To be or not to be

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To be or not to be: The organizational conditions for launching one-stop-shops for energy related renovations

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\textbf{A B S T R A C T}

Residential energy-related renovations have a high potential to reduce emissions. However, organizing such renovation is riddled with high transaction costs. In response, scholars and policymakers (e.g., European Commission) have advocated the One-Stop-Shop (OSS) concept to simplify house owners’ access to complex renovation solution, but adoption of the concept remains slow. So far, research has focused on the positive impact of OSS at the end customer interface, paying less attention to the governance challenges among supply-side actors. We perform abductive research that combines insights from 45 supply-side actor interviews with transaction cost economics and resource-based theory toward developing a conceptual framework that outlines 15 organizational conditions for supply-side actors’ uptake of the OSS model. Empirically, we find that supply-side organizations are, at this point, reluctant to take up governance of the OSS model. The reported reasons for this vary between different classes of organizations, but overall align well with the organizational conditions outlined in transaction cost economics and resource-based theory. We propose policy interventions to tackle these shortcomings and to structurally support the supply-side of the renovation market in developing the relevant conditions for OSS uptake.

1. Introduction

In most advanced economies, buildings, especially one- and two-family houses (henceforth: detached houses), are the largest single consumers of energy and producers of carbon emissions (Edenhofer, 2015). These emissions can be reduced by adopting energy efficiency measures, namely low carbon heating, ventilation, and cooling (HVAC) technologies; improvements of insulation in the building envelope; and installation of electricity micro-generators such as solar photovoltaic (PV) systems. However, the annual rate of energy-related renovations (henceforth: ERR) is still not sufficient to meet the Green Deal goals (European Commission, 2019a), and the objective of reduction of energy consumption by at least 32.5% by means of improvements in energy efficiency by 2030 (European Commission, 2019b; European Commission, 2019c). The European Commission has called for action to stimulate new investments in energy efficiency of buildings via the updated Energy Performance of Buildings Directive (EPBD) EU 2018/44 (European Parliament, 2018a), the revised Energy Efficiency Directive (EED) EU 2018/2002 (European Parliament, 2018b), and the EU “Renovation Wave” strategy (European Commission, 2020). These actions aim, among others, to provide affordable solutions for energy efficient buildings (especially, to medium and lower-income households), and to at least double the current annual rates of renovations, which varies from 0.4% to 1.2% of the building stock in different Member States (an average 3% is considered as optimal) (European Commission, 2018).

Despite the plethora of supporting measures, the insufficient rate of energy renovations is due to a variety of factors related to both the demand and supply of ERR. For homeowners, the decision for an ERR is the result of the influence of various parameters related to financial, social-behavioral, and information issues (Pardalis, 2021). A key problem is that the process of organizing ERR is riddled with considerable transaction costs (henceforth: TC), which inhibit the adoption of renovation solutions (Kiss, 2016; Ebrahimigharehbaghi et al., 2020; Ang and Straub, 1998). Those TC can be identified in all stages of ERR projects (i.e., planning, execution, and monitoring) with a total impact on the project costs reported as high as 20% (Ürge-Vorsatz et al., 2012). With TC constituting a considerable part of the total project costs, interventions towards cost reduction are regarded as beneficial in boosting the development and commercialization of ERR (Valentović et al., 2018). However, on the supply side, there is a lack of integrated solutions in the
Industry, Research and Energy issued a report (Cuffe, 2020) emphasizes to gain traction. For instance, European Parliament 2019, 2020, 2021). The OSS concept (Pardalis, 2021; Haavik et al., 2012; Cicmanova et al., 2020), and mapping of the progress of existing and emerging OSS cases in Europe (Boza-Kiss and Bertoldi, 2018). Furthermore, several studies have been conducted towards developing the OSS concept (Pardalis, 2021; Haavik et al., 2012; Cicmanova et al., 2020; McGinley et al., 2020; Balson et al., 2016), adapting it to national contexts (Bjørneboe et al., 2017; Brown et al., 2018), as well as testing homeowners and supply-side actors’ perceptions of it (Pardalis et al., 2019, 2020, 2021).

To date, the focus of scholars and policymakers has mostly been on the (positive) implications of OSS at the end customer interface. But recently, policies and studies focusing on the governance of the supply side network of actors behind one customer-facing contract have begun to gain traction. For instance, European Parliament’s Committee on Industry, Research and Energy issued a report (Cuffe, 2020) emphasizes the role of OSS in facilitating active involvement of local actors, creating value chains at the local and regional levels, and developing inclusive scalable community-based integrated renovation programs (IRP). In a similar vein, the research examining the supply side of the OSS concept have explored the business case for OSS by studying collaborative business model design processes of potential OSS actors (Mlecnik et al., 2019), implementation opportunities for OSS business models (Volt et al., 2019), refurbishment packages and replicable OSS business models for key stakeholders in the construction sector (Laflont-Eloire et al., 2020), and the role of local and regional authorities in setting up different types of OSS business models (Cicmanova et al., 2020). Nevertheless, although these studies have contributed to an understanding of how the supply side can be organized for offering OSS, they reveal a mixed picture regarding the business potential of OSS, with some OSS cases operational, some still under development, and others discontinued. In this regard, it remains unclear what are the exact supply-side organizational conditions that favor establishing (and scaling) an OSS and which (if any) actors see it as an attractive opportunity to take up the governance of an OSS model as part of their business strategy.

Correspondingly, in this research we specifically focus on the supply-side conditions of the OSS concept and ask the following two research questions: (1) Which organizational conditions serve to increase the ability and willingness of the supply-side market participants to take up governing an OSS model? (2) How to support the supply-side market participants to improve their ability and willingness to govern an OSS model?

To gain insight into these questions, we perform an abductive analysis (Dubois and Gadde, 2002) where we iteratively develop a framework about the conditions of supply-side OSS adoption by drawing from theory on organization science and empirical data originating from 45 interviews with five classes of supply-side actors active on the Swedish renovation market. Corresponding to our specific focus on the supply-side organization of the OSS concept, the literature we draw on includes two prominent perspectives in organization science — organizational transaction cost economics (Madhok, 2002; Dyer, 1997; Williamson, 1989) and resource-based theory (Barney, 1991; Penrose, 1959; Teece et al., 1997) — which together form the basis for explaining the strategy of organizations for the type of business they choose to perform and the way they behave concerning markets (Williamson, 1999).

The study makes three contributions. Firstly, we report on how a wide range of supply-side market participants perceive OSS in relation to their organizations. This focus on supply-side actors is distinctly different from the end-user, the policymaker or the collective business model perspective on the OSS concept featured elsewhere. Secondly, related to the previous, we contribute to economic analysis in renovation studies by turning attention to organizational economics on the supply side. In this regard, we develop a framework that outlines the conditions in which an actor is likely to take up and succeed at governing an OSS model, identifying 15 such organizational conditions. Thirdly, considering that all the five actor classes we studied reported it unlikely to adopt the OSS concept at a sufficient scale, we outline supply-side policy interventions to improve the organizational conditions for establishing a detached house OSS for ERR. Based on our analysis of organizational economics, we argue that in increasing the market penetration of the OSS model, supply-side interventions would be (critically) complementary to the demand-side policy interventions that have been in focus earlier (Pardalis, 2021; Friige, 2016; Mainali et al., 2021; Murphy, 2016; Pettifor et al., 2015).

2. Literature review

2.1. How transaction costs are holding back the ERR market

Transaction cost economics (henceforth: TCE) is a branch of economics and organization science that explains how an economic exchange is organized as a function of the costs caused by market inefficiencies around that exchange (Coase, 1937). These so-called ‘transaction costs’ are a natural part of trade — so, to know the true cost of any exchange, one would include both the cost of the goods that are being exchanged and the transaction costs associated with the exchange.

In this regard, major inefficiencies currently burden the market of ERR of detached houses with recent studies (Kiss, 2016; Ebrahimighareshbaghi et al., 2020; Urge-Vorsatz et al., 2012; Wilson et al., 2015) quoting the proportion of TC in total project costs as high as 20%. Considering ERR of detached houses from the point of view of transaction cost economics (Dyer, 1997; Mundaca et al., 2013) at least three reasons for high TC in this context stand out. Firstly, with transactions occurring when ‘a good or service is transferred between technologically separable stages’ (Williamson, 1999), ERR projects as integrations of products and services from different suppliers entail not one but several different transactions. Furthermore, though projects have standard elements, every detached house is different in its particularities requiring its own planning (Risholt and Berker, 2013; Owen and Mitchell, 2015; Hrovatin and Zoric, 2018). Consequently, the project, as well as organizing its components involve search, contracting, monitoring and enforcement costs (Dyer, 1997) that are project-specific TC.

Secondly, knowledge asymmetry between the supply and demand-side actors on this market is high. This asymmetry is further enforced by the default option of house owners to not renovate at all (Wilson and Dowlatabadi, 2007). Many owners lack an understanding of the effect of energy use on the environment (Wilson et al., 2015; Knudsen and Jensen, 2014), while others see renovation not as a need, but as part of a do-it-yourself culture (Gram-Hanssen, 2014; Zundel and Stieß, 2011). Furthermore, owners have insufficient information regarding qualified artisans who can perform more comprehensive renovations, and limited
knowledge or awareness of the benefits, in terms of maintenance costs and improved living environment that a renovated house can offer them (Mahapatra et al., 2013). Supply-side actors on the renovation market contribute to the knowledge asymmetry by using the influence they have on customers – on mostly small localized markets – to promote their own products, often offering sub-optimal energy efficiency solutions (Mahapatra et al., 2013). Moreover, negative experiences from previous renovation projects can lead to mistrust between house owners and artisans (Klöckner and Nayum, 2016), which becomes even greater when services offered are perceived as overpriced (Buser and Carlson, 2017).

Thirdly, as noted by D’Oca et al. (D’Oca et al., 2018), due to the contextual nature of each project, there are often considerable discrepancies between intended and achieved project outcomes. Owners, however, seek to lower their uncertainty by assuming a guarantee that the aggregate energy-efficiency effects of the renovation project are indeed achieved. This being hard for suppliers to ensure, they are incentivized to add to the service cost a margin for potential post-project claims and rework. While potentially masked under production costs, effectively this buffer is a TC also.

With inefficiencies of that magnitude, if an intervention such as OSS can indeed facilitate a significant reduction of TC in this market, ERR adoption is likely to be boosted considerably (North, 1992). Nevertheless, this effect is predicated on the OSS role emerging in the first place, especially if it is to truly serve as the one contractual front with the customers (i.e., the all-inclusive OSS) (Cicmanova et al., 2020).

2.2. Conditions for OSS to emerge

The argument for OSS as put forth by scholars and policymakers is fundamentally an argument on the reduction of TC, achieved by restructuring the relationships of different supply-side actors and of supply and demand. As such, we recognize considerations from TCE as central to analyze how an OSS might emerge. Meanwhile, as featured in organizational economics, TCE goes beyond just categorizing and measuring the transaction costs of an exchange (e.g., procuring a house renovation). The theoretical perspective serves also as a leading explanation to the choice of the most efficient governance form, given a transaction is embedded in a specific economic context (Buser and Carlson, 2017). This means that, if we assume OSS to be present on the supply-side of the market, TCE is likely to have great explanatory power over how one or more organizations structure themselves to produce an OSS model.

The most significant question in this regard is the extent to which an all-inclusive OSS organization (Cicmanova et al., 2020) as a particular risk-bearing legal entity would integrate necessary renovation activities within the boundaries of itself, and to what extent they would contract external market-based actors to perform certain sub-parts of ERR (Williamson, 1989). It would be possible for an OSS entity to choose to individually perform all relevant project activities from planning and execution to monitoring without involving any other actors on the supply side (except in buying materials). We refer to this as the full integration strategy to being an OSS. At the other end of the spectrum, an OSS could, in principle, do nothing else but organize the one customer-oriented contract and procure all other activities from external parties. We refer to this as the full market-based governance strategy to being an OSS. According to TCE, prospective OSS organizations would make a choice about where on this spectrum they wish to be, by considering the internal production and control costs of each activity required by the renovation cycle and whether such costs are below or above the combination of the price of that service/product on the market and the transaction costs associated with acquiring it from other parties (Williamson, 1989). Activities where the aggregate cost is lower internally, they would perform themselves; all others, they would attempt to acquire from the market. Nevertheless, while this template makes it possible to evaluate how an actor would systematize the OSS around their organization, it cannot yet sufficiently predict if or under what conditions an actor is likely to assume the role of OSS in the first place. Two conditions appear necessary for (an) OSS to emerge.

First, assuming OSS as a cost-reduction mechanism (de Groot and Lefever, 2016), it is necessary that the sum of production (PC) and transaction costs (TC) in the OSS model indeed be lower than the respective one in a market without OSS so that prospective customers actually start preferring the OSS over self-organizing. We represented this condition in Fig. 1.

Drawing from TCE, that condition would be brought about if (a) an OSS can reduce TC among the suppliers, ceteris paribus; and/or if (b) an OSS can reduce production costs (PC) among the suppliers, ceteris paribus, by more than the emergence of the OSS role costs for the end customer (in terms of TC and profit margin). For condition (a) in particular, TC is reduced in inter-organizational relationships, for example, if the transacting parties have had (frequent) previous successful transactions (Ring et al., 1989), perceive each other as having a track record in relevant production areas (D’Oca et al., 2018), or grant each other acts of goodwill (Dore, 1983), all leading to increased trust and commitment between the transaction partners (Williamson, 1983). Trust and commitment, conjointly, reduce the likelihood of opportunistic behavior and uncertainty in partner behavior (Kim and Mahoney, 2006). In that sense, and particularly regarding the OSS, their ability to reduce TC depends on having access to a network of trusted collaborators for the greatest possible coverage of the comprehensive list of necessary externally procured activities.

For condition (b), the OSS creates the most cost reduction if it chooses not only the comparatively most advantageous party (i.e., themselves, or another supplier) to supply a relevant product/service into the project, but seeks also to further improve that advantage by enabling additional economies of scale for that component (Stigler, 1958). This means that even if the OSS maintains production capabilities, the economics of the model may be better off sometimes procuring their competitors (Madhok, 2002). Furthermore, condition (b) further implies that OSS as a business model likely becomes more valuable the higher the number of projects it governs and the more standardized these projects are, both being the basis for increased economies of scale.

Second, looking back at the two idealized strategies for being an OSS (i.e., full integration vs. full market-based governance), only in the full integration strategy would the OSS organization rely entirely on the capability to produce without needing to govern other supply-side actors. In all other strategies where the OSS would procure at least some activities from the market, they would have to coordinate and take responsibility toward the end customer over the contributions of other actors on the supply side (Madhok, 2002). This means that to be a successful OSS, unless the organization has an internal cost advantage in all activities of the renovation project, they need to possess some level of exchange governance capability. Furthermore, TCE would argue that the costs of performing OSS governance would need to be lower than within other prospective OSS organizations; otherwise, it would be more advantageous for some other organization to become OSS instead (Madhok, 2002). It is here that resource-based theory provides a complementary analytical lens.

In organization studies, resource-based theory argues that organizations are heterogeneous because they have (access to) heterogeneous resources and capabilities (Barney, 1991). Organizations seek to perform activities as per their available resources and capabilities, or risk being outperformed by other organizations that have an advantage in the respective activity area (Teece et al., 1997). Resources and capabilities especially are developed generally in long, path-dependent learning processes (Winter 1988), which entail carrying out related activities repeatedly (Nonaka and Takeuchi, 1995). Therefore, strategic options of an organization are at any one moment largely limited by the past activities of that organization. One would thus expect that among any set of market participants, the most interested and able to take up the OSS role (i.e., perceive the opportunity as attractive) are those that in doing so can re-use existing resources and capabilities more than their
peers. In this regard, the ability to transact and govern transactions with others should be thought of as a particular capability in itself (Winter 1988) which organizations have to a varied extent depending on whether they have previously performed and knowledgeably routinizing the learning in this area into steady capabilities (Kale et al., 2002).

Overall, organizational economics would, therefore, argue that for any one organization to be willing and able to take up the leadership of the OSS assumes a number of organizational preconditions which together form the first version of our conceptual model on OSS emergence.

3. Methodology

For this research, we adopted the abductive approach, performing what Dubois and Gadde (2002) refer to as ‘systematic combining’ of previous theory and empirical evidence into an evolving framework. We chose this approach because, on the one hand, the relationship of organizational economics and strategy has been thoroughly studied in a wide array of industries, providing us with a well-established literature base for developing a theoretical perspective on OSS emergence. On the other hand, the application of these theories to the context of OSS is new, warranting a more open-ended approach than a standard deductive study would provide. Therefore, we chose to employ the abduction principle of iterating between previous theory and empirical evidence to further develop (as opposed to generating new) theory (Dubois and Gadde, 2002) on the organizational conditions for OSS emergence. Abductive research has previously been employed in similar situations, for example, by Edwardsson et al. (2008), Kjindstrøm et al. (2013) and Storbacka (2011).

3.1. Empirical context

The context of this research is Kronoberg County in Sweden. Sweden, which has been the context of multiple earlier studies on ERR (Thuvander et al., 2011; Brown et al., 2013; Palm and Reindl, 2016; Johansson et al., 2017; Azizi et al., 2019), is argued to be among the markets where OSS would be most relevant for two reasons. First, the market is currently dominated by micro- and small-sized construction companies that typically offer fragmented services in their area of expertise (Mahapatra and Gustavsson, 2013). Second, in Sweden 45% of the housing stock (approximately two million dwellings) is detached houses (Statistics Sweden (SCB), 2019). About 80% of those houses are more than 35 years old and need major renovation to improve their energy performance. The existing building regulations (BBR29) in the country mandate for deep renovated houses to reach the energy consumption level of newly built houses (Boverket, 2020). Furthermore, there is an obligation for energy performance contract (henceforth: EPC) in cases of ownership or tenancy changes in a house. The EPC includes recommended potential energy-efficiency measures appropriate for the specific house, and it is assumed to trigger ERR. Studies by Mahapatra et al. (2019) and Pardalis et al. (2021) in Kronoberg County, and Pardalis et al. (2021) in Sweden overall, have also shown interest from the homeowners’ side to use OSS-like services for the renovation of their whole dwelling, or of specific elements in it. This, in theory, could indicate business potential for supply-side actors to offer such services. Nevertheless, progress in establishing the OSS model has so far been slow in Sweden. In this regard, Sweden is a prototypical case which we believe is well suited as a benchmark to other Nordic countries, and much of Europe in general. Similar market conditions have so far been reported in at least the countries of Belgium, Denmark, Finland, the Netherlands, Norway, and Latvia.

3.2. Data collection

We collected empirical data using semi-structured interviews with market participants (see Annex A). To provide diverse perspectives on the perceptions and behavior of actors concerning the OSS concept, we sampled actors from five distinct classes of market participants: construction-related micro- and small-sized companies (henceforth: MSEs) (marked as CONST(MSE)), medium-sized construction enterprises (marked as CONST), banks (marked as BKNG), municipal authorities (marked as MPTY), and real estate agents (marked as RE). These five classes of informants were selected because each of them has been previously appeared in literature to be involved in house renovation processes (Bjarnoeboe et al., 2017; Boza-Kiss and Bertoldi, 2018; de Groote and Lefever, 2016; Eriksson and Kjeang, 2021; Gram-Hanssen, 2014; Hrovatin and Zoric, 2018; Janda and Killip, 2013; Johansson et al., 2016; Mahapatra et al., 2013; Mlecnik et al., 2019; Pardalis et al., 2020; Sesana and Salvai, 2018). In total, we conducted 45 semi-structured interviews spanning the period of 2017–2019 (see Annex A). Construction-related MSEs are enterprises with less than 40 employees and an annual turnover of up to €10 million and (European Commission, 2018) and form a large part of the construction sector in Sweden (Statistics Sweden (SCB), 2019b). They typically offer fragmented services in their area of expertise, such as plumbing, carpentry and insulation. Construction-related MSEs were sampled randomly from online yellow pages based on their activity descriptions including ‘construction works’ (byggarbeten in Swedish) and ‘renovation works’ (renoveringsarbeten in Swedish). An effort was made so the sample to be as diverse as possible, including actors offering different services related to renovation (see Annex A). The actors included in this category have experience of working as sub-contractors to larger scale projects, but they usually do not coordinate such projects themselves. They are also actors that operate on a local/regional level. Medium-sized construction enterprises has more than 40 employees and an annual turnover of more than €10 million (European Commission, 2018). They usually have previous experience of undertaking and coordinating projects as contractors. Those actors were selected to represent construction organizations with both local and nationwide activities. Real-estate agents are actors who arrange real estate transactions between buyers and sellers of a house and are likely to play an important role in promoting ERR, as part of their profession is to have knowledge regarding the properties of
their clients, including knowledge about the state of the property and its potential renovation needs (Carlsson, 2017). We sampled real-estate agents to include both bigger firms with local branches in the entire country, and smaller family-owned firms. Mortgage loan officers guide future or existing homeowners through the mortgage process with respect to buying or renovating a house. They help their clients to choose the appropriate loan for their case and understand all the rates and terms associated. Mortgage loan officers were sampled in such a way to represent some of the largest banks in Sweden. Finally, energy advisors are entrusted with the responsibility to interact with (and educate) households on energy-related issues. Energy-advising in Swedish municipalities is publicly funded, and constitutes an important policy measure in the country (Eriksson and Kjeang, 2021). We interviewed eight municipal energy advisors from all the eight municipalities of Kronoberg province.

In the abductive approach, the aim is to iterate between insights drawn from existing theory and the empirical context. Therefore, we started the project by surveying organization science literature to distinguish organizational considerations in adopting a new business model. We quickly realized that, depending on the context, such considerations can be grounded in several different theoretical perspectives (e.g. Amit and Zott, 2001). Therefore, instead of potentially priming interviewees to some theoretically driven perspective, we decided to perform data collection in an open-ended fashion (Galletta, 2013) with a focus on interviewees reflecting on their standpoint regarding the OSS concept. In this light, we asked interviewees to explain how their organization relates to the concept and what possible role they assume within an OSS network, provide a perspective on which other parties and how they would be included in the OSS operational model, and articulate strategic considerations around initiating the OSS model. The interviews were performed in a semi-structured fashion where the interviewer followed up on the answers given to the protocol-based questions. All interviews were performed by the lead author of the paper. Where possible, the interviews were recorded for later transcription. Where recording was not allowed, extensive notes were taken during the interviews. All interviews were conducted in person at the workplaces of the interviewees. The interviews lasted, on average, 95 min.

### 3.3. Data analysis

To analyze the data, we developed the first coding scheme based on the theoretical perspectives of transaction cost economics (Madhok, 2002; Dyer, 1997; Williamson, 1989) and resource-based theory (Barney, 1991; Penrose, 1959; Teece et al., 1997) (see Section 2 of this paper), focusing on the categories identified from previous literature. Meanwhile, as per the abductive approach, we were also explicitly searching for arguments in the data that went beyond that initial theoretical framework. The first round of coding entailed the lead author coding the entire database of interviews and both the other authors independently coding a sample of 100 excerpts from the interviews to test the reliability of the first coder. Fully transcribed interviews and interview notes were used as the basis for data analysis. Analysis was performed separately per actor class to distinguish different perspectives of the different market participants.

After the first round of coding, we adjusted the scheme by including newly found additional categories not yet included in the initial theoretical framework. The updated coding scheme was discussed and agreed in a research meeting, leading to a new iteration of coding of the entire database. To perform parallel independent coding and estimate agreement of the coders, we distinguished in the data a total of 207 statements which were independently coded across the entire coding scheme by two co-authors. The entire coding scheme can be seen in Table 1. Across the 18 individual dimensions (across 5 main categories), we achieved an average Cohen’s Kappa of 0.54, which is near the upper bound of a ‘moderate’ agreement (Landis and Koch, 1977). More

| Category                           | Dimension                        | Empirical indicators                                                                 |
|-----------------------------------|----------------------------------|--------------------------------------------------------------------------------------|
| Access to trusted partners        | Previous collaborations in       | Working together in previous projects (municipal or private)                         |
|                                   | accomplishing projects           | Working together with local actors                                                   |
| Appreciation of the               | Appreciation of the              | Rumors of good work/skill of others                                                   |
|                                   | craftsmanship of others          | Showing mutual respect                                                                |
| Acts of goodwill                  | Acts of goodwill                 | Client referrals to one another                                                       |
|                                   |                                  | Reciprocal provision of favors to one another                                          |
| Dedicated network-building        | Dedicated network-building       | Presenting at/organizing industry events                                              |
|                                   | activities                       | Networking as firm strategy                                                          |
|                                   |                                  | Researching the background of other supply actors                                     |
| Sharing similar                   | Sharing similar philosophy/vision| Speaking the same ‘language’                                                          |
|                                   |                                  | and/or vision                                                                        |
| Creating economies of scale       | Local market limitations         | (High) opportunity costs to ERR activities in the region                             |
|                                   |                                  | (Lack of) willingness to pay by customers in the region                               |
|                                   |                                  | Losing face with customers for proposing expensive services                           |
|                                   |                                  | (Lack of) suitable local partners                                                     |
|                                   |                                  | (Delays in) customer acceptance                                                      |
| Local market opportunities        | Local market opportunities       | Involving owners’ associations to increase scale                                       |
|                                   |                                  | Local support schemes to boost demand                                                 |
|                                   |                                  | Numbers of similar dwellings in the region                                            |
|                                   |                                  | Increased role of municipalities in supporting OSS emergence                           |
| Multi-locality                    | Multi-locality                   | Ambition/opportunity to scale beyond local context                                    |
| Exchange governance               | Own capabilities for governing    | Availability of resources/capabilities to govern others                               |
| capabilities                       | others                           | Availability of structures and legal entities to govern others                        |
|                                   |                                  | Fit with overall profile of the organization                                          |
| Experience in governing others    | Experience in governing others   | References to previous instances of governance performed by the organization and to the profile of those governed over |
|                                   |                                  | References to previous instances of customer contract governance and the complexity of those projects |
| Opportunities for                 | Opportunities for standardized    | References to innovative approaches (technology) that enables standardizing renovation offerings |
| standardizing the offering        | the offering                     | Willingness to guarantee the quality of others’ work                                  |
| Fears and anxieties               | Fears and anxieties concerning   | Conflicts arising from supply-side actors not aligning with each other                 |
| concerns during transactions      | transactions                     | Delays caused by coordination challenges                                               |
| costs and governing of others     | costs and governing of others    | Costs associated with ensuring profitability for all                                  |
|                                   |                                  | References to margin (expectations) and/or profitability of serving the OSS role     |

(continued on next page)
specifically, seven of the dimensions resulted in ‘substantial’ (0.6–0.8), eight in ‘moderate’ (0.4–0.6), two in ‘fair’ (0.2–0.4) and one in ‘slight’ (0.0–0.2) agreement. A series of meetings were then held to align the coding between the raters.

3.4. Data synthesis

Based on the agreed-upon coding of all statements in the 18 dimensions, we proceeded to synthesize the codes into narratives that each explain the standpoint of an actor class as per category (Table 1).

4. Findings

The research identifies five categories of organizational conditions for OSS to emerge. These are access to trusted partners, ability to create local economies of scale, transaction capabilities, production capabilities, and perceived attractiveness of OSS opportunity, which apply to all the examined supply-side actors and allow us to examine the suitability of each actor to become the OSS provider, as well as identify the underlying reasons that lead those actors in the decision to adopt OSS at sufficient scale. Additionally, we draw information on potential other actors that could lead the OSS concept.

The findings are discussed first as per each examined actor. Each narrative in this section is supported by a respective synthesis table in Annex B that includes a selection of quotations supporting each narrative.

### 4.1. Mortgage loan officers (banks)

Based on our research, banks appear to have the clearest picture regarding their role in the OSS concept. Despite perceiving OSS as an attractive opportunity overall, such a concept is not related to their area of operations. Furthermore, they report on a lack of supply-side network, as well as governance and production capabilities in the renovation sector. Therefore, becoming an OSS coordinator is not seen as the appropriate coordinator since it is perceived to have both the competence and the trust of local communities and businesses. Both are required conditions for the successful development of OSS. That overall position of banks appears well articulated by the following quotation:

“... Even with the loans existing in the market, such a concept could have great potential if all the players were willing to dedicate time and resources for this scope. Municipalities or the Energy Agency, in collaboration with homeowners’ associations, could provide free-of-charge energy auditing of the properties and post-renovation quality control. That would minimize to some extent the total cost for such a comprehensive renovation and the results from this auditing would be difficult to be challenged by the other actors involved.”

### 4.2. Medium-sized construction companies

In principle, the OSS concept appears attractive to most of the interviewed medium-sized construction companies who see it as a possible opportunity for future growth. They are, in fact, active in broadening their network of collaborations, with the purpose to offer customers more integrated services and achieve better economies of scale in their activities. Furthermore, as far as exchange governance capabilities are concerned, medium-sized construction companies report having some experience in coordinating external parties in renovation projects before.

Nevertheless, several aspects of the assumed OSS model are perceived as potentially problematic. First, medium-sized construction companies recognize that participation in OSS might entail cooperating with partners they have no previous experience of working with or that do not belong to their network of trust. That creates concerns regarding how the relationship network will evolve if OSS is to be adapted alongside other business activities. One of the interviewees referred to this issue as follows:

“... working in such a concept means that we potentially have to break business relationships with partners we have worked with for long. That affects our network and creates implications in the rest of our operations.”

Another common concern of the examined medium-sized construction companies is related to quality and budgeting risks that a renovation under an OSS entails. To succeed as an OSS, the companies see a need to address the risks related to renovation work, budget, and timing, which would require a comprehensive contract among the supply-side parties. With the coordinator ultimately responsible to the customers, to ensure that the OSS is covered for any risk, the medium-sized constructors propose that the coordinating party charges the customer with an additional risk mitigation margin on the final price (ranging from 5% to 15% of the total renovation cost). The interviewed companies in this group recognized, though, that this might be problematic considering the high uncertainty associated with finding enough customers for a comprehensive renovation when the cost is high. Finally, in different ways, that group of actors expressed their concerns on the implications of “not speaking the same language” between collaborating parties, so their integration to a coherent project is seen as a major task.

Overall, the interviewed medium-sized construction companies remained hesitant to act towards initiating an OSS, even if they have several of the traits qualifying them as actors fitting for the role of the OSS coordinator. For that role they assume other actors to be more appropriate to take the lead. In their thinking, municipalities and homeowners’ associations should have a leading role (at least in the beginning of the concept) in a collaborative scheme that will include newly graduated engineers and architects and experienced consultants
with backgrounds in the construction industry. For consultants, three of the examined medium-sized construction companies expressed the opinion that they could act independently as OSS coordinators. In that sense, the move toward an OSS is seen as a gradual process with public involvement in the first stages.

4.3. Construction MSEs

The interviewed construction MSEs perceived the OSS concept as overall attractive, but rather than bringing it on the market they see themselves predominantly participating as suppliers to some other OSS. Five main reasons for this standpoint are noted, each by at least two different construction companies. First, an OSS needs supply-side parties to significantly change their attitude and ways of working, posed as an argument by construction MSEs working with installations of HVAC and PV systems, as well, as architects. Second, the concept is seen as too costly for most homeowners, so the market is limited, and one risks losing face with customers by offering the service at actually necessary price levels. This argument was expressed by almost all the interviewed construction MSEs. The companies claimed that their customers prefer individual services to integrated renovation as in most of the cases their savings cannot cover the cost of more extended renovations. On the other hand, they claimed that lowering the price for specific services when becoming part of an integrated renovation offer under an OSS concept will raise questions on whether or not the service delivered will be of sufficient quality (and, thus, gain the trust of customers).

Third, there are presently more attractive opportunities for craftsmen in the new-build market. This argument was especially popular among the smaller in size (below 20 employees) companies. According to them, the new construction market is still ensuring a turnover which, in combination with the smaller independent projects they undertake, allows their businesses to be viable in the market. Fourth, to become successful, the concept needs to start at scale so one needs to make significant upfront investments. The argument of scale was common among all the interviewed construction MSEs. In that sense, an increased volume of renovation projects is seen as a possible alternative to employment in new construction, but the scale is expected to be developed by other parties. A larger volume of projects is seen also as beneficial for local economies, as it could lead to a boost in employment and skills upgrade in the market. For now, however, covering the needs for personnel and training that operating in renovations at scale is seen as too risky. In this, the companies quote a need for significant support by the state. Fifth, although the interviewed construction MSEs are confident that any missing production capabilities can be procured from well-established local networks, the need to coordinate and take responsibility for the work of other suppliers is not seen as feasible. With minor exceptions (e.g., architects), those companies have zero experience of coordinating integrated projects, which involve collaboration between different professionals. That creates insecurities about the quality of the work that would be delivered to the customer. Moreover, the issue of varied working cultures among different professionals was noted, which, according to the interviewed companies, creates risks on the equal engagement of all involved professionals to an ERR project. Finally, although all the interviewed construction MSEs expressed the opinion that there is no lack of technical skills in the market, the MSEs did not wish to guarantee the quality of work of other professionals. This would inevitably lead to increases in the price of ERR services, which would be undesirable.

The MSE construction companies did assume that there are specific segments in the market that may become interested in an OSS service, especially if the outcome significantly increases the value of their property. Providing a clear return on investment is an important metric in outlining and negotiating with that segment. Still, for performing the marketing and coordination, micro- and small-sized construction companies assume that other types of parties are better positioned, these including established (larger) construction companies, energy agency and energy utilities, municipalities, and independent consultants. Additionally, expectations for a legislative push of the OSS concept was frequently mentioned.

4.4. Real-estate agents

The results from the interviews with the real-estate agents showed an agreement regarding the OSS concept in general. The concept was perceived as attractive, with potential to differentiate buildings and improve the state of the building stock. The majority of them (six out of eight), emphasized the strong influence of local conditions (e.g., climate and property value) for the attractiveness of the concept to building owners, and consider this factor as a potential cause of differences in OSS interest between regions of the country. As such, that group of real-estate agents saw it important for the state to take a leading role in developing a national strategy for energy efficiency. A representative quote, given by one of those real-estate agents, reads:

“… The first step has already been made when they introduced mandatory energy certificates for houses on sale. Investments in energy efficiency should rise, but we must keep in mind the great differences in climate and property value in Sweden. If you look at certain markets, like for example in the north of the country, investing 1.5 million SEK to renovate a house is impossible to give your money back. We need as country to formulate a strategy that will provide answers to those challenges, and OSS could be a part of that strategy.”

According to all the interviewed real-estate agents, both themselves and the firms they represent are engaged in dedicated networking activities, turning attention foremost to good collaborations with financial institutions and energy advisors. They have also commented that both these actors are likely necessary collaborators in making OSS possible. However, though all real-estate firms are familiar with individual artisans and construction companies in their region, their network is still limited to frequent collaborators on small-scale projects. Such projects include renovations that aim to short-term improve the value of a property (i.e., kitchen, bathroom, etc.). This is also the category of projects they have experience in managing (though they do not always have a managing role in such projects). All the interviewed real-estate agents admitted they lack deeper knowledge and understanding of the technical parameters of construction work and construction processes. That weakness made them consider their role within an OSS organization as supporting rather than leading. Additionally, those real-estate agents working in firms with nationwide presence claimed that even if their local branch could see a business opportunity in developing an OSS it would be impossible for them to initiate one as they are bounded by the overall strategy of the mother company. Therefore, the adoption of new business models such as OSS is reported to require an overall change in corporate strategy.

Regarding which actor could have the role of the coordinator in an OSS, the opinion that government agencies related to the construction and energy sector should take the lead, was common to all the interviewed real-estate agents. Alternatively, independent consultants (for two of the interviewed real-estate agents) or well-established construction companies (for six of the interviewed real-estate agents) could have the role of the OSS coordinator. Those actors were proposed by real-estate agents, as they were assumed to have deep knowledge of construction work and processes, and the network of suppliers and construction companies to deliver the tasks related to an ERR project.

4.5. Municipal energy advisors

Interviews with the energy advisors of the Municipalities of Kronoberg province revealed that municipalities themselves have a low inclination to perform commercial integration on the supply side. This is the result of several reasons. According to the examined municipal
energy advisors, the current demand for ERR in detached houses appears to be limited. Moreover, all the interviewed energy advisors reported that municipalities, despite their size, have a lack of resources to dedicate to the coordination of renovation projects, alongside legal limitations to doing so on a commercial basis. All the interviewed energy advisors pointed out that for municipalities a coordinating role in an OSS exposes them to the risk of being accused of intervening in the market and promoting unfair competition.

Nevertheless, and according to the interviewed energy advisors, municipalities maintain ties with diverse local actors, including homeowners’ associations, local energy agency branches and energy utilities. Furthermore, the topic of building energy efficiency is already found at the core of their sustainability agenda and advice related to energy efficiency is also offered to their citizens. Additionally, despite not engaging in deliberate network building activities, municipalities know local construction companies that have earlier provided services to municipal projects. As such, municipal energy advisors expressed the conviction that municipalities would not mind being involved in a supportive role to OSS, without taking the lead.

Regarding which actors could become OSS coordinators, the energy advisors expressed diverse opinions. Two of the interviewees argued that homeowners’ associations should take that role as they are able to easily reach potential beneficiaries to integrated renovation services (i.e., the detached houses owners). Such associations were perceived as having the lobbying power (e.g., via the National Board of Housing, Building and Planning) to push for incentives to those homeowners willing to perform ERR. For the rest of the interviewed municipal energy advisors the criteria for the coordinator of a potential OSS were connected to the competencies required to successfully coordinate such a concept. In this regard, experienced consultants from the building sector and professionals with legal and technical knowledge of the construction industry were perceived as most viable candidates. According to this group of interviewees, these actors can consider the OSS a concept that will provide them with enough business opportunities to commit to its development.

5. A framework for the conditions of OSS uptake

Fig. 2 represents the framework of organizational conditions that encourage supply-side renovation market participants to uptake OSS governance for ERR in detached houses and to run it successfully. The framework serves to integrate the conditions informed by TCE and resource-based theory with the empirical results of this study.

In Fig. 2, each arrow represents an identified causal influence of one organizational condition over another, while the ‘+’ or ‘-’ signs indicate the direction of each influence as positive or negative. As such, one could read, for example, that having (in-house) ‘production resources/capabilities’ positively influences the ability of the supplier to understand diverse renovation activities. That, in hand, positively influences that supplier’s ‘exchange governance resources/capabilities’ with other suppliers on renovation activities. The higher the exchange governance capability of a supplier, the more economically they can convince other suppliers because their governance would lead to lowered transaction costs in exchanges between suppliers (e.g., because they can estimate better when a quotation overestimates the cost of work), and so forth. Overall, as indicated earlier in Fig. 1, all conditions where the organizational structure reduces either production costs or transaction costs on the supply side improve the competitiveness of the OSS model (i.e., the right side of Fig. 2) over performing ERR activities without OSS involvement (i.e., the left side of Fig. 2).

However, in the empirical setting that we studied using a sample of five classes of renovation market actors in Sweden, we found that presently none of these actor classes appear likely to take up governance of an OSS model. In this regard, each of them reported significant deficiencies in the conditions outlined in Fig. 2. Micro- and small-sized construction companies possess specialized production capabilities but lack capabilities and resources in performing formal exchange governance. Consequently, they see themselves as participating in the OSS concept as a supplier, but not as the coordinator. Medium-sized construction companies can, in principle, see themselves as the OSS coordinator and report having both the resources and the exchange governance capabilities for the successful delivery of the concept. However, for them, the main argument against OSS appeared to lie in the limitations of their network of partners. In the OSS concept, the assumed necessity to collaborate with (unknown) partners significantly weakens their perceived capability to govern the whole concept and creates additional fears and anxieties on the implications that the collaborations with such partners will bring. This is particularly linked to regulating the warranty and rework risk which OSS is expected to bear at the end customer interface. Furthermore, it was questioned if the margin necessary to reduce that risk would not diminish the number of potential customers and result in companies losing face with their market.

Meanwhile, municipality energy advisory services have traits that would boost their involvement in OSS. Particularly, they can drive economies of scale on the local level by connecting a broad network of supply-side collaborators with systemic actors on the demand side (e.g., owners’ associations). However, concerning OSS, they reduce their perspective to a supporting role at most, mentioning the legal restrictions to participating in market transactions, lack of immediate resources to dedicate to developing the concept, and the unwillingness to carry the actual transactional risk on behalf of commercial actors.

Real-estate agents is another actor class that superficially might have the potential to become the initiator of an OSS. Though seeing the concept as attractive overall and reporting managerial capacity for coordination, their standpoint not to proceed in the development of an OSS derives from a lack of strategic interest at the corporate level, and a lack of deeper knowledge regarding the technical parameters of the renovation process. This is seen as a significant shortcoming to efficiently governing other supply-side actors.

Finally, banks opt out from becoming the OSS provider because of a perceived lack of supply-side network, governance, and production capabilities in the renovation sector. Banks saw their future relationship with the OSS concept as close to their current core business: in providing financial services.

Therefore, in our empirical investigation, we encountered a significant resource and competence gap leading currently to excessive production and/or transaction costs and, consequently, the non-emergence of OSS in that context. This leads us to argue that a useful way to think about the supply-side of OSS is that, for the model to emerge and scale in any one local context, a kind of a critical threshold of favorable supply-side organizational conditions needs to be achieved.

6. Conclusions and policy implications

Our paper contrasts from earlier works around the OSS concept by turning explicit attention to the supply side of OSS by examining organizations (not) becoming the OSS as a strategic choice driven by certain organizational conditions. As seen in Fig. 2, we have outlined a total of 15 such conditions, thus responding to our first research question.

Furthermore, while previous research, when computing the TCs that are visible from the end customer perspective, has estimated TC to constitute perhaps as much as 20% of the total cost of renovation (Kiss, 2016; Urge-Vorsatz et al., 2012), our investigation into the supply-side economics of OSS would indicate that this proportion is probably significantly higher. Following Fig. 2 in this paper, in fact any deficiencies in the organizational conditions on the supply side are related to increased TC, except they become hidden into the exchanges on the supply-side as part of at least two cost components: a) margins added by actors in the value chain to mitigate the quality/coordination risk of other suppliers’ work; and b) previous network ties causing imperfect competition in the cost-efficiency of sub-sections of work. It was beyond
Fig. 2. Framework for estimating the attractiveness of becoming the OSS for an actor.
the scope of this research to quantify these elements for a truer estimate of total TC in renovation projects, but we see it as a critical task for future research.

In this regard, we posit that tackling the hidden TC on the supply side may be at least as important to the future of the OSS concept on the European energy landscape as the interventions previously suggested for reducing TC on the demand side of the market (e.g., educating the public, or procuring at scale via owners’ associations) (Kiss, 2016). Furthermore, we see also a qualitative difference in OSS support by compensating for high TC (i.e., subsidizing to overcome the prohibitive nature of some TC) and in intervening with the goal to (permanently) reduce TC, so that the model would become sustainable even if public support is later tapered. Therefore, in responding to our second research question, in Table 2 we outline the organizational conditions to focus on, and the possible policy implications to improving these organizational conditions toward higher readiness of market participants in taking up governance of OSS models. The proposed policy interventions have been composed with capacity development and TC reduction (as opposed to TC compensation) in scope, combined from the arguments from TCE, resource-based theory, and the informants of our research.

Our framework (Fig. 2) also makes it possible to hypothesize about potential other candidates for taking up the governance of an OSS and the (inter-)organizational structures that would have to emerge in providing the service. Following our framework, the most likely OSS would be an actor that has either a widespread portfolio of internal production capabilities (therefore needing little external governance) or the combination of a) an extensive background and underlying capabilities to coordinate other parties in executing various types of renovation work down to technical detail, b) a trusted network of partners with production capabilities across the categories of renovation work, c) an ability to drive local economies of scale, and d) strategic interest to commit to OSS as a path of growth for the actor. Based on these criteria two actor profiles surface as potential OSS adopters. With a profile of (almost) entirely internalizing the renovation work necessary in holistic renovation would be large construction companies. So far, however, these companies have shown little interest in small-scale residential renovations as the associated production and transaction costs are higher compared to those of constructing new buildings or renovating multi-family residential buildings (Buser and Carlsson, 2017; Ekström, 2017). With a combined profile of criteria a) — d), there is potential for either energy efficiency or engineering consultants to adopt the OSS, perhaps as a spin-off from their current business. Their perspective on the matter remains for future research to investigate, but based on our framework, if they were to become the OSS, we expect these actors to rely on the strategy of an almost complete market-based governance with limited in-house production activities (with the likely exceptions of initial inspection and composition of renovation plan), because that structure would fit best their current resource and competence profile.

This research serves also as a contribution to the increasingly popular literature on business model innovation in the construction industry. Unlike previous research which has focused on the functional logic of novel business models (Mahapatra et al., 2013; Thiuvander et al., 2011), our research joins Mlecnik et al. (2019) in emphasizing the organizational conditions that hinder or support the adoption of new business models. In particular, we have made a link between superficial business model features (e.g., resources, partnerships, and revenue model) as they would be described according to component-based business model frameworks (e.g. Mkhlesian and Holmén, 2012), and their underlying organizational economics as explained by the combination of TCE and resource-based theory. In that sense, we believe that grounding our framework on OSS adoption conditions in prominent base theory in organization studies increases its explanatory power and the possibility for generalizing the framework beyond the investigated sample of organizations and their context.

Meanwhile, based on the limitations of our own study we invite further research. First, we draw inference from TCE and resource-based theory and empirical findings from a single country context. The framework needs validation in additional empirical contexts with different legislative and market characteristics to explore how our results might generalize regarding the emergence of OSS and the willingness of various actors to lead and contribute to an OSS. A related future research avenue might be to translate our framework into a systematic analysis tool for the active testing of various support interventions to reach the critical threshold of supply-side conditions for an OSS model to emerge and scale (Walrave and Raven, 2016). Such a model could then be applied across local contexts as a

| Table 2 | Policy implications for supporting OSS-encouraging organizational conditions. |
|---------|--------------------------------------------------------------------------------|
| OSS-encouraging organizational conditions | Policy implications |
| Increasing (diversified) production capabilities of suppliers | Enabling innovation funding for new production capability development (e.g., partial staff reimbursement in SME innovation subsidizing) |
| Increasing exchange governance resources/capabilities of suppliers | Encouraging and funding knowledge-exchange between universities and the construction industry (e.g., by new service development grants) |
| Increasing the detailed understanding of renovation activities previously outside the scope of the supplier | Encouraging (e.g., co-funding a university) the development and provision of supply-side training on governance capability topics such as project management, new energy standards, quality control, and the use of BIM in offering scheduled stepwise ERR. |
| Reducing fears and anxieties regarding governing other suppliers | Enabling innovation funding for governance capability development (e.g., partial staff reimbursement for project management) |
| Increasing potential of local economies of scale | Establishing regional renovation programs supported by public grants, potentially focused on a certain impactful intervention (e.g., roof insulation). |
| Increasing number of homeowners attracted to OSS | Disseminating invitations for ERR (with OSS) via owners’ associations and local information events (see also Berry et al., 2014; Tjjerger and Gausset, 2019; Kwon and Mlecnik, 2021; Meijer et al., 2018). |
| Developing local networks (including alignment of business philosophies, demonstrating peer track records, and goodwill) | Creating an open access building stock database of an area to assist suppliers in segmenting the market. |
| Introducing the attractiveness of OSS as an opportunity for suppliers | Offering initial renovation audit at a reduced cost (free), potentially via municipality energy advisory services (Eriksson and Kjeang, 2021) |
| Developing suppliers’ experiences in exchange governance (including inducing more exchanges between supply-side actors) | Establishing/supporting intermediaries who facilitate boundary processes, such as collective business model development sessions (Mlecnik et al., 2019), pilot visitations to other geographies and local knowledge exchange. Furthermore, dedicated intermediary organizations could dynamically respond to any particular market failures (Kivimaa, 2014); and, in some cases, even temporarily take up the operationalization of a novel business model (e.g., OSS) only to divest from it once the business becomes sustainable (Talmar et al., 2019). |
| Encouraging forward-looking mindset and leadership in suppliers | Assuming diverse consortia when publicly procuring renovation activities. |
| Disseminating invitations for ERR (with OSS) via owners’ associations and local information events (see also Berry et al., 2014; Tjjerger and Gausset, 2019; Kwon and Mlecnik, 2021; Meijer et al., 2018). | Encouraging the use of digital support tools in ERR management. |
| Disseminating trade associations and third-party materials on technological (e.g., implementation of BIM) and market trends (e.g., new business model compositions) to local renovation market actors. | Disseminating trade associations and third-party materials on technological (e.g., implementation of BIM) and market trends (e.g., new business model compositions) to local renovation market actors. |
policy-development instrument. Second, our study analyzed five actor classes in adopting the OSS coordinator role. Meanwhile, based on our empirical results, we hypothesized two other potential actor classes as candidates for taking up the governance of OSS. In this regard, additional research is recommended, taking into consideration also how national legislation differences influence the (active) involvement of governmental authorities in OSS provision. Third, our study focused on OSS emergence in the context of ERR in detached houses. Prior research has identified various types of OSS-based business models depending on the roles and responsibilities of OSS and the type of customers it serves (Cicmanova et al., 2020; Laffont-Eloire et al., 2020) A potential line of inquiry thus concerns the implications of the TCE and resource-based theory framework for differences between OSS models to different market segments. Fourth, by building this research on TCE and resource-based theory, we have implicitly taken a rationalist perspective on organizational decision making. This assumption, while dominant in organization studies, can be complemented by focusing on organizational behavior as led by boundedly rational (Brunsson, 1982) or potentially irrational (Simon, 1972) decision mechanisms. These alternative perspectives likely have explanatory power over some elements of organizational behavior, thus leading to a yet more complete understanding of the supply-side of ERR and OSS once combined with the results of this paper.

Overall, we argue in this paper, that much of the impact potential of OSS is likely to be unleashed once supply-side TC become well understood first, and then structurally reduced in as many organizational pre-condition categories (to OSS) as possible. In this paper, we have taken steps in exploring these condition categories and respective policy interventions. Nevertheless, more work remains in detailing out these combinations and, especially, in testing the effect of policy interventions on the reduction of inefficiencies on the supply-side of the market.

CRediT authorship contribution statement

Georgios Pardalis: Conceptualization, Methodology, Validation, Investigation, Project administration, Funding acquisition, Writing – original draft, Writing – review & editing, Formal analysis. Madis Talmar: Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Formal analysis. Duygu Keskin: Conceptualization, Writing – review & editing, Formal analysis.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

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Appendix A. Supplementary data

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