			Private-driven		
OSS / Activity	Oktave	SuperHomes	Picardie Pass Renovation	SiRE	RetrofitWorks	Klimatfastigheter Småland AB
An on-site visit and pre-renovation audit	X	X	X		X	X
Access to financing	X	X	X	X		
Management of renovation works		X	X		X	X
Post-renovation inspection	X	X	X			X
Upskilling activities	X			X	X	

need to lower their costs, reorganize their models and streamline the value chain to become attractive to their targeted customer segments. Public-driven OSS models appear to have performed the largest number of renovations, while from the private OSS, only RetrofitWorks presents a comparable amount of renovations. The scale of renovations delivered by the examined OSS also shows that these models are still in a developing stage, targeting early adopters for the service they offer, even if some of them make efforts to expand in other customer segments.

The six OSS have been initiated by a heterogeneous group of actors. On the one hand, Hauts-de-France Pass Renovation is solely owned by a public actor, SupeHomes owned by a state agency, and Oktave by a mix of private and public actors. On the other hand, SiRE and RetrofitWorks are the product of collaboration between different supply-side actors in the renovation market, and Klimatfastigheter Småland AB is a purely entrepreneurial effort collaborating with local actors in the renovation market. Several models (Oktave, SuperHomes, Hauts-de-France Pass Renovation, Klimatfastigheter Småland AB) either employ project managers or act themselves as project managers. Simultaneously, the actual renovation work, and in some cases the pre-renovation audit, are performed by sub-contractors. Other models (RetrofitWorks, SiRE) focus on matching each renovation project with the appropriate sub-contractors who will deliver the work, leaving the project management of the whole process to them. The organization responsible for the operation of OSS needs to consider which parts of the service can be delivered by in-house resources and which need to be contracted to external actors to perform them. That poses a dilemma explained by transaction cost economics theory [7]. An OSS organization needs to make a choice between deliver part of the services or all of them or procure them from external parties by considering the internal production and control costs of each activity required in the renovation and whether such costs are below or above the combination of the price of that service on the market and the transaction costs associated with acquiring it from other parties [28]. Activities where the aggregate cost is lower internally, they would perform themselves; all others, they would attempt to acquire from the market. The above depends on the organization's capabilities and competence, their need for control for the whole process, and whether they are willing to bear the risks associated to the renovation project [15]. Some organizations use online portal solutions to match potential customers to appropriate renovation work providers. This "matchmaking" reduces non-monetary costs for customers, and to a certain extent, for the OSS provider. Those portals could be further developed as to allow better monitoring of the renovation process and evaluation of the quality of the work of different professionals involved in a renovation.

The examined OSS provide integrated renovation services, including a series of key activities to provide the house owners with quality renovation service considering their needs and financial capacity. Such activities are the pre-renovation audit of the dwelling, the management of the renovation works, the post-renovation inspection for quality assurance, and, where applicable, the provision to the customer of access to financing mechanisms for the renovation (mostly public-driven OSS). Apart from these activities, some OSS ensure that the sub-contractors they procure for the various renovation works have the capacity to deliver their service in a quality way. To achieve that, those OSS organise and execute training schemes to make sure that their collaborators will be able to provide customers with a good service, strengthening customers' trust in the OSS. The key activities that the examined OSS offer are summarized in Table 2[1].

Regarding customer segment, the examined OSS focus on single-family houses (all six of them) and multi-family houses (three out of six). Single-family houses are an attractive segment as they constitute over 60 % of the total building stock in the European Union [29]. Having to deal with a single homeowner makes the consultation process more accessible, the renovation projects are less complex, and it also requires a small network of service providers for each project. On the other hand, multi-family residential buildings offer a sufficient project size that is attractive to OSS providers.

The diversity of revenue streams in the six models illustrates how differently the business models have been developed. The most common revenue type is to get compensation for every completed renovation, which is paid either directly (payment to carry out the renovation works) or indirectly (charging an overhead per contracted work). Some OSS charge membership fees to professionals in order for them to be part of the network of sub-contractors for the OSS. The public-driven OSSs also re-

1. Access to financing/SiRE: Not directly from the OSS but through its founding organization.

ceive support funds from third parties, in the form of mostly national or regional funds. For example, Hauts-de-France Pass Renovation receives funding from a very broad funder based like e.g., the regional council, European Investment Bank (refinancing loans) and French public development bank (finances projects of the local authorities), European subsidies (like Elena[2] and ERDF[3]), French subsidy schemes (CPER[4]) etcetera. Regarding costs, the most common relate to labour, which includes salaries for project managers, advisors etc. Other costs are related to the internal administration of each OSS and to activities aiming to increase the visibility of the OSS (marketing, public relations, networking events etc.). For some OSS, there are also costs for the development and maintenance of online portals which are necessary for the approach those OSS follow to deliver their service.

Conclusions

In this paper, six operating one-stop-shop business models from five European countries have been presented and analysed using a profile containing some of the most relevant business model building blocks of Osterwalder and Pigneur's [9] business model canvas. All these blocks have been filled with information deriving from the OSS's websites, webinars conducted by them, insider knowledge, and presentations given in scientific and business seminars. A comparative analysis of those models was conducted, shedding light on how these OSS operate and identifying repetitive patterns, commonalities, and differences between them.

The analysis showed that OSS still have not reached a maturity level which will allow them to expand beyond the early adopters' segment for their service. This indicates the need to update the way they organize their business model to achieve a state where they will become attractive to a broader segment of potential customers. It is also a need for those models to actively try to lower their costs and streamline their value chains. The key to achieving lower costs and streamlining value chains might lie in finding ways to industrialize the renovation process. Research showed that a large proportion of homeowners prioritizes the renovation of only specific components of their dwelling [30]. With this as a starting point, there are opportunities for OSS providers to approach renovations from a different perspective. w. First, it is easier to discuss the performance of a specific component than the performance of a whole dwelling. Second, dwellings have much more variables, so the chance a different dwelling with all the same variables, to occur is limited. However, when only a component is considered there are opportunities for repetitions in the solutions proposed. Additionally, renovating only a component instead of a complete dwelling needs lower level of investment from homeowners. That paves the way for a higher uptake of energy-efficiency measures, aiming in the gradual improvement of the energy performance of the dwelling, through the renovation of those specific components, according to their needs and capabilities This approach also leaves space for the existing instruments to be exploited in their full capacity and expanding to a broader base of homeowners. Moreover, industrialization on the component level, allows small- and medium-sized enterprises (SMEs) in the market, to develop their own solutions on component level, and have the needed volume of operations to focus their business attention more towards renovations rather than new buildings [31]. Additionally, an increased volume of operations, allows bigger players in the construction industry to enter the market and provide cost-effective renovations (due to highly developed production capabilities).

Public-driven OSSs appear to be more firmly grounded compared to private-driven ones. They are backed by strong and trustworthy organizations, and apart from providing services strictly connected to the renovation itself, they work actively to raise awareness on the benefits of energy efficiency, by communicating to the community information that is comprehensible and fits the actual needs of the groups targeted. This is important for the building of a sense of trust between them and their potential customers, a trust that private entities struggle toa chieve since the credibility of the information they provide is usually questioned by homeowners [32]. Additionally, their ability to provide access to funding mechanisms (national or regional funds) allows them to reach a broader client base for their services. Moreover, they have operational resources in the form of funds for the operation of the OSS itself, which allows them to have a greater degree of flexibility and provide their services even in cases where the customers have difficulties paying back the service provided. This reliance on public money that public-driven OSS currently have allows them to achieve some expansion of their activities, but it cannot be considered a sustainable business solution in the long run. For some, private-driven OSS financing is an issue. Providing opportunities for loans with favourable terms or not providing funding opportunities at all limits the number of potential customers, as those either have to deal with an additional financial burden or finance the renovation from their own savings, which limits the extent of measures to be adopted. Moreover, a private-driven OSS operates in a profit-making sense, which does not leave much room for flexibility in their financial transactions with its customers, as they cannot afford to operate without getting paid for their services or with receiving belated payments. The services offered by each OSS are not connected to whether they are public or private driven but to the type of their OSS model (facilitation, coordination, or all-inclusive). For the public-driven OSS, post-renovation inspection is an integral part of the service they offer, while for private-driven OSS (at least not all of them), this does not seem to be the case. Those OSSs that do not provide post-renovation inspection to balance this weakness through organizing education programs for the supply-side actors they subcontract, trying to ensure that way that the quality of the work delivered will be of high standard.

The examined OSSs address their service mostly to single-family houses. Most of those houses are in need for renovation, offering opportunities for large-scale renovation services to be developed. For public-driven OSS, and bigger private driven OSS opportunities could be developed through pooling similar building typologies, leading to the development of industrialized renovation services on neighbourhood or district level. By

2. ELENA (European Local Energy Assistance). More information at: https://ec.europa.eu/transport/themes/sustainable/news/2018-06-28-elena_en.

3. European Regional Development Fund.

4. Les contrats de plan État-Région (State-Region planning contracts) are investment catalysts, they allow the State and the Region to unite to finance projects exercising a leverage effect for local investment.

bundling buildings and achieve a sufficient volume for a project, more financiers will be attracted, and other actors such as house owners' associations, municipalities, etcetera will be encouraged to get more actively involved. For smaller private-driven OSS, small individual renovation projects appear to be a viable solution, even if the impacts from the COVID-19 pandemic on households' finances pose a threat to the viability of those models.

Concluding, public-driven OSSs seem to be better positioned in the market, at least for now, and they have the necessary capabilities to extend their operations. Private-driven OSS need to make further efforts to strengthen their position in the market and increase their attractivity, and towards that direction, the contribution of policy interventions and re-adjustment of existing financing mechanisms could be further examined. In general, the findings of this paper provide some valuable information regarding operating OSS business models that could be utilized by construction companies considering entering the market of energy renovations, investors, analysts, and policymakers.

References

1. European Commission (2020). Energy efficiency in buildings. European Commission – Department: Energy – In focus. Available at: https://ec.europa.eu/info/sites/info/files/energy_climate_change_environment/events/documents/in_focus_energy_efficiency_in_buildings_en.pdf.
2. European Commission (2018). CORDIS Results Pack on Deep Renovation. Publications Office of the European Union. Luxembourg, November 2018.
3. European Parliament (2018). Directive 2018/844/EU of the European Parliament and of the council of 19 June 2018 on the energy performance of buildings (recast). Official Journal of the European Communities, 61 (156), 75–91.
4. European Parliament (2018). Directive (EU) 2018/2002 of the European Parliament and of the Council of December 11, 2018 amending Directive 2012/27/EU on energy efficiency. Official Journal of the European Communities. Retrieved, February 24, 2021, from https://eur-lex.europa.eu/legalcontent/EN/TXT/PDF/?uri=CELEX:32018L2002&from=EN.
5. European Commission (2020). Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. A Renovation Wave for Europe – greening our buildings, creating jobs, improving lives. COM/2020/662 final. Retrieved, February 9, 2021, from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52020DC0662.
6. Mlecnik, E., Kondratenko, I., Cré, J., Vrijders, J., Degraeve, P., van der Have, J. A., Haavik, T., Aabrekk, S., Grøn, M., Hansen, S., Svendsen, S., Stenlund, O., & Paiho, S. (2012). Collaboration opportunities in advanced housing renovation. Energy Procedia, 30, 1380–1389. https://doi.org/10.1016/j.egypro.2012.11.152
7. Laffont-Eloire, K., Bourdeau, M., Joumni, H., Belaid, F., Grasset, H., Marchi, F., Dall'Oro, L., Pratlong, M., & La, X. W. (n.d.). Sustainable business models for the deep renovation of buildings.EU Horizon 2020 project STUNNING (GA No. 768287).
8. European Commission (2016). Accelerating clean energy in buildings. Annex to the Clean Energy for All Europeans. Brussels, 30.11.2016. COM (2016) 860 final. Retrieved, March 5, 2021 from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016DC0860.
9. Osterwalder, A. & Pigneur, Y. (2010). Business Model Generation: Ein Handbuch für Visionäre, Spielveränderer und Herausforderer. Campus Verlag GmbH, Frankfurt am Main, 51 pp.
10. Wilson, C., Crane, L., & Chryssochoidis, G. (2015). Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy. Energy Research & Social Science, 7, 12–22. https://doi.org/10.1016/j.erss.2015.03.002
11. Kiss, B. (2016). Exploring transaction costs in passive house-oriented retrofitting. Journal of Cleaner Production, 123, 65–76. https://doi.org/10.1016/j.jclepro.2015.09.035
12. Ürge-Vorsatz, D., Eyre, N., Graham, P., Harvey, D., Hertwich, E., Jiang, Y., Kornevall, C., Majumdar, M., McMahon, J. E., Mirasgedis, S., Murakami, S., Novikova, A., Janda, K., Masera, O., McNeil, M., Petrichenko, K. & Herrero, S. T. (2012). Energy end-use: buildings. In Global Energy Assessment: Toward a Sustainable Future (pp. 649–760). Cambridge University Press. https://doi.org/10.1017/CBO9780511793677.016
13. Ebrahimigharehbaghi, S., Qian, Q. K., Meijer, F. M., & Visscher, H. J. (2020). Transaction costs as a barrier in the renovation decision-making process: A study of homeowners in the Netherlands. Energy and Buildings, 215, 109849. https://doi.org/10.1016/j.enbuild.2020.109849
14. Boza-Kiss, B. & Bertoldi, P. (2018). OSS for energy renovations of buildings. JRC Science for Policy Report. 113301. Available at: https://e3p.jrc.ec.europa.eu/publications/one-stop-shops-energy-renovations-buildings
15. Mahapatra, K., Gustavsson, L., Haavik, T., Aabrekk, S., Svendsen, S., Vanhoutteghem, L., Paiho, S. & Ala-Juusela, M. (2013). Business models for full-service energy renovation of single-family houses in Nordic countries. Applied energy, 112, 1558–1565. https://doi.org/10.1016/j.apenergy.2013.01.010
16. Bjørneboe, M. G., Svendsen, S., & Heller, A. (2017). Using an OSS concept to guide decisions when single-family houses are renovated. Journal of Architectural Engineering, 23 (2), 05017001. https://doi.org/10.1061/(ASCE)AE.1943-5568.0000238
17. Bertoldi, P., Economidou, M., Palermo, V., Boza-Kiss, B., & Todeschi, V. (2020). How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU. Wiley Interdisciplinary Reviews: Energy and Environment, 10 (1), e384. https://doi.org/10.1002/wene.384
18. Cicmanova, J, Eisermann, M., & Maraquin, T. (2020). How to set up an OSS for integrated home energy renovation: a step-by-step guide for local authorities and other actors. July 2020. Available at: https://energy-cities.eu/publication/how-to-set-up-a-one-stop-shop-for-integrated-home-energy-renovation/.

19. Balson, K., Moreira, M., & Simkovicova, L. (2016). Description of OSS models for step by step refurbishments. EuroPHit.
20. Mainali, B. & Mahapatra, K. (2020). One-Stop-Shop for Deep Renovation: Examples of Local Interventions in residential sector in achieving SDG 7.3, in Bhattacharyya, SC, 2021, Proceedings of the Virtual International Conference on Aligning Local Interventions with the UN Sustainable Development Goals, Conference held on 2nd July 2020, Institute of Energy and Sustainable Development, Leicester.
21. Pardalis, G. (2021). Prospects for the Development of a One-Stop-Shop Business Model for Energy-Efficiency Renovations of Detached Houses in Sweden (Doctoral dissertation, Linnaeus University Press).
22. Boza-Kiss, B., Bertoldi, P., & Economidou, M. (2017). Energy Service Companies in the EU – Status review and recommendations for further market development with a focus on Energy Performance Contracting, EUR 28716 EN [JRC106624]. Luxembourg: Publications Office of the European Union. https://doi.org/10.2760/12258
23. Augustins, E., Jaunzems, D., Rochas, C., & Kamenders, A. (2018). Managing energy efficiency of buildings: analysis of ESCO experience in Latvia. Energy Procedia, 147, 614–623. https://doi.org/10.1016/j.egypro.2018.07.079
24. Recalde, M. Y. (2021). Which aspects may prevent the development of energy service companies? The impact of barriers and country-specific conditions in different regions. In Energy Services Fundamentals and Financing (pp. 293–315). Academic Press. Cambridge, Massachusetts, USA. https://doi.org/10.1016/B978-0-12-820592-1.00013-0
25. Bowen, G. A. (2009). Document analysis as a qualitative research method. Qualitative research journal, Vol. 9 No. 2, pp. 27–40. https://doi.org/10.3316/QRJ0902027
26. Tipperary Energy Agency (2016). "SuperHomes Ireland – Giving homeowners the opportunity to access finance and retrofit their house into". Covenant of Mayors.
27. Pardalis, G., Talmar, M. and Keskin, D. To be or not to be: What does it take to launch OSS for Energy Efficient Renovations? (Working paper.)
28. Williamson, O. E. (1989). Transaction cost economics. Handbook of industrial organization, 1, 135–182.
29. Eurostat (2018). Distribution of population by dwelling type. Statistics explained. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Housing_statistics#Type_of_dwelling.
30. Pardalis, G., Mahapatra, K., Mainali, B., & Bravo, G. (2021). Future Energy-Related House Renovations in Sweden: One-Stop-Shop as a Shortcut to the Decision-Making Journey. In Emerging Research in Sustainable Energy and Buildings for a Low-Carbon Future (pp. 37–52). Springer, Singapore. https://doi.org/10.1007/978-981-15-8775-7_4
31. Pardalis, G., Mahapatra, K., & Mainali, B. (2020). Swedish construction MSEs: simply renovators or renovation service innovators? Building Research & Information, 48 (1), 67–83. https://doi.org/10.1080/09613218.2019.1662713
32. Ebrahimigharehbaghi, S., Qian, Q. K., Meijer, F. M., & Visscher, H. J. (2019). Unravelling Dutch homeowners' behaviour towards energy efficiency renovations: What drives and hinders their decision-making? Energy Policy, 129, 546–561. https://doi.org/10.1016/j.enpol.2019.02.046

Acknowledgements

The authors gratefully acknowledge the financial support from the European Union Horizon 2020 project ProRetro, and the Interreg Northsea Region project Stronghouse.