
Communication Challenges in Building Energy Efficiency Retrofits: Croatia Case

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Abstract

As climate change has become a growing concern, sustainable development has become increasingly important. Emissions reduction is a key step for more efficient energy use. The European Parliament implemented the Energy Efficiency Directive (2012/27/EU), which establishes a set of binding measures to help the EU reach its 20% energy efficiency target by 2020. The building sector is the largest energy consumer in the EU; the new policies implement rules on the energy performance of buildings. In the last few years, the residential building sector in Croatia has received financial support for multi-dwelling building energy efficiency retrofits. However, some of these projects encountered difficulties due to information asymmetry between the key participants. This study addresses the problem from the perspective of the principal–agent theory, which is concerned with information asymmetry and its repercussions. A social network analysis is conducted to reflect the operation and management details of Croatian multi-dwelling buildings. The key stakeholders of energy efficiency retrofits are mapped, along with the contractual and communication ties between them. The analysis stresses the importance of the key relationship between owner representatives and property managers. Trust between them encourages communication and cooperation during project development. This study demonstrates that close cooperation between all stakeholders is essential for satisfactory project completion.

Keywords:

Communication, Croatia, Energy efficiency retrofits, Multi-dwelling buildings, Principal–agent theory, Social network analysis

1 Introduction

Energy consumption in the EU-27 reached 990 million tons of oil equivalent (Mtoe) in 2019 (European Environment Agency 2020). Large energy demand continues at a time of increasing global concern over carbon emissions and resulting global climate change (Amasyal and El-Gohary 2016). The European Parliament implemented the Energy Efficiency Directive (2012/27/EU), which established a set of binding measures to help the EU reach its 20% energy efficiency target by 2020 (European Commission 2020). Overall EU energy consumption should be no more than 1.483 Mtoe of primary energy or 1086 Mtoe of final energy. In 2018, an amended Directive on Energy Efficiency (2018/2002) updated the policy framework to 2030 and beyond. Taking account the withdrawal of the UK, the 2030 target for EU-27 is 846 Mtoe of final energy. One of the aims of the directive is to implement national long-term renovation strategies for the building stock in each EU

country. However, the newest data from the European Environment Agency (2020) warn that achieving the 2020 targets is increasingly uncertain, and that “substantial changes in the energy system will be necessary to achieve the EU’s energy objectives and climate neutrality by 2050”.

As the largest single energy consumer in the EU (European Commission 2020), buildings are responsible for 40% of energy consumption in the EU, and one-third of global energy consumption (Meijer *et al.* 2009). The residential sector is the second largest consumer in the EU, with 26% of final energy consumption after transport (Eurostat, 2021). The European Commission (2020) emphasises the importance of the building sector in achieving EU energy and environmental goals. The Commission has introduced a renovation wave for public and private buildings as part of the European Green Deal aiming to “take further action and create the necessary conditions to scale up renovations and reap the significant saving potential of the building sector” (European Commission 2020).

Accordingly, many European countries have enacted policy measures to achieve these goals. Energy efficiency retrofits (EERs) have become more common, but some research indicates that they are lagging behind expectations (Feser and Runst 2016). Amasyal and El-Gohary (2016) showed that a considerable number of building occupants are unsatisfied with the resulting energy efficiency, indicating that their health and/or personal productivity are negatively affected by the indoor environmental conditions after retrofit. Researchers have been investigating failures in EER projects, indicating agency problems (Liang *et al.* 2019), information asymmetry (Feser and Runst 2016; Högberg 2014) and opportunistic behaviour (Qingmiao *et al.* 2009) as the main reasons, which are all related to the principal–agent theory and communication problems between participants.

In economics, principal–agent theory describes the relationship between two or more parties; one party, designated as the principal, engages another party, designated as the agent, to perform a task on their behalf (Moe 1984; Jensen and Meckling 1976; Ross 1973). According to Moe (1984), there are information asymmetries and goal conflicts in the agency relationship. Information asymmetry considers that an agent possesses more or better information regarding the details of individual tasks assigned to him, his own actions, abilities, and preferences (see Akerlof 1970). Goal conflicts refer to conditions in which the desires and interests of the principal and the agent are in conflict with each other (Kivisto 2008). Information asymmetry and goal conflicts lead to opportunistic behaviours by participants and increasing agency costs (Kivisto 2008).

These issues come especially into focus for multi-dwelling residential buildings, which contain multiple separate housing units, each with its own owner. Retrofitting requires considerable investment, which is often not possible for homeowners, and collective decision-making among numerous stakeholders, often with diverse social and economic status (Dimitrova *et al.* 2019).

This study addresses the implementation of EER projects in Croatia, one of the EU-27 countries. The specific legislative, technical, and social aspects of the operation and management (O&M) of multi-dwelling residential buildings in Croatia are explained. A social network analysis (SNA) is conducted to map the key stakeholders. Contracts and communication ties between them are analysed, and the repercussions of principal–agent theory are discussed. The paper closes with framework focused on future research directions.

2 Energy efficiency retrofits in Croatia

Croatia entered the EU in 2013, and had to adapt its policy measures according to the EU Energy Efficiency Directive (2012/27/EU). The main actor in defining and implementing the new policy measures is the Ministry of Construction and Physical Planning (MCP) (2020). Another important actor is the Environmental Protection and Energy Efficiency Fund (EPEEF). The EPEEF is the central point for collecting and investing budgetary resources in environmental and nature protection programmes and projects, energy efficiency, and renewable energy sources. “In the system of management and control of utilisation of EU structural instruments in Croatia, the EPEEF performs the function of Intermediate Body level 2, for the specific objectives in the field of environmental protection and sustainability of resources, climate change, energy efficiency and renewable energy sources” (Environmental Protection and Energy Efficiency Fund 2020). Since 2014, the MCP and EPEEF have jointly managed the co-financing of EERs in Croatia, both from the state and the EU. More than 3400 multi-dwelling residential buildings in Croatia have received more than 295 million euros in incentives during the last six years (Kriz Selendic 2020)

In Croatia, the O&M of multi-dwelling residential buildings is defined by the Ownership and Other Proprietary Rights Act – OOPRA (2014). According to OOPRA, owners entrust the O&M of their building to the property manager (PM). OOPRA includes the principles of legal unity of real estate and the linking of specific parts of a building. This means that each family and business unit (dwelling) has its own owner, and all owners are together responsible for the maintenance of common areas (such as staircases, the façade, etc.). Thus, building maintenance is subject to the collective decision-making of the owners. To make this possible, owners must authorize an owner representative (OR) to represent them and protect their interests in O&M. A PM is a person or legal entity entrusted by the owners with the management of their building. The PM is obliged to protect the interests of all owners as much as possible, and must follow their instructions in O&M. His primary duty is ensuring that common areas and appliances in the building are properly maintained for normal use (Ownership and Other Proprietary Rights Act 2014). PMs are also responsible for EERs in Croatia (Nahod and Ceric 2015).

To receive state and EU incentives, more than 50% of the owners must agree to enter the process. The PM becomes a holder of their claim and represents them in front of the other actors during project implementation. For EER, designers are included in the project from the start. They are responsible for achieving the necessary energy savings after the retrofit. If the design is selected for co-financing, the PM picks the contractor responsible for executing the retrofit. For EERs in Croatia, the PM participates as a central figure in the communication and transfer of information between owners (clients), contractors, designers, and public bodies.

3 Methodology

A multitude of stakeholders and contracts signed between them provide fertile ground for agency problems. There are two key issues in agency problem, split incentive and asymmetric information (Liang *et al.* 2019). In the Croatian market, there are several principal–agent relationships to consider. To map the EER stakeholders and highlight the key relationships, a social network analysis (SNA) is conducted for EER projects in this study.

SNA is “a methodology used to identify the conditions of social structures by analysing the interactions and interrelationships of a set of actors” (Park *et al.* 2011, p. 345). It is commonly used

in different fields to “understand a community by mapping the relationships that connect them as a network, and then trying to draw out key individuals, groups within the network (‘components’), and/or associations between the individuals” (Home Office 2016, p. 3). SNA has been validated in other construction project research (for example, Park *et al.* 2011) and collaborative efforts research (Korba *et al.* 2006). Thus, SNA is appropriate for achieving the research objectives:

1. Map the groups in EERs.
2. Map the key individuals in EERs.

Gephi software is used in this research to conduct the SNA. Gephi is an open source software for graph and network analysis that uses a 3-D render engine to display networks in real-time and to accelerate statistical analysis (Bastian *et al.* 2009). In SNA, relationship data are visually represented and statistically evaluated following the steps shown in Figure 1. First, a visual representation is produced. All stakeholders are represented as nodes, and interactions between them are shown as ties (or edges). In this case, the only interactions are contractual and formal communication channels. The network is undirected because directional relationships (for example, messages) between actors were not considered. Network visualisation enables mapping of the stakeholder groups for EERs in Croatia.

A statistical analysis enables mapping of the key individuals. In this step, some of the network properties are calculated:

1. Degree - the number of nodes connected to a particular node (De Nooy *et al.* 2005). A node with a higher degree plays a more decisive role in information transaction (Park *et al.* 2011).
2. Centrality - a rough indicator describing the social power and influence of a node based on how well-connected the node is in the network (Park *et al.* 2011).

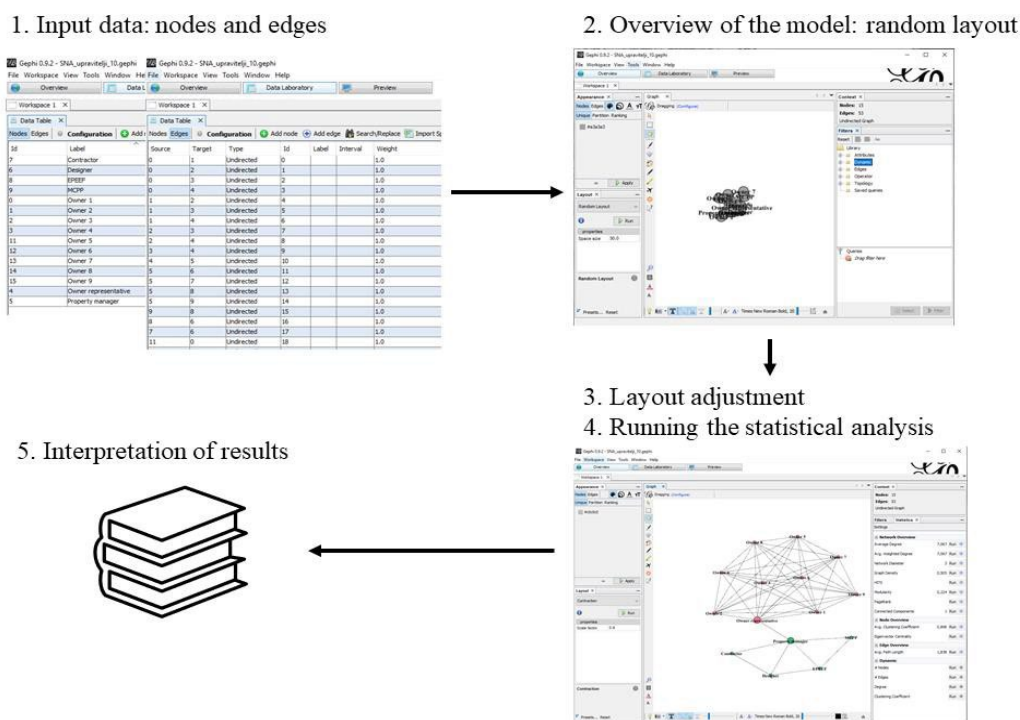


Figure 1. Conducting SNA in Gephi

The evaluated centrality types include betweenness centrality and closeness centrality (Freeman 1979). Betweenness centrality signifies the extent to which a node lies between other pairs of nodes. Closeness centrality indicates the ability to access information through other nodes.

Different scenarios were considered during the analysis to enable comparison of results regarding key individuals in a network. The scenarios included different network densities by varying the number of owners. The results are shown for two selected scenarios:

S1: EER in a multi-dwelling building with five owners;

S2: EER in a multi-dwelling building with ten owners.

4 Key findings

Key findings of the presented SNA were organized to explore defined research objectives. The analysis indicated two different “clusters”, or groups of stakeholders in EERs in Croatia, and enabled the mapping of key relationships between stakeholders.

4.1 Groups of stakeholders

Visual representation of social contacts between stakeholders during EERs in Croatia is depicted in Figure 2 and Figure 3. These figures represent different scenarios for multi-dwelling buildings, with five and ten owners, respectively. Both social networks are divided into two clusters, *red* and *green*. A *red cluster* represents a group of stakeholders living in a building experiencing a retrofit. Owners and their representative are clients, but the communication between the nodes is relatively enclosed, enabling external information exchange only through their representative. Similarly, the *green cluster* is organized around a property manager. Public institutions, designers, and contractors exchange information with the property manager, not directly with clients. The difference is that communication between the nodes in a *green cluster* is more restricted than in a *red cluster*; thus, the nodes are not entirely interconnected.

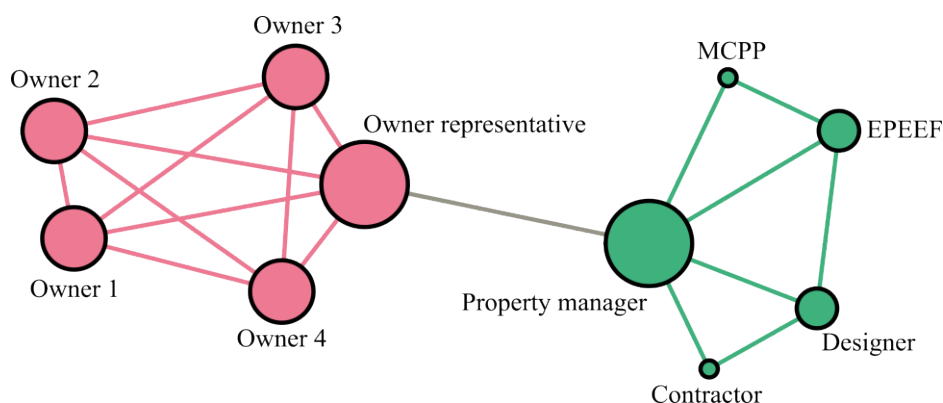


Figure 2. SNA for S1 – visual representation

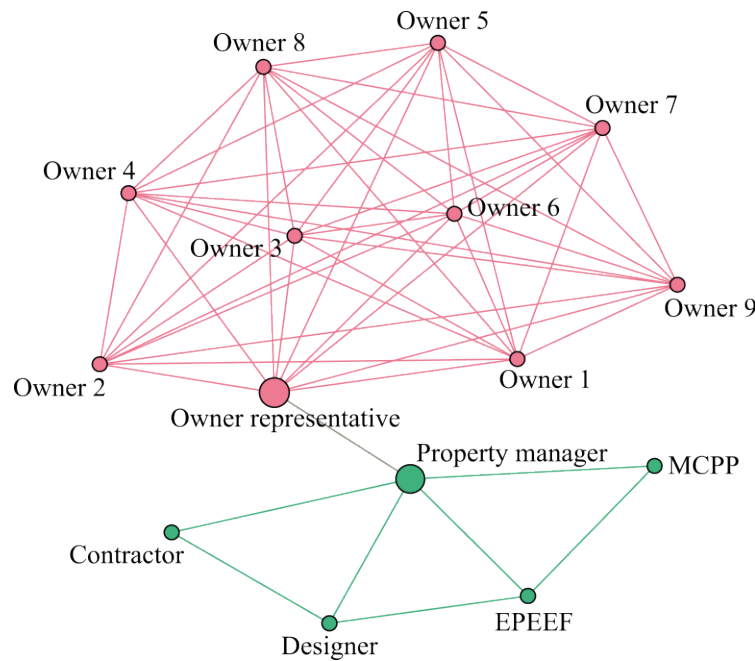


Figure 3. SNA for S2 – visual representation

4.2 A key relationship

After identification of two clusters in an EER network, it is obvious that the relationship between the OR and PM is the only tie enabling information flow between different stakeholder groups. Further statistical analysis also emphasises the importance of two key stakeholders in EERs in Croatia.

Table 1 presents a comparison of two scenarios, with five (S1) and ten (S2) building owners. Centrality measures depict the actual social power and influence of a node. According to betweenness centrality, the OR and PM are by far the most important participants in a network. Their importance increases with an increase in the number of owners; the social power and influence of owners remains 0.0 in both scenarios. The social power and influence of other participants is rather similar to that of the owners, and is not dependent on the number of owners. The OR and PM control the majority of information flowing in a network during an EER. Nevertheless, their roles in a network are fairly different. According to Home Office (2016), if a node has a high betweenness and a low degree, it can be considered as a gatekeeper. If a node has a high betweenness and a high degree, it indicates a central figure in the network. Thus, a PM for a building with more than five owners is a typical gatekeeper of information. He may play an important role in activity, but not much information is held by him. Removing this node from the network may cause fragmentation (Home Office 2016). According to Haas (2015), gatekeepers play an important role in decision processes by regulating information flows. They can also withhold access to information from participants in another group, and can be an obstacle to information exchange or access to decision-makers within the group (Haas 2015). They can have a filtering role in the network.

An OR is highly visible and has a central role in a network (Home Office 2016). An OR can be considered as a boundary spanner, an interpreter of environmental conditions, and a provider of information to decision-makers (Haas 2015). ORs bring together knowledge from different groups as they are responsible for contacting persons outside of their own group (Haas 2015). According to Home Office (2016), they represent key participants that may be focused on fragmenting networks and gathering information. However, much information flows between the owners, as indicated by high closeness centrality. Owners may be involved in many activities in a network, but do not play a

unique role (Home Office 2016). This is especially true with a multitude of owners when they are connected to each other and have a high degree, but their centrality remains 0.0. Other participants in a network such as a designer, a contractor, and public bodies also provide information, but do not have a key role in communication.

Table 1. SNA – comparison of S1 and S2

Node	Degree (S1)	Betweenness centrality (S1)	Closeness centrality (S1)	Degree (S2)	Betweenness centrality (S2)	Closeness centrality (S2)
Owners	4.0	0.0	0.5	9.0	0.0	0.61
OR	5.0	20.0	0.69	10.0	45.0	0.78
PM	5.0	22.0	0.69	5.0	42.0	0.61
Designer	3.0	0.5	0.47	3.0	0.5	0.41
Contractor	2.0	0.0	0.45	2.0	0.0	0.4
EPEEF	3.0	0.5	0.47	3.0	0.5	0.41
MCPP	2.0	0.0	0.45	2.0	0.0	0.4

Relevant findings of previous literature are somewhat different than the results of this study because they depend on country's legislation and a specific environment in question. For example, Xu *et al.* (2021) conducted a SNA to investigate the stakeholders' power over the impact issues of building energy efficiency in China. Their results indicate that the most influential stakeholders in China are designers, manufacturers, commissioning agents and researchers. Nevertheless, the measures they use are similar as in this study (measures of centrality). The unique role of PM is specific for Croatian context. Nahod and Ceric (2015) mentioned the importance of PMs in EERs in Croatia, but this study has further explained their role in information exchange between owners and other participants in a network.

5 Framework for principal–agent model for EERs in Croatia

According to previous literature (Xu *et al.* 2021), insufficient knowledge and experience, lack of information integrity and unclear responsibility can be a serious threat for enhancing energy efficiency. Other researchers have also indicated that agency problems (Liang *et al.* 2019), information asymmetry (Feser and Runst 2016; Högberg 2014) and opportunistic behaviour (Qingmiao *et al.* 2009) are the main reasons for failures in EER projects, which are all related to the principal–agent theory and communication problems between participants.

Feser and Runst (2016) investigated the information asymmetry between owners and public energy efficiency consultants as change agents in Germany. In Germany and in other countries, such as Sweden, Finland, Belgium, Denmark, USA, and UK, energy efficiency consultants have been promoted to overcome information asymmetry problems and increase transparency, information flows and ex-post quality controls. They also mention the information asymmetry between owners and construction companies performing the EERs. In China, researchers (Qingmiao *et al.* 2009) investigated the principal-agent problem between the government and the owners. Nevertheless, this

study has shown that EPEEF (as the consultant body) and MCPP (as the government body) do not have a central role in the Croatian context and cannot influence the information flow as much as PM and OR.

SNA results for EER projects in Croatia emphasise the key relationship between the OR and the PM. They are recognised as boundary spanners and gatekeepers of information in the network. Regarding communications, the responsibility of the OR is to overcome boundaries and facilitate communication and information exchange between the owners and the PM. The PM controls what information passes from one group (owners) to another (other stakeholders). The role of the PM can be considered negatively with hoarding of information, or positively with sharing of useful information and filtering of irrelevant information (Long *et al.* 2013). Gatekeepers have attributes and make decisions that may not be visible to owners (Shumsky and Pinker 2003), leading to a principal–agent model with information asymmetry between the PM and owners. A key principal–agent issue arises with self-interest, or because stakeholders are not willing to share all information all of the time.

There are three types of information asymmetries that apply in this case: hidden characteristics, hidden information, and hidden intention. These information asymmetries generate the risk of adverse selection, moral hazard, and hold-up, respectively. Adverse selection occurs when owners do not know the exact qualifications of the PM before the contract is signed. Moral hazard occurs when owners cannot be sure that the PM will fully act on their behalf after the contract is signed. Hold-up occurs when owners have invested resources in the belief that the PM will behave appropriately, but instead he acts opportunistically after the contract is signed (Jäger 2008; Schieg 2008).

In Croatia, the principals hire a representative, the OR, to protect their interests. A property management firm can employ a representative to manage a specific building case. A detailed principal–agent model for key EER stakeholders is shown in Figure 4. As agents, the owner and PM representatives are in a non-contractual relationship; the other stakeholders are in contractual relationships.

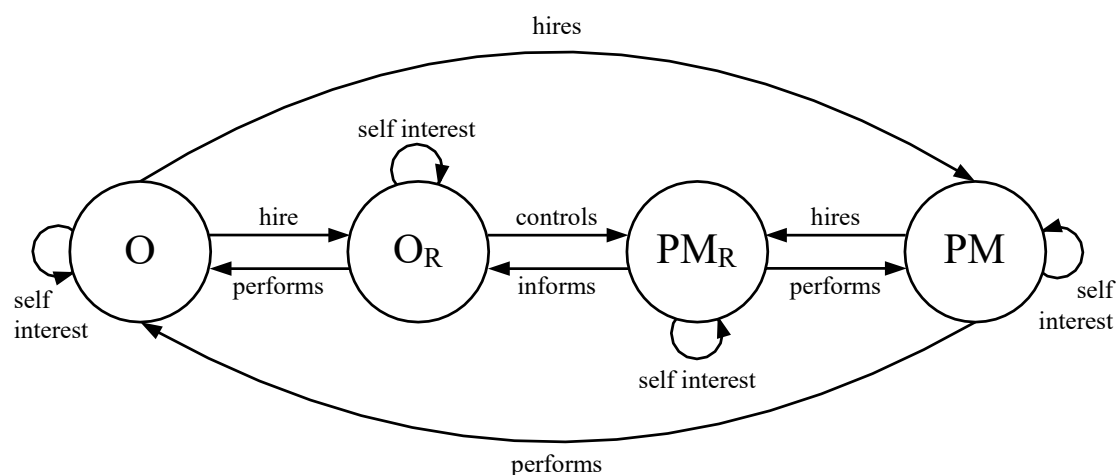


Figure 4. Principal–agent model for key EER stakeholders (O – owners; OR – owner representative; PM – property manager; PM_R – property manager representative)

A proposed framework is a useful understanding of how all the relationships are intertwined in EER projects. According to Jäger (2008) and Schieg (2008), owners can minimize risks by screening and monitoring the intentions of the PM. The purpose of screening is to gather information for the owners in an effort to learn more about the qualifications of the PM, including references,

certificates, work probes, and credit worthiness, reducing the risk of adverse selection. Similarly, the purpose of monitoring the PM is to ensure that they are behaving in the best interest of the owners, to reduce moral hazard and hold-up risks. Ceric (2016) emphasised the importance of trust between the two representatives, and the use of information technology and communication protocols to enable successful communication and coordination. In the future, modern technologies such as blockchain can also minimize information asymmetries and risks in EERs. Research on blockchain technology and its applications in projects related to energy efficiency retrofits has begun (Aoun 2020). Blockchain technology ensures that all project participants have access to all information exchanged between them over the project duration. It can significantly reduce information asymmetry and produce more trustful relationships between project stakeholders (Ceric 2019). The proposed framework is a useful pointer for future research in applying principal-agent theory in EER projects.

6 Conclusions

This study provides insight into the social network of energy efficiency retrofits, which have become more common in Croatia in recent years. Increasing global concern over carbon emissions and climate change has resulted in implementation of a wide variety of policy measures directed to increase the energy efficiency of buildings. EERs in Croatia have been especially oriented to multi-dwelling residential buildings, which have received incentives from the state and the EU. Nevertheless, the EERs of these buildings have encountered some problems, with numerous privately-owned dwellings and shared ownership of the common areas. Scientific research conducted in other countries indicates that agency problems, information asymmetry, and opportunistic behaviour are the main causes. Thus, there was a need to investigate social and communication networks, and the repercussions of principal-agent theory on EERs in Croatia.

The social network analysis results emphasise the importance and centrality of two key participants in an EER network in Croatia – the owner representative and the property manager. They are recognised as the boundary spanners and gatekeepers of information in this network. As such, they control the flow of information between the owners and other stakeholders such as contractors, designers, and public bodies. They both have great social power and great influence on the success of project communication.

The directed interactions between stakeholders were not tracked during this study; the results are limited in this way. This study was intended to provide insight into undirected contractual relationships and formal communication channels. With broader input data, social network analysis can provide even more detailed information regarding social interactions between stakeholders. Future researchers are encouraged to consider this challenge. The results of this study provide a starting point for much broader research of information asymmetry and strategies for its minimization in future EER projects. Some possible directions include application of new information technologies (such as blockchain), developing communication protocols, and building trust between stakeholders in EERs.

7 References

Akerlof, G., 1970. The market for lemons: quality, uncertainty, and the market mechanism. *The Quarterly Journal of Economics*, 84 (3), 488–500.

- Amasyali, K. and El-Gohary, N.M., 2016. Energy-related values and satisfaction levels of residential and office building occupants. *Building and Environment*, 95, 251–263.
- Aoun, A.G., 2020. Blockchain application in energy performance contracting. *The International Journal of Strategic Energy & Environmental Planning*, 2 (3), 23–40.
- Bastian, M., Heymann, S., and Jacomy, M., 2009. Gephi: An open source software for exploring and manipulating networks. In: *3rd International AAAI Conference on Weblogs and Social Media*, May 17–20, 2009, San Jose, California. Association for the Advancement of Artificial Intelligence, 361–362.
- Ceric, A., 2016. *Trust in Construction Projects*. Oxon: Routledge.
- Ceric, A., 2019. Blockchain strategy for minimizing information asymmetry in construction projects. In: Završki, I., Cerić, A., Vukomanović, M., Huemann, M., and Ronggui D. (Eds.), *Proceedings of the 14th International Conference Organization, Technology and Management in Construction and 7th International Project Management Association Research Conference*, September 4–7, Zagreb, Croatia. Croatian Association for Construction Management and University of Zagreb, Faculty of Civil Engineering, 494–556.
- De Nooy, W., Mrvar, A., and Batageli, V., 2005. *Exploratory social network analysis with Pajek*. Cambridge, UK: Cambridge University Press.
- Dimitrova, E., Petrova-Tasheva, M., Mutaftchiiska, I., and Burov, A., 2019. Energy-related policy in the housing sector of Bulgaria: In search for a meeting point of social and technical dimensions. *IOP Conference Series: Earth and Environmental Science*, 329, 012005.
- Environmental Protection and Energy Efficiency Fund, 2020. *Activities of the Fund* [online]. Environmental Protection and Energy Efficiency Fund. Available from: http://www.fzoeu.hr/en/about_us/activities_of_the_fund/ [Accessed 31 March 2020].
- European Commission, 2020. *Energy efficiency directive* [online]. European Commission. Available from: https://ec.europa.eu/energy/topics/energy-efficiency/targets-directive-and-rules/energy-efficiency-directive_en [Accessed 13 July 2021].
- European Environment Agency, 2020. *Final energy consumption by sector and fuel in Europe* [online]. European Environment Agency. Available from: <https://www.eea.europa.eu/data-and-maps/indicators/final-energy-consumption-by-sector-11/assessment> [Accessed 13 July 2021].
- Eurostat, 2021. *Energy consumption in households* [online]. Eurostat. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Energy_consumption_in_households [Accessed 13 July 2021].
- Feser, D. and Runst, P., 2016. Energy efficiency consultants as change agents? Examining the reasons for EECs' limited success. *Energy Policy*, 98, 309–317.
- Freeman, L.C., 1979. Centrality in social networks. *Social Networks*, 1, 215–239.
- Haas, A., 2015. Crowding at the frontier: boundary spanners, gatekeepers and knowledge brokers. *Journal of Knowledge Management*, 19 (5), 1029–1047.
- Högberg, L., 2014. *Building Sustainability: Studies on Incentives in Construction and Management of Real Estate*, Doctoral Thesis. Stockholm: Department of Real Estate and Construction Management Royal Institute of Technology.
- Home Office, 2016. *Social Network Analysis: 'How to guide'*. Crown, UK: Home Office.
- Jäger, C., 2008. *The Principal-Agent Theory within the Context of Economic Sciences*. Norderstadt: Herstellung und Verlag, Books on Demand GmbH.
- Jensen, M.C. and Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3 (4), 305–360.
- Kivisto, J., 2008. An assessment of agency theory as a framework for the government–university relationship. *Journal of Higher Education Policy and Management*, 30 (4), 339–350.
- Korba, L. Song, R. Yee, G., and Patrick, A., 2006. Automated Social Network Analysis for Collaborative Work. In: *Proceedings of the Third International Conference on Cooperative*

- Design, Visualization and Engineering (CDVE 2006)*, September 17–20, Palma de Mallorca, Spain.
- Kriz Selendic, I., 2020. Energetska ucinkovitost i održivost zgrada nakon 2020. In: *Hrvatski graditeljski forum 2020*, February 20, Zagreb. Faculty of Civil Engineering, University of Zagreb.
- Liang, X., Shen, G.Q., and Guo, L., 2019. Optimizing incentive policy of energy-efficiency retrofit in public buildings: A principal-agent model. *Sustainability*, 11 (12), 3442.
- Long, J.C., Cunningham, F.C., and Braithwaite, J., 2013. Bridges, brokers and boundary spanners in collaborative networks: A systematic review. *BMC Health Services Research*, 13, 158.
- Meijer, F., Itard, L., and Sunikka, M., 2009. Comparing European residential building stocks, performance, renovation and policy opportunities. *Building Research & Information*, 37, 533–551.
- Ministry of Construction and Physical Planning, 2020. *Regulations in the field of energy efficiency* [online]. Republic of Croatia Ministry of Construction and Physical Planning. Available from: <https://mgipu.gov.hr/access-to-information/regulations-126/regulations-in-the-field-of-energy-efficiency-8645/8645> [Accessed 31 March 2020].
- Moe, T.M., 1984. The new economics of organization. *American Journal of Political Science*, 28 (4), 739–777.
- Nahod, M.M. and Ceric, A., 2015. Maturity of buildings for energy efficiency retrofits. In: *Savjetovanje Upravitelja nekretninama*, April 22–25, Supetar, Brac, Croatia. Zagreb: Udruga Upravitelj, 35–44.
- Ownership and Other Proprietary Rights Act – OOPRA, 2014. Official Gazette 91/96, 68/98, 137/99, 22/00, 73/00, 129/00, 114/01, 79/06, 141/06, 146/08, 38/09, 153/09, 143/12, 152/14.
- Park, H., Han, S.H., Rojas, E.M., Son, J., and Jung, W., 2011. Social network analysis of collaborative ventures for overseas construction projects. *Journal of Construction Engineering and Management*, 137 (5), 344–355.
- Qingmiao, H., Changbin, L., Yang, Z., and Zhanyong, J., 2009. Economic incentive contract design with asymmetric information in building energy efficiency retrofit. *Tumu Gongcheng Xuebao/China Civil Engineering Journal*, 42 (8), 129–133.
- Ross, S.A., 1973. The economic theory of agency: The principal's problem. *American Economic Review*, 63 (2), 134–139.
- Schieg, M., 2008. Strategies for avoiding asymmetric information in construction project management. *Journal of Business Economics and Management*, 9 (1), 47–51.
- Shumsky, R.A. and Pinker, E.J., 2003. Gatekeepers and referrals in services. *Management Science*, 49 (7), 839–856.
- Xu, X., Xiao, B., and Li, C.Z., 2021. Stakeholders' power over the impact issues of building energy performance gap: A two-mode social network analysis. *Journal of Cleaner Production*, 289, 125623.