



EFFICIENCY AND CHALLENGES IN PUBLIC REAL ESTATE MANAGEMENT: INSIGHTS FROM LITHUANIA

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Abstract. Public real estate is considered an integral part of national wealth. It generates a wide range of economic activities that contribute to creating and providing common public goods. This study examines the efficiency of public real estate management in Lithuania. Our findings show that public property use, disposal, and management strongly depend on the managerial approach. We apply data envelopment analysis (DEA) in addition to the income value, regression, and correlation methods. We find that there are certain biases present due to the exclusion of some state-owned properties from the public register. Furthermore, we identify the need for greater precision in the indicators used for financial reporting of state-owned assets. The excessive number of vacant asset units poses a challenge, as it requires substantial maintenance expenditures. Moreover, the appraisal of alternative use of these assets is lacking, thereby limiting the potential for maximizing public benefits. Our analysis reveals that the rental price per 1 m² and the residual value of the leased premises are the most critical determinants influencing the management efficiency of publicly owned property. Furthermore, it is evident that the residential property is the only type of state-owned property managed efficiently within the Lithuanian public sector. These findings underscore the importance of formation of robust public real estate policies.

Keywords: public real estate management, efficiency, DEA approach, decentralized model, centralized model.

Introduction

Public real estate is an integral part of national wealth, as it is viewed through the multifunctional prism of a country's potential. It generates a wide range of economic activities that contribute to creating and providing common public goods. Therefore, it is essential to manage public real estate efficiently. Structural inefficiencies in the property market can have a ripple effect on many sectors of the economy (Herath & Maier, 2015).

By its fundamental definition, public real estate is owned by a state. The primary classification of the public real estate includes land, buildings, and infrastructure (Kaganova & Amoils, 2020). In most countries, public real estate is defined by local laws (Gross & Žróbek, 2020). One of the major characteristics of public real estate is that it is governed by local governments on different levels (national, regional, or local) (Grover & Elia, 2011), involving the disposal of the facilities as a part of the activities, particularly buildings or similar properties.

Since public real estate can be transferred from states to private organizations in a form of rent or lease (Gross & Žróbek, 2020), the definition of public real estate depends on who possesses the rights to a property (Grover & Elia, 2011). The private entities, agencies, or other organizations then assume control over the properties. However, these properties still fall under the definition of public real estate that provides public services. Real estate service providers, on the other hand, have to improve service qualities, define solutions in order to maximize service quality of the property service industry under the budget constraints (Chiang & Perng, 2018).

Additionally, real estate ownership requires to carry out managerial decisions of the facilities, which in literature refers to real estate management. The concept of real estate management has a shorter history compared to management of production processes (Muczyński, 2015). It is only over the last few decades, research has shown an increase in real estate management topic (Liu et al., 2022). For an extended period, according to Muczyński (2015),

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properties were essentially regarded as objects facilitating the production, storage, sale, or utilization of objects. Throughout this duration, real estate management was confined to the passive performance of routine tasks associated with rent collection, operational expense coverage, maintenance of a property, and oversight of contractual obligations and legal issues during the use of the physical object (*the narrow approach*).

The contemporary theory real estate management commenced as it was realized that a property constitutes a form of capital asset. Therefore, the market value of such assets depends on how well it is taken care of, in other words quality of management matters. An effective management, in turn, can impact the asset's value, thereby bring positive financial gains to the owner in the form of income or earning, either through lease or selling the property at a higher price later (Scarrett, 1983). The modern theory suggests a *broader and more comprehensive approach* to real estate management. This approach includes knowledge of evolving and changing market conditions, strategic decision-making, and management at a portfolio level, and property's life cycle management as important competences (Muczyński, 2015; Kaganova & Amoils, 2020).

Management of public real estate assets is a complex and interdisciplinary field, which is relatively new for government entities (Van der Voordt & Arkesteijn, 2016). The main focus of PREM is related to the effective implementation of public functions by the property that help deliver social benefits or services to communities (Abdullah et al., 2011; Muczyński, 2015). It is also assumed and distributed differently compared to the private sector (Muczyński, 2015). The first concerns in public real estate management (PREM) began to emerge in the early 1990s in major US cities. During this time, public real estate gradually transformed from being a systematically unappreciated public good to an asset that was expected primarily generate measurable benefits. These benefits included such as investment returns for society, income generated from the lease of certain state-owned properties, and the disposal of assets not involved in any economic activity (Wheeler, 1993; Kaganova & Nayyar-Stone, 2000). The global financial crisis in 2008 increased the importance of prioritizing the management of public real estate. There has been a growing interest among municipalities that recognize the substantial effort required to improve the administration of real estate and its associated matters. The new practice of PREM incorporates a coherent system with certain established management procedures (between subjects and objects) and standard activities (such as leasing and selling) to further facilitate the rational use of a property (Żróbek et al., 2012). Even though the focus of PREM is related to the effective implementation of public functions by the property, it prioritizes the implementation of social benefits first (Muczyński, 2015). Therefore, the general PREM emerged into supplying the right quantity of property to the goods and services, supporting local economic development and at the same time obtaining revenues that the property management can obtain from

the existing resources (property that can be leased or disposed (Muczyński, 2015).

This modern approach of public real estate as assets that generate returns for society has spread around the world. However, the implementation was not equal between the countries. PREM in matured markets according to Trojanek (2015) includes: a) improvement of cost rationalization of maintenance, b) managerial professionalism, c) constant increase in efficiency of managing the assets, and d) differentiating obligations between the owner and the tenant. In the economies established in the 1990s, such as Lithuania, the process included a slightly different structure. Since the local governments had to go through the process of restoration after Lithuania regained its independence, additional elements were included in the development of public real estate management: acquisition of state ownership, increasing the perception of public assets as financially profitable assets, application of free market principles to asset management and a change in the status of the public entity from a contributor of public services to a partner and regulator (Kaganova & Nayyar-Stone, 2000; Trojanek, 2015). Along with that, some significant inefficiencies in the running of the public real estate sector were highlighted. Kaganova (1999) finds that public entities face several areas for improvement in managing public property assets, portfolio administration, neglected strategy and perspective. These flaws have hindered public entities from efficiently managing the assets in a new asset management approach. Even after several decades, these shortcomings have yet to be resolved in many countries worldwide. According to Giglio et al. (2018) it is common for governments to underinvest in maintenance or operations of public assets, which often leads to premature deterioration of an asset and subsequent rise in costs for future repairs and replacements. Muczyński (2015) emphasizes the necessity of adopting a comprehensive approach to the management of public real estate assets, incorporating strategies and practices derived from the private sector. This approach can improve the efficiency of the public sector, particularly in the public housing management. The annual control procedures for the management of property carried out by the responsible authorities in Lithuania similarly identify specific gaps in managing public real estate assets that still need to be eliminated.

The increasing popularity of the new approach to PREM and its efficiency has made it a frequent topic of study among scholars worldwide (Just & Maennig, 2012; Wojewnik-Filipkowska et al., 2015; Marona & van den Beemt-Tjeerdsma, 2018; Hoing & Kaempf-Dern, 2019; Carbonara & Stefano, 2020; Gross & Wolny-Kucińska, 2021). However, only a few researchers have assessed the issue of the actual efficiency of PREM. Carbonara and Stefano (2020) propose a method to evaluate the efficiency of PREM in which they measure the degree of real estate utilization using the so-called utilization index. Gross and Wolny-Kucińska (2021) find that the efficiency of PREM can be measured through the ratio of the income generated to the expenditure allocated to it. Other researchers

have studied this topic from a more theoretical perspective. Just and Maennig (2012) examine the efficiency of PREM and its determinants. Wojewnik-Filipkowska et al. (2015) investigate the issues related to state real estate management. Klumbytė and Apanavičienė (2014) research the efficiency of state real estate management, its issues, and modern methods of asset management, such as acquisition, maintenance and renovation of existing assets, or lease and sale of idle assets. Ragauskienė (2011) highlights the importance of the management process of state real estate. Mažylis and Jasudavičiūtė (2005), and Mackevičius and Ragauskienė (2012) emphasize the impact of a centralized model of public real estate management on efficiency. Meanwhile, Klumbytė and Apanavičienė (2014) identify the importance of the need for state real estate in the context of the efficiency of state real estate management.

The extant literature develops the recognition and acknowledgment of the need for efficient to some extent. As a result, scholars generally focus on the theoretical aspects of PREM efficiency instead of carrying out empirical research by using specific methods. Furthermore, it is noteworthy that the assessment of the PREM efficiency itself is also based on a relatively narrow range of research methods, which, in a general sense, do not contribute to answering the question of whether public real estate is being managed efficiently or not. This is because different authors have analyzed the efficiency of PREM without assessing some or all of the factors determining the efficiency. Therefore, we fill this gap by contributing to the literature in two ways: (1) by developing and conceptualizing a model of factors influencing the efficiency of PREM and (2) by applying this concept in assessing the efficiency of PREM in Lithuania through the determining factors identified in the scientific literature. Thus, this paper develops an empirical research methodology to assess the efficiency of PREM.

1. Related theoretical background

1.1. The concept of efficiency in public real estate management

Efficiency is one of the most fundamental concepts in economics. From a broader perspective, efficiency is a measurement of the ratio between the results of business activity and the costs necessary to achieve it (Cymerman & Cymerman, 2019). In the economic literature, an efficient market is one in which the allocation of resources is “Pareto efficient” so that no reallocation of resources can make someone better off without making someone else worse off (Herath & Maier, 2015). Various market actors and scholars interpret PREM efficiency differently. However, most of the interpretations support application of different managerial practices or strategic planning (Marona & van den Beemt-Tjeerdsma, 2018). Higgins (2022) suggests that efficient management of real estate assets ensures the efficient delivery of public services. Abdullah et al. (2011) argue that efficiency in the man-

agement of public real estate requires coordinated processes of administrating, forecasting, planning, directing, coordinating, and controlling. Girginer and Kaygisiz (2013) suggest viewing efficiency as a proper allocation of costs, proper administration, and good governance set to maximize the benefits to the public. Klumbytė and Apanavičienė (2014) claim that efficiency in the context of public real estate management is related to reducing operating and management costs without compromising the quality of the services provided by the assets. Just and Maennig (2012) determine that to achieve the efficiency of a public real estate asset, the managing entity should consider the asset’s entire life cycle, evaluating the maintenance costs and the potential revenues that the asset can generate. The optimal value creation of the asset and the alternative use of that asset should first be assessed. If a particular asset cannot be used efficiently, it should be disposed of through public procurement. This approach stimulates the state to achieve efficiency in managing public real estate by reducing the costs of maintaining assets while increasing the revenue generated by selling them. The efficiency of PREM can be achieved by applying modern methods of the strategic planning approach—i.e., the acquisition of new assets, maintenance and renewal of existing assets, or the lease and sale of vacant assets. Therefore, it is essential for government agencies to have a comprehensive understanding of their real estate assets and develop strategies to optimize their use and value (Marona & van den Beemt-Tjeerdsma, 2018). Effective asset management can contribute to the professionalization of municipal real estate management (Beemt-Tjeerdsma & Veuger, 2016).

A substantial amount of academic literature emphasizes the importance of focusing on financial indicators in the context of effective PREM. However, equal importance should be placed on both organizing the PREM process and setting strategic objectives. This aspect again stresses that the concept of the efficiency of PREM is vaguely understood and is interpreted differently by different scholars. For example, Ragauskienė (2011) argues that PREM efficiency can only be achieved when the asset management has financial targets, a budget, and a specific strategic action plan with milestones for implementation. A strategic action plan is critical for efficient PREM as it ensures accurate planning, considering the managed property’s development plans and current technical and economic conditions (Klumbytė & Apanavičienė, 2014).

Given the complexity of the PREM efficiency concept, Figure 1 identifies the factors influencing this phenomenon. These factors are primarily analyzed regarding the ability to properly manage and accurately identify the need (demand) for public real estate. In their analysis, Klumbytė and Apanavičienė (2014) suggest dividing public real estate into three main groups: new real estate assets, the assets that are required for use, and the assets that are not required for use. According to the authors, the need analysis for public real estate could help in determining

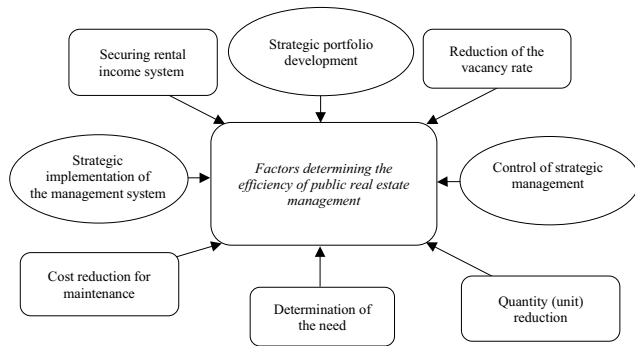


Figure 1. Factors influencing the efficiency of public real estate management (source: created by the authors based on research literature)

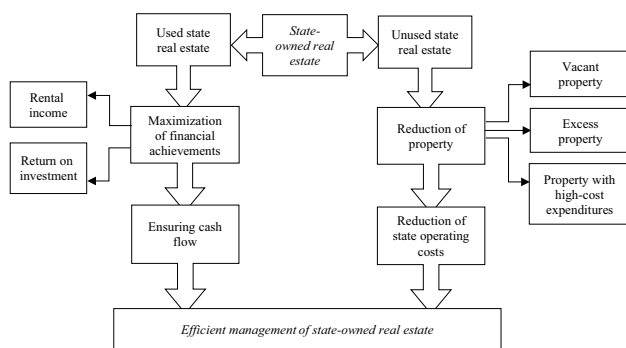


Figure 2. Ensuring the efficiency of public real estate management (source: created by the authors based on research literature)

precisely how much and what type of assets are required for the optimal performance of state or municipal functions and what kind of assets would not meet any needs of state institutions.

The results stress the importance of optimizing the space available and argue that one of the most critical factors in ensuring the efficiency of PREM is the appropriate use of the space available (Figure 2). The first strategy is no different from that of private real estate companies, aiming for revenue streams through the secured leases of assets (Phelps, 2011; Cohen, 2013; Gross & Żróbek, 2020). The second strategy, as suggested by Asatryan et al. (2017)

and Brill (2022), involves the reduction of assets through selling excess property and assets that require high-cost expenditures, thus reducing the state’s operating costs. It is argued that to reduce the maintenance costs of assets, the number of vacant properties not in use for any activity should be reduced first. Then, efficient management of public-owned real estate should explicitly focus on financial achievement through maximizing the return on rental income or the return on investment. Rental income, as opposed to the sale of an asset, ensures the generation of cash flows in the long term.

1.2. Practices of public real estate management

Practices in different countries distinguish lease-based asset management and asset-based management determined by use and services and classify them as centralized and decentralized. Under centralized public sector asset management, the government uses and disposes of the assets delegated to one responsible entity (Amendment to the Law on Management, Use and Disposal of State and Municipal Property of the Republic of Lithuania, July 25, 2019, No. XIII-2398, 2019). In comparison, under decentralized asset management, an asset is governed and disposed of by the entity that uses the property (i.e. state and municipal institutions) (National Audit Office of Lithuania, 2020). Some countries have a dual control model that lies somewhere in between the centralized and decentralized models (see Table 1).

Various examples point out that public real estate reforms help achieve economic efficiency at some point. Of course, not all countries can achieve the desired results immediately and move towards a centralized public sector asset management model. The process can take decades. However, it is generally agreed upon that the most favorable public real estate management model in terms of efficiency is the centralized model. Centralized approach in PREM allows for the consolidation of resources, standardization of practices, effective risk management and specialized knowledge (Hernes, 2021).

As Table 2 shows, the United Kingdom, Sweden, and Estonia practice a decentralized public real estate model. In the United Kingdom, there is a designated body, the Government Procurement Office, which aims to assess the efficiency of public real estate governance and develop

Table 1. Models of public real estate management (source: compiled by the authors based on Ragauskienė, 2011)

Types of models		
Decentralized governance model	Dual control model	Centralized governance model
There is a coordinating entity that is responsible for cooperation with other entities. This entity is responsible for the overall policy and direction of state-owned enterprises	Responsibility for asset management is divided between the sector and a coordinating (central) entity, usually the Ministry of Finance. Thus, the Ministry of Finance is responsible for ensuring operational efficiency, timely analysis of financial indicators, and other related reporting. The ministry is also responsible for commercial activities	A single entity or an agency is designated to be responsible for the duties and rights of ownership of most state-owned assets

Table 2. Public real estate management by selected countries (source: compiled by the authors based on the Government of the Republic of Lithuania, 2009)

Country	Model of management	Lease-based	Management policy set by the Ministry of Finance	Centralized asset management model financed by the state
Denmark	Centralized	Yes	Yes	No
United Kingdom	Decentralized	No	Yes	No
Norway	Centralized	Yes	No	No
Finland	Centralized	Yes	Yes	No
Sweden	Decentralized	Yes	No	No
Estonia	Decentralized	Yes	Yes	No

more efficient asset use and governance programs. Sweden currently employs a market-oriented, decentralized public real estate governance model. His public real estate governance principle was chosen to ensure more efficient use of state-owned assets and to eliminate monopoly. In Estonia, public real estate is also decentralized and structured so that each state institution is responsible for the assets it owns, disposes of, and uses. Currently, the country has no roadmap for effective governance, meaning Estonia must still identify a specific public real estate governance model. It has yet to decide how public assets should be managed to become more efficient (centralized or decentralized approach, with budgetary or private funding, etc.). Denmark employs a centralized public real estate management approach implemented by the Danish Residents and Properties Agency (RPA). The agency aims to ensure an adequate supply of assets to public authorities and manages, renovates, leases, and maintains leased assets. The RPA is financed by the rent paid by the public authorities, and the agency itself is under the authority of the Ministry of Finance. In Norway, the centralized governance of public property is shaped by the Ministry of Public Administration and Reform, which manages the royal buildings owned by the state, diplomatic residences, embassies in foreign countries, and cultural and public administration buildings and colleges. The ministry is responsible for the rational organization of the construction of buildings, planning the space requirements of public institutions, and other similar functions based on cost, time, and quality criteria. In Finland, property governance is also centralized and governed by a state-owned company called Senate Properties under the Ministry of Finance. The entity's goal is to ensure the efficiency of the management of public buildings and the provision of services such as renting premises, investment, property development, and administration. All the activities are financed by rental income. All public properties are first transferred to the Ministry of Finance, which then hands over the assets to the Senate Properties for further management. However, before acquiring a new asset, a screening procedure is first carried out to ensure that the asset is fit for future use. Although under the Finnish model of public real estate governance, an asset is managed by the designated authority, the ownership is still vested in the state (on the

adoption of the Strategy for the Centralized Management of the Public Property 2009–2016, November 25, 2009, No. 1597, 2009).

1.3. Methods for assessing the efficiency of public real estate management

Gross et al. (2014) analyze the efficiency of PREM measures by employing a cross-sectional approach. The approach indicators, such as the number of property registrations, the number of sales of state-owned real estate, etc., are compared with cross-country samples. Gross and Wolny-Kucińska (2021) further suggest that the efficiency of public real estate management can also be measured through budget and strategic plan documents. The authors estimate the results based on an analysis of the resource allocation (i.e., a comparison of revenues and expenses) of public real estate. In their study, Gross and Wolny-Kucińska (2021), apply the following formula to calculate the relationship between income and expenditure, which allows them to determine the efficiency of real estate governance:

$$P_R = \frac{I_{IR}}{C_{IR}}, \quad (1)$$

where: P_R is the profitability ratio for property management; I_{IR} is the income coverage ratio; C_{IR} is the cost coverage ratio.

Carbonara and Stefano (2020) assess the efficiency of PREM by applying the use index, an efficiency indicator that shows the yield associated with the use of an asset in relation to its occupancy. The index consists of two parameters describing the actual degree of use in terms of surface area (P_1) and the ability of the tenants to pay the management and utility costs (P_2) (e.g., electricity, gas, water, and waste collection fees). The first parameter is linked to the management of space and is expressed by the ratio between the total floor area of a building and its occupancy. This ratio indicates the degree of utilization or underutilization of an asset, allowing for a new strategy to be devised for the use of the property. The second parameter shows the capacity of the asset to achieve financial rationality in using resources. The formula used to calculate the ratio is as follows:

$$I_{ut} = \left\{ \frac{P_1 + P_2}{2} \right\} = \left\{ \frac{\left(\frac{S_{occ}}{S_{tot}} \right) + \left(\frac{K_{occ}}{K_{tot}} \right)}{2} \right\}, \quad (2)$$

where: S_{occ} is occupied space; S_{tot} is the total space of the buildings; K_{occ} represents the utility costs incurred by tenants; K_{tot} represents the total utility costs incurred.

Thus, according to the occupancy index constructed by Carbonara and Stefano (2020), an estimated value of 1 means that a building is fully occupied, and a utility cost of 0.5 means that tenants fully cover utility expenses.

2. Methodology

2.1. Data description

Considering the availability of the statistical data, we include data for the period between 2016 and 2020. We collect data from the state-owned enterprise Turto bankas, the National Audit Office, the Ministry of Finance of the Republic of Lithuania, and their published reports. The data sample consists of 45 observations. The major limitation is the lack of historical data. Therefore, the analysis of real estate property management is based on only one interpretation of the efficiency of public real estate management concerning the achievement of financial indicators. Another limitation is the availability of to-date data. Even though the State Property Information Retrieval System (SPIRS) was developed in 2009, reports about state-owned real estate management only became accessible in 2016 after state-owned enterprise Turto bankas published its first report about the management, use and disposal of public property. To date of carrying out this research, five such reports have been published for each calendar year. Table 3 presents all of the variables employed in this study.

In Lithuania, public real estate is owned by the Government of Lithuania. The legislative branch of the government controls the Seimas of the Republic of Lithuania (Seimas), which enacts laws, enforces the Constitution, passes the budget, and both controls and confirms the activities of the prime minister and the government. Seimas also adopts and initiates regulations, exercises the management and use of public real estate, and determines the procedures for the management and use of public real estate. In comparison, the Ministry of Finance is responsible for the policy, coordination, and control of public real estate, as it has delegated the management operations of centrally managed public real estate to the state-owned enterprise Turto bankas. The right to use, dispose and manage public real estate is entrusted to the Bank of Lithuania, state institutions, organizations, state or municipal enterprises, and other legal entities. While, the control over the management, use, and disposal of public real estate and the keeping of accounts is exercised by state institutions, the internal audit service of the state institution or organization, and the National Audit Office of Lithuania (2018).

2.2. Methodology

The purpose of the study is to assess the efficiency of the PREM in Lithuania and the factors determining it. We apply the income value (capitalization of income), comparative, regression, and correlation methods. The statistical data analysis is based on a non-parametric linear programming technique called data envelopment analysis (DEA), which was popularized by Charnes et al. (1978) and extended by Banker et al. (1984). The DEA model is constructed in the form of multiple inputs and outputs in efficiency assessment.

Anderson et al. (1999) use DEA to measure the managerial efficiency in the hotel industry. Li (2008) calculates the operational efficiency of the real estate industry in

Table 3. Variables employed in this study

Variable	Abbreviation	Description
Input variables		
The number of state-owned real estate units according to their purpose	$number_of_objects_{it}$	Number of state-owned real estate units
Managed state-owned area according to its purpose (Thousand, m ²)	$managed_area_{it}$	Managed area of real estate owned by the state
Vacant state-owned real estate according to its purpose (Thousand, m ²)	$free_area_{it}$	State-owned area that is not included in any economic activity
Rent price per 1 m ² of leased state-owned real estate (EUR/month)	$rent_rate_{it}$	Rent price per 1 m ² for the rented state-owned property
The residual value of the managed state-owned real estate (Thousand, EUR)	$value_{it}$	The residual value of state-owned real estate
Output variable		
Capitalization rate – the efficiency of the management of the state-owned real estate (%)	r_{it}^{income}	The ratio of the rent received for state-owned real estate to the value determined by that property

30 medium and large Chinese cities using DEA. DEA is also suitable for assessing the efficiency of the PREM, as it assesses the weights of the factors and outcomes generated under study, subject to certain constraints applied in the analysis. Even though to our knowledge, DEA has never been used in assessing the efficiency of PREM, the relevance of its use is supported by the “Pareto-efficient” concept, as proposed by Koopmans (1951).

The income value method is widely used not only for estimating the value of a business but also for assessing the value generated by different assets, including real estate (Trojanek, 2010; Tamošiūnienė & Paškevičienė, 2016). Within the framework of this study, the income value method is used to assess the efficiency of PREM through the perspective of financial achievement from the lease income obtained through leasing public property to other entities. We apply regression and correlation analysis methods to determine the influence of various factors on the efficiency of PREM (Varnelis, 2011). We establish statistical relationships between the factors identified in Figure 1 (input), which are used to investigate the efficiency of PREM. The capitalization rate is calculated using the income value method, which shows the result of the PREM efficiency (output).

The capitalization rate, which represents the output of PREM efficiency, is calculated as follows (Varnelis, 2011):

$$R_{it}^{Income} = \frac{GP_{it}}{PK_{it}} \cdot 100, \quad (3)$$

where: R_{it}^{Income} is the capitalization rate calculated for a property i in period t , and is expressed as a percentage; GP_{it} is the net public real estate income in EUR/month, per 1 m², according to the use of property i in period t ; PK_{it} is the residual value of the public real estate in EUR per 1 m², according to the use of the property i in period t .

This study takes the estimated output indicator R_{it}^{Income} as its dependent variable. The following independent variables (inputs) are employed to assess their impact on R_{it}^{Income} :

$$R_{it}^{Income} = r^{income} (number_of_objects_{it}, managed_area_{it}, free_area_{it}, rent_rate_{it}, value_{it}), \quad (4)$$

where: $number_of_objects_{it}$ is the distribution of the number of public real estate objects by the use of property i in period t , and is expressed in pcs; $managed_area_{it}$ is the distribution of the area of owned public property by type of use of property i in period t , and is expressed in thousand m²; $free_area_{it}$ is the distribution of vacant public real estate area by type of use of property i in period t , and is expressed in thousand m²; $rent_rate_{it}$ is the distribution of rent per m² of public real estate by type of use of property i in period t , and is expressed in EUR/month; $value_{it}$ is the distribution of the residual value of the public real estate by type of use of property i in period t , and is expressed in EUR.

The influence of the independent variables on the dependent variable takes the form of a linear function using panel data:

$$r_{it}^{income} = \alpha_0 + \alpha_1 number_of_objects_{it} + \alpha_2 managed_area_{it} + \alpha_3 free_area_{it} + \alpha_4 rent_rate_{it} + \alpha_5 value_{it} + \varepsilon_t, \quad (5)$$

where: r_{it}^{income} is the capitalization rate, which represents the output of the management efficiency of the public property, for property i in period t , and is expressed as a percentage; $\alpha_0, \dots, \alpha_3$ are the scalar quantities (coefficients); ε_t is the error term.

For DEA, the relative efficiency score of the decision-making units (DMUs) can be defined as a linear programming problem:

$$E_A = \min_{\theta \in} \left\{ \theta \mid (\theta x_A, y_A) \in \hat{P} \right\}, \quad (6)$$

where: E_A is the relative DMU efficiency; x_A is the input used to achieve the result; y_A is the result achieved (output); \hat{P} is the empirical production set. DMU A is efficient when $E_A = 1$. If \forall DMU, where $A \in \{1, \dots, T\}$ and $(x_A, y_A) \in \hat{P}$, the efficiency index $0 \leq E_A \leq 1$.

We carry out DEA after the regression and correlation analysis results; therefore, the input indicators for DEA are selected in the follow-up study based on the final regression equation. The output of DEA is the capitalization rate calculated by the income value method for each property. To determine the weights of each input and output separately, we carry out DEA on a rolling time series basis.

For assessing the efficiency of public real estate property, we apply the classical DEA (resource-oriented) method in the form of an envelopment:

$$\min(\theta) \mid \sum_{j=1}^m z_j x_{ij} \leq \theta x_{ij}; \sum_{j=1}^m z_j y_{rj} \geq y_{rj}; \sum_{j=1}^m z_j = 1; z_j \geq 0, \quad (7)$$

where: $j = 1, \dots, m$, $i = 1, \dots, m$; y_{rj} is the r -th outcome indicator for the j -th public real estate application x_{ij} is the i -th resource indicator for the j -th purpose of the public real estate; z_j is the efficiency estimate for the j -th result indicator.

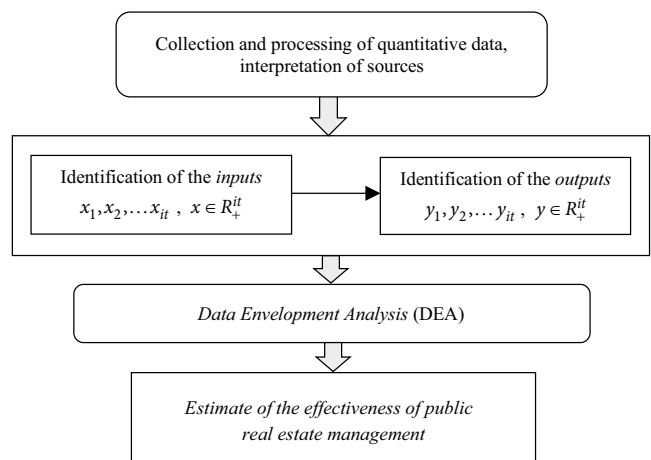


Figure 3. Model for assessing the effectiveness of public real estate management

Figure 3 illustrates the model of research used in this study, which is divided into three phases. In the first phase, we collect information about Lithuania's PREM structure, including the entities involved, the objectives set for effective asset management, and scientific literature that could provide some basis for the interpretation of the results of the empirical research. We systematize and process data from the State Enterprise Asset Bank, the National Audit Office, the Ministry of Finance of the Republic of Lithuania, and their published reports. In the second phase, we identify the input and output indicators. The input indicators are identified based on the information found in the scientific literature. The output indicator is identified following the income value (revenue capitalization) approach. In the same stage, we examine the statistical significance of the specified inputs and outputs using regression and correlation analysis, and interdependencies are sought. In the third phase, DEA is carried out using the regression and correlation analysis data. DEA results in the calculation of the public real estate management efficiency score, which answers the main objective of this study.

3. Results and discussion

As mentioned above, reports of PREM only became accessible since 2016. In our analysis we employed five reports that were available at time of carrying out this study (2016–2020).

Table 4 shows that the trends for 2016–2020 indicate several changes. Due to reorganization, liquidation procedures, and the reform switching to a centralized PREM approach from 2016, the number of state-owned properties has decreased by as much as 32% (from 724 to 494 units). However, the data presented in Table 4 show that Lithuania's public real estate remains largely decentralized. The continued inefficient sale of public real estate has led to a further decrease in the number of state-owned properties (down by 2.5% from 28,071 units in 2016 to 27,379 units in 2020, reducing the total area by 5.5% from 10.45 million m² in 2016 to 9.88 million m² in 2020). However, the decrease in public real estate has been slowed down by the volume of stateless or inherited real estate that is being taken over by the state, as well as by the increase in sales of low-value properties (i.e. small area property sale). Looking at the vacancy (new area) trend from 2016

to 2020, there is a 52% decrease to 0.095 million m². This significant change is not only due to the sale or lease of inefficient properties but also to the assignment of some vacant properties. As a result, vacant public properties accounted for less than 1% of the total in 2020, while it was approximately 2% in 2016.

The residual value of public real estate increased by as much as 13% between 2016 and 2020 or EUR 2,755.07 million. This is due to the increase in the volume of residual value data entered in SPIRS. Thus, the increase in the residual value of public real estate is attributed to better portfolio management and control through the systematization of state-owned assets in a single database. Finally, the costs required to maintain the properties increased by 26% to EUR 174.53 million between 2016 and 2020. This significant cost increase is due to the year-to-year rise in repair costs related to modernization and repair. In addition, the latter number also includes the cost of implementing SPIRS. Thus, all the changes over the last five years are related to the main objective of the efficiency of the management of Lithuanian public real estate: a) to have only enough public real estate units required for performing the functions of the public authorities, and b) to only keep properties that will not require ongoing maintenance or renovation expenses.

According to the latest report of Turto bankas in 2020, the largest share of the assets is used for fiduciary functions (78.7% of the total assets in 2020). In 2020, Turto bankas managed only 12% or 1.2 million m² of the public assets of 9.88 million m². However, out of the managed 1.2 million m² of assets, the centralized asset management model was applied to 664.7 thousand m² of the total 1,716.9 thousand m² of administrative-purpose assets. In 2019, 584.7 thousand m² of the 1,742.6 thousand m² of the administrative-purpose assets were managed by Turto bankas based on the centralized asset management model. This 80 thousand m² increase indicates that the centralized asset management model is progressing in Lithuania.

The main task of the last few years has been transferring administrative properties towards the centralized asset management model. For this reason, the Ministry of Finance of the Republic of Lithuania adopted the Order on the Establishment of the Efficiency Indicators for the Use of the Public Real Estate for Administrative Purposes and the Norms for the Provision of Real Estate for

Table 4. Summary of state-owned real estate for the period 2016–2020 (source: compiled by the authors based on Turto bankas, 2020)

Year	Number of managers	Number of objects	Total area (million m ²)	Vacant area (million m ²)	Residual value (EUR, million)	Maintenance costs (EUR, million)
2016	724	28,071	10.45	0.196	2,755.07	138.90
2017	700	28,320	10.40	0.178	3,007.30	154.58
2018	590	28,486	10.29	0.147	2,769.46	166.94
2019	532	27,906	9.94	0.105	2,996.11	152.83
2020	494	27,379	9.88	0.095	3,122.74	174.53

Administrative Purposes Necessary for the Execution of the Activities and the Implementation of the Public Functions of the State on February 23, 2017.

Our goal is to estimate the following ratios: the ratio of leased area to the total area, the ratio of the area not used for functional purposes to the total area, and the total maintenance costs of the administrative public real estate assets per 1 m² of total area (Table 5). The ratio of leased area to the total area shows that the latter varied from a minimum value of 1.35% (2016) to a maximum value of 2.3% (2017). The ratio of the area not used for functional purposes to the total area also did not reach the 5% reference value in any year during the sample period. In 2016–2020, this indicator varied from a maximum of 1.55% (2016) to a minimum of 0.93% (2018). Meanwhile, the total maintenance costs of the administrative assets

per 1 m² of the total area in all periods were approximately EUR 15 – EUR 17 per m². These results fall below the normative value of EUR 36 per m². Therefore, we can conclude that not all indicators were in line with the normative values in the period between 2016 and 2020. Conversely, the efficiency indicators for using administrative public assets identified and verified by the Ministry of Finance exceeded the actual values in all periods.

Even though the most significant part of public real estate is used to perform its fiduciary functions, attention to the lease of public real estate is equally important. Approximately 3.3% of the public real estate area is leased, generating additional revenue for the state budget. Furthermore, public entities lease assets to tenants and lease real estate from other entities, such as landlords (Table 6). Therefore, it is essential to overview the structure of trends

Table 5. Efficiency indicators for the use of administrative-purpose properties (source: compiled by the authors based on the Ministry of Finance of the Republic of Lithuania, 2017)

No.	Ratios	The formula for calculating the indicator	Indicator normative value
1.	Total floor area per employee, m ²	$\frac{\text{Total area}}{\text{Employee number}}$	28 m ²
2.	Office space per employee, m ²	$\frac{\text{Office area}}{\text{Employee number}}$	10 m ²
3.	The ratio of area transferred on a lease basis to total area, %	$\frac{\text{Area transferred on a lease basis}}{\text{Total area}} \times 100$	5%
4.	The ratio of leased area to total area, %	$\frac{\text{Leased area}}{\text{Total area}} \times 100$	5%
5.	The ratio of area not used for functional purposes to total area, %	$\frac{\text{Area not used for functional purposes}}{\text{Total area}} \times 100$	5%
6.	Total maintenance costs of the administrative public real estate assets per 1 m ² of total area, EUR	$\frac{\text{Total maintenance costs of administrative assets}}{\text{Total area}}$	36 EUR/m ²
7.	The ratio of office space to total area, %	$\frac{\text{Office space}}{\text{Total area}} \times 100$	60%

Table 6. Efficiency indicators for the use of administrative-purpose properties (source: compiled by the authors based on Turto bankas, 2020)

Year	Leased property by the state		Leased property from the state	
	Total leased area (million/m ²)	Annual rent paid (EUR, million)	Total leased area (million/m ²)	Annual rent received (EUR, million)
2016	0.074	5.99	0.250	6.52
2017	0.065	5.07	0.294	6.48
2018	0.075	5.84	0.304	5.65
2019	0.076	5.43	0.303	5.29
2020	0.074	5.75	0.318	12.18

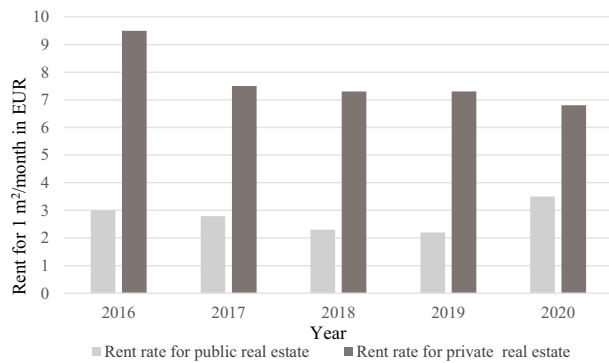


Figure 4. Comparison of rents per m²/month for leased public real estate and rented property (source: created by the authors based on Turto bankas, 2016–2020)

of the costs paid for leases and the revenues received from leased premises while performing PREM analysis.

Table 6 shows that in 2020, the total rent income generated from leasing public real estate equals EUR 12.18 million, an increase of 130% compared to 2019. The main driver of this sharp growth was the rise in lease fees for transportation and garage purpose premises (EUR +2.8 million) and auxiliary holding purpose premises (EUR +1.2 million). The increase in rent for these types of premises was driven by the rents of premises that the state-owned enterprise “Lietuvos oro uostai” (Lithuanian Airport) manages in Vilnius, Karmėlava, and Palanga. Although less real estate area was leased in 2020, the annual rent paid for it was almost 6% higher than in the previous period.

Lease of administrative property from the private sector accounts for most of the leased property and total rent paid in 2020 (0.064 million m² out of a total leased area of 0.074 million m², and lease revenue accounts for almost 91% of the total rent paid).

The rent rate is one of the most important factors to consider in the process of efficiently managing public real estate. Table 6 suggests that the difference between the cost of rented and leased property has always favored the state budget during the sample period. However, Figure 4

illustrates the rent rate for the leased state-owned property per m²/month compared to the rent rate per m²/month in the private sector and reveals that rent rates for public real estate are several times lower than rent rates for private real estate.

To assess the impact of selected independent variables (input) on PREM performance (output), we conduct a multistage panel data regression analysis. The final regression equation for the capitalization rate, which represents the output of public real estate’s management efficiency is as follows:

$$r^{income} = 0.6739 + 0.4014rent_{rate} - 1.64E - 06value. \quad (8)$$

Our findings suggest that the rent per 1 m² of public real estate is positively related to efficiency, where the coefficient on *rent_rate* is positive. An increase in the rent price of 1 EUR/month for 1 m² of will increase the output of the PREM efficiency by 0.4014%. Meanwhile, an increase of EUR 1 million in the residual value of the managed public real estate, which has a negative and thus fragile relationship with the dependent variable, will decrease the output of the PREM efficiency by 1.64E-06%. The coefficient of determination of the panel data regression equation equals 0.63, which means that the independent variables explain 63% of the PREM efficiency (output) variance.

In the next step, we conduct DEA with the following statistically significant independent variables: inputs *rent_rate_{it}* and *value_{it}*. As an output factor, we use *r_{it}^{income}*; the output is the result of the efficiency of PREM. In DEA, the output variables identified in the regression analysis are returned to the study’s *r_{it}^{income}* exclusions (anomalies). These exclusions were recorded for the 2018 health, 2020 auxiliary farm, and 2020 health public real estate use.

We perform DEA on two time series, with separate studies of the input *rent_rate_{it}* and output *r_{it}^{income}*, and the input *value_{it}* and output *r_{it}^{income}* weights. When considering the input *rent_rate_{it}* and output *r_{it}^{income}* time series, we assess whether the rent per 1 m² of leased public property for a given period is being managed efficiently. When considering the input *value_{it}* and output *r_{it}^{income}* time series, we assess whether the public entities responsible for the

Table 7. Estimation of the management efficiency of public real estate using the DEA approach by resource (input) *rent_rate_{it}*, 2016 and 2020

2016			2020		
No.	Purpose of the property	Efficiency estimate	No.	Purpose of the property	Efficiency estimate
1.	Manufacturing and warehousing	1	1.	Residential	1
2.	Transport and garages	1	2.	Auxiliary farm	1
3.	Residential	0.865	3.	Manufacturing and warehousing	0.837
4.	Auxiliary farm	0.538	4.	Science	0.506
5.	Other	0.308	5.	Administrative	0.355
6.	Science	0.250	6.	Other	0.337
7.	Health	0.147	7.	Transport and garages	0.221
8.	Administrative	0.113	8.	Health	0.073

property management have made the right decision at a given time: to continue disposing of such a residual value or whether it would have been better to sell the asset in terms of efficiency. In assessing the results, it is essential to realize that it is not only the number of available resources (inputs) but also the ability to use them most efficiently (generating the maximum result) that determines the efficiency of the management.

Table 7 reports the assessment of the input $rent_rate_{it}$ and output r_{it}^{income} time series and shows that in 2016, manufacturing and warehousing public assets and transport and garage public assets are recorded as efficiently managed (with an efficiency score = 1). This is due to their ability to deliver maximum efficiency with minimal input. However, the 2020 results show that those assets are no longer rated as efficient. In 2020, the efficiency score for manufacturing and warehousing public assets dropped to 0.837, and the score for transport and garage assets fell to 0.221. These efficiency estimates show that if the inputs of resources for each public property were to be more intensively used, a correspondingly higher output could be achieved r_{it}^{income} (i.e., 16.3% for manufacturing and warehousing, and 77.9% for transport and garages assets).

In 2016, the least efficient type of public assets were administrative assets (efficiency score = 0.113). Even though in 2016, administrative assets had the second-highest output indicator r_{it}^{income} and the highest input indicator, this type of public property was not ranked as cost-effective. In other words, the public entities responsible for the management efficiency of public administrative assets should have ensured a more intensive use of the available resources, which would have led to a higher output indicator r_{it}^{income} and could have increased the output by as much as 88.7%. However, regarding the 2020 results, the administrative assets already had a higher efficiency score (0.355) than in 2016. Therefore, we can argue that the available resources (input) have become more intensively used, and an even higher intensity of their use could lead to a higher output rate r_{it}^{income} of up to 64.5%.

We then examine the input $value_{it}$ and output r_{it}^{income} time series. Table 8 shows that in 2016, auxiliary farm assets and transport and garage assets scored 1 in the efficiency estimate. These results combined with those in Table 7 show that in 2016, transport and garage public assets were managed efficiently, both in terms of setting the rent per m^2 and deciding on the optimal residual value of the latter. The most inefficient types of assets in 2016 were administrative assets and scientific assets due to their high residual value. This structure did not change in 2020. Moreover, the efficiency estimates for the administrative assets dropped significantly, which is related to the increased residual value year on year. This causality could be explained by the fact that when some of the administrative assets were transferred to centralized management, they were subject to renovations to improve the quality of the assets.

Table 9 provides descriptive statistics on the effectiveness of PREM for all asset purposes over the 2016–2020 period. Input $rent_rate_{it}$ and resource (input) $value_{it}$ show similar trends. The average efficiency estimates for both started to decrease in 2017, only to recover in 2020. The overall average efficiency rate was 0.414 for input ($rent_rate_{it}$) and 0.231 for $value_{it}$ efficiency. The latter estimates show that if the available input resources were used more intensively in each case, an increase in output r_{it}^{income} of up to 58.6% could have been achieved over the entire sample period with input $rent_rate_{it}$, and up to 76.9% higher output r_{it}^{income} with input $value_{it}$. For resource (input) $value_{it}$, the efficient types of assets maintained their leading position throughout the sample period, indicating that no significant structural changes could have led to a change in efficiency. However, in the case of resource (input) $rent_rate_{it}$ the most significant changes in efficiency estimates over the 2016–2020 period were recorded for the auxiliary farm assets, scientific assets, and administrative assets. Efficiency estimates for auxiliary farm, scientific, and administrative assets respectively increased by 46.2 pp, 25.6 pp, and 24.2 pp to 1, 0.506, and 0.355 in 2020. Although the latter trends are positive, scientific

Table 8. Estimation of the management efficiency of public real estate using the DEA approach by resource (input) $value_{it}$, 2016 and 2020

2016			2020		
No.	Purpose of the property	Efficiency estimate	No.	Purpose of the property	Efficiency estimate
1.	Auxiliary farm	1	1.	Auxiliary farm	1
2.	Transport and garages	1	2.	Transport and garages	0.105
3.	Manufacturing and warehousing	0.390	3.	Residential	0.062
4.	Residential	0.304	4.	Manufacturing and warehousing	0.061
5.	Health	0.164	5.	Health	0.036
6.	Science	0.099	6.	Science	0.019
7.	Administrative	0.070	7.	Other	0.016
8.	Other	0.055	8.	Administrative	0.015

Table 9. Descriptive statistics for the DEA efficiency estimate, 2016–2020

Resource $rent_rate_{it}$ and result r_{it}^{income} time series					
	2016	2017	2018	2019	2020
Averages of efficiency estimates	0.528	0.511	0.265	0.228	0.541
Minimum value	0.113	0.156	0.030	0.016	0.073
Median	0.423	0.291	0.131	0.115	0.431
Number of effective types of assets in the group	2	2	1	1	2
Resource $value_{it}$ and result r_{it}^{income} time series					
	2016	2017	2018	2019	2020
Averages of efficiency estimates	0.385	0.163	0.281	0.163	0.164
Minimum value	0.055	0.015	0.010	0.010	0.015
Median	0.234	0.041	0.049	0.044	0.049
Number of effective types of assets in the group	2	1	2	1	1

assets and administrative purposes remain underperforming and could potentially achieve approximately 49.4% to 64.5% improvement in output r_{it}^{income} results.

The above analysis allows us to state that the efficiency of the PREM in Lithuania up until 2015 was regarded more as a formality. No centralized database of information concerning management efficiency existed until 2015. The major transformations in the legislations started to be addressed from 2015 as the new strategy was adopted. The renewed strategy included a set of desired criteria for efficient PREM and the renewed structure of the entities involved in formulating the public property policy and its management. Given this limitation in the availability of statistical data, the current study only assesses the efficiency of PREM for the period between 2016 and 2020, without having evaluated the efficiency of management before the significant changes started taking place in 2015.

Our empirical results comparing different types of assets suggest that public property in Lithuania is still considered one of the most inefficiently managed. Out of eight public asset types only residential assets showed efficient management in 2020. The trends of residential assets over the period 2016–2020 show a consistent increase in rent, a decrease in vacancy, and an increase in management efficiency output. Our results are similar to those of Girginer and Kaygisiz (2013), who also find that the efficiency of PREM is largely determined by the financial results achieved through the proper allocation of costs or the rental and sale of idle assets, and not by the organization of management. Our findings suggest that the output of public real estate management efficiency is positively determined by an increase in the fixed rent per m² of rented assets and negatively determined by an increase in the residual value of public real estate. Similar results have been obtained in other related studies, complementing the empirical results of this study. For example, Gross and Wolny-Kucińska (2021) show that the efficiency of public utility management is influenced by the short-term

surplus of public revenues over public expenditure. The authors attribute this to the desire to reduce the burden of maintaining public real estate. In other words, making improvements to a particular real estate unit from the public revenue surplus will increase the asset's residual value. In the long run, making improvements will reduce the cost of maintaining the property, as the improved condition of the asset will require less investment. Another similar study by Carbonara and Stefano (2020) also highlights that revenues, as opposed to expenditures, have a much more substantial impact on the efficiency of managing real estate assets. When the public entities responsible for the effective management of public property decide to reduce public expenditure alone without considering increasing public revenues, it leads to irrational and inefficient results of management.

Furthermore, the research results suggest that residential assets, which were mainly managed based on the decentralized approach, are the only public assets efficiently managed by the state in 2020. Scientific literature suggests that the centralized management of public property is one of the critical aspects determining management efficiency (Mackevičius & Ragauskienė, 2012). However, the results of this paper show the exact opposite trend, indicating that the decisive impact of a centralized management approach on the efficiency PREM is questionable. This outcome is supported by the fact that the administrative state-owned premises, as a part of central approach, were managed inefficiently between 2016 and 2020.

Conclusions

The efficiency of public real estate management is perceived differently by various scholars. Some argue that efficiency should be focused on a specific financial objective, using modern management techniques such as acquiring new assets, maintaining, and renewing existing assets, or leasing and selling idle assets. Others stress that the financial indicators and the foreseen budget alone are

insufficient to ensure the efficiency in the management of public property and that a specific strategic action plan should be adopted in parallel.

Our literature review results suggest that the most favorable approach for public real estate is the centralized management model. However, other factors can also ensure management efficiency, such as introducing a strategic public real estate procedure management system, securing rental income, strategic portfolio development, reducing vacant space, strategic organization of the management scheme, reducing the amount of space managed, identifying the need for public real estate, and reducing the cost of property maintenance. Unfortunately, in the context of the scientific literature, these factors are not adequately explored using different empirical assessment methods but rather analyzed in a more theoretical context. Furthermore, the assessment of the PREM efficiency itself is also based on relatively narrow research methods, which do not greatly contribute to answering the question of whether public real estate is being managed effectively or not. This is because different authors have analyzed the efficiency of PREM without assessing some or all the factors determining the efficiency. Thus, to address this research gap, this paper develops an empirical research methodology to assess the efficiency of PREM.

The results of the analysis suggest that public real estate in Lithuania is still one of the most inefficiently managed sectors. The results of the panel data regression study imply that the output of the management efficiency of public property is mainly determined by the rent per 1 m² of the leased area and the residual value of the managed property. Only two out of eight state-owned property types were efficiently managed in 2020: residential and auxiliary farms. However, given that an anomaly was recorded in 2020 for auxiliary farm assets, only residential assets were deemed efficiently managed. However, residential assets were managed in a decentralized way. This is in contrast to administrative assets, which were not managed efficiently in any year of the 2016–2020 period. However, given the limitations of this study and the fact that administrative assets have not been separately assessed as centralized or decentralized, this study's results may change with additional data. We noticed a progressive trend in the efficiency of PREM. This progress is related to better portfolio management, the disposal of unnecessary property, the increasing revenue collected for the state budget, and managed property ratio. If this trend continues in the future, the state will be able to collect more revenue from leases and thus increase the efficiency of the management of public assets. Additionally, our results reveal that the most critical output determinants of PREM efficiency are the rental price per 1 m² and the residual value of the leased premises. Furthermore, in the Lithuanian public sector, residential property is the only type of state-owned property that is managed efficiently. Alternatively, our results imply that publicly managed premises are not managed properly for the public benefit and thus highlights the importance of public property policy formation.

Within the framework of the empirical study conducted in this paper, we did not analyze centralized and decentralized administrative state-owned real estate separately, the results of which may differ. In addition, the results in 2020 may have been influenced by the COVID-19 pandemic, which brought into force the provision for a rent reduction of 80% of the total rent set in the lease agreement. This provision was applied to all public real estate tenants. However, the reduced rent was paid by tenants during the first quarantine months and for two months after its lifting. Thus, during the first quarantine, the state did not receive rental income of approximately EUR 163.8 thousand, which was also not included in the database used for this research. Despite these limitations, future research could further elaborate on the efficiency of PREM from a broader perspective, considering both centralized and decentralized management approaches, including a more extended period and other relevant aspects related to macroeconomic developments or the local economic situation.

Furthermore, while our research acknowledges the distinct priorities of PREM, such as the emphasis on public services, community well-being, and long-term infrastructure development, importance of political consideration (this is why profit generation usually considered as a secondary objective), we must admit that these priorities were not integrated in our model. This indicates a potential area for future research and improvement of the suggested model.

Author contributions

VC and EK conceived the study and were responsible for the design and development of the study and the data analysis. EK was responsible for data collection. VC and EK were responsible for data interpretation. VC completed amendments based on the referees. AB and SR were responsible to double check data interpretation and the results. VC wrote the first draft of the article and was responsible for proof-reading services. SR was in charge of the revisions the first draft of the article.

Disclosure statement

The authors do not have any competing financial, professional, or personal interests from other parties. We confirm that this manuscript has not been published elsewhere and is not under consideration by another journal. All authors have approved the manuscript and agree with its submission to the International Journal of Strategic Property Management.

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