

ATTRACTIVENESS OF COMMERCIAL REAL ESTATE LOCATIONS MEASURED USING WARD'S METHOD

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ARTICLE INFO	ABSTRACT
<p>Keywords: location attractiveness, commercial real estate, sales offer of investment properties, Ward's method</p> <p>JEL Classification: O14, O16, O18</p>	<p>The study addresses the problem of assessing the investment attractiveness of commercial real estate measured based on the location and land use planning of the real estate offered for sale. The database includes offers published on the following websites: www.olx.pl and www.otodom.pl, in the period from the beginning of June to the end of December 2022. The subject matter of the analyses undertaken in the presented study is focused on land properties which can generate income, including commercial, speculative and capital properties. In the study, the exits from national roads which provide access to expressways and motorways were analyzed, as well as the designation of commercial real estate specified in spatial planning acts, in relation to the property's offer price [USD]. The study used Ward's taxonomic method which determines the distance between clusters. The least favorable areas are Type 3 and Type 4 counties, whereas the most favorable location and the best land use planning was observed in the counties classified as Type 1. The offer price amount does not always confirm the assumption that the higher the offer price, the better the conditions for investment.</p>
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1. Introduction

The attractiveness of an area for business development is mainly determined by its location through its geographical, natural, infrastructural, technological, demographic, socio-economic, cultural etc. environment, as well as the economic actors operating in the area. Entrepreneurs choose the location which offers a competitive advantage over their competitors in both the long- and short-term perspective. The location itself remains the essential element of the decision to invest, however, the administrative and legal (planning) preparation of the future investment site is also crucial, which, in Poland, is primarily the responsibility of the local government.

The supply of building land is influenced by the ease of changing the designation of undeveloped land

(wastelands, agricultural land, forests) for the purposes of new development, the ease and freedom of dividing real property, access to infrastructure necessary for the construction and operation of structures, freedom of managing building land plots (regardless of their size) as well as planning and town-planning restrictions (Heldak, 2017; Krajewska et al., 2014). Compared with the buying of general products, real estate purchase requires more abundant and complex information (Chen & Wang, 2023).

According to Snieska et al., (2019), in most cases, local authorities become the key developers, creators and advertisers of the location (as an attractive place to develop a business). Under the market economy conditions, the so-called investment climate, created by the local government and business institutions, plays a key role. The state, regional and local authorities have

an important influence on creating the image of a place, the conditions for the development of entrepreneurship and highlighting both the spatial and fiscal advantages of a particular location (Strzelczyk, 2015). Local governments offer the location potential with the support of state mechanisms; entrepreneurs, on the other hand, make the choice of an efficient location in the long-term perspective. Younsi and Bechtini (2019), among others, discussed the development of sound policies and the establishment of a favorable business climate.

In Poland, the basis for obtaining a building permit is the local spatial development plan or, in the absence of a plan – the decision on land development and land use conditions. Therefore, the state of land preparation in terms of planning is very important and significantly reduces the time of preparing an investment for implementation. In addition to the local spatial development plan, which is not obligatory, municipalities have studies of spatial development conditions and directions, and once the legislative amendments have been implemented, they will be adopted as the general plans of the municipality. These plans do not replace the local plan, but only enforce the compatibility in terms of the content of both planning acts and limit the possibility for issuing decisions regarding the locations indicated in such an act. The investment climate created by Poland's smallest local government unit, the municipality, is reflected in preparing land for investment from the planning perspective (indications regarding the relevant function of land in the spatial planning act or the issued decision on its development conditions).

The attractiveness of a particular location depends on the compatibility level between the characteristics of the site and the needs arising from the nature of activity to be carried out (Budner, 2004). Location decisions are usually made in relation to a specific, already existing, economic and spatial layout (Szymańska & Płaziak, 2014).

The attractiveness of an investment in terms of the business location is also reflected in the transaction prices of the real estate offered for sale, which in connection with the intended land use, motivated undertaking the presented study.

The following authors wrote about the identification and analysis of decisive factors when it comes to attractiveness: Crozet, et al. (2004), Arauzo-Carod et al. (2010), Godlewska-Majkowska (2012), Ambroziak (2014), Sáez and Perianez (2015), Strzelczyk (2015), Ežmale (2016), Snieska et al. (2019), Zykiene et al.

(2021), and many others. Research covering the comparison of cities from multiple perspectives was conducted by the following authors: Bronisz et al. (2008), Freudenberg (2003) and Huggins (2003). In addition, a separate strand of research was performed in the field of land property market analysis and the influence of market characteristics on real estate transaction prices. The analyses covering this area were carried out by several authors, in Poland including: Hełdak and Kucher (2024), Hełdak et al. (2022), Bieda and Maniak (2024), Gaca (2018), Kucharska-Stasiak (2010), Foryś and Putek-Szeląg (2015) and others.

In Poland, the definition of land property is set out in the provisions of the Civil Code, in Art. 46 (consolidated text Journal of Laws from 2023, item 1610 as amended): land property is a part of the earth's surface which constitutes a separate object of ownership (land), as well as buildings permanently connected to the land or their component parts, if under specific provisions they constitute an object of ownership separate from the land. According to the cited definition, real estate can be divided into land, buildings and premises.

The subject matter of the analyses undertaken in the presented study refers to land properties which can generate income, including commercial, speculative and capital properties. No definition of a commercial real estate can be found in the legislation, however, it can generally be considered as suitable for business and unoccupied.

Due to different purposes of the property, commercial real estate is divided into office, retail and that intended for service activities. The purpose of commercial real estate is either to generate income or to approach it as a long-term deposit of cash (Uryniak, 2013). Office properties are generally divided into three classes of facilities: A, B and C, with the letter A assigned to the highest class and the letter C to the lowest one. Retail properties most frequently occupy very large areas and bring together tenants from a variety of fields. The properties intended for service activities include any premises offering services that allow employees and customers to remain in their area without restrictions, such as, e.g., car parks, warehouses, restaurants, beauty salons, etc. (Pabijanek, 2019).

The purpose of this study is to assess the investment attractiveness of a real estate based on analyzing the impact of the location and land use planning of the commercial real estate offered for sale in relation to the property's offer price. The study analyzed the impact of

the national roads, the distance from transport nodes allowing access to expressways and motorways, the intended use of commercial real estate in spatial planning acts and the decisions issued on development conditions, and the area of the real estate in relation to offer price of the properties offered for sale converted according to the dollar [USD] exchange rate at the National Bank of Poland on the day the observations were recorded.

In the initial phase of the study, a literature review was conducted, and the background of the research was presented, highlighting the importance of location as a crucial market characteristic in investment decision-making. After establishing the research objective and selecting the study area, information acquisition and data analysis methods were outlined. Sales data on properties intended for service purposes, gathered from online platforms were examined using a taxonomic method that facilitates the classification of objects with multiple attributes. The subsequent chapter characterizes the collected observations (land sale offers) and determines their statistical measures. The core section of the study conducts an analysis of the average offer prices for service properties across

various counties, comparing them with specific groups of market features: (1) property area and the investment readiness of the land from a planning perspective; (2) property area and access to major transport routes; and (3) property area, investment readiness of the land, and access to major transport routes. In the following chapters, a discussion is presented, responses to the formulated research questions are provided, and conclusions are drawn.

2. Material and methods

To achieve the adopted purpose of the study, the supply phenomenon in the regional commercial real estate market was analyzed and the listed offer prices were related to the selected characteristics influencing the prices of real estate intended for economic activity purposes, including the location and designation of the real estate in the spatial planning acts or the issued decisions on development conditions. Market analyses were carried out in Łódzkie and Wielkopolskie Voivodeships. Łódzkie Voivodeship is situated in central Poland, while Wielkopolskie Voivodeship is located to the west of Łódzkie Voivodeship.

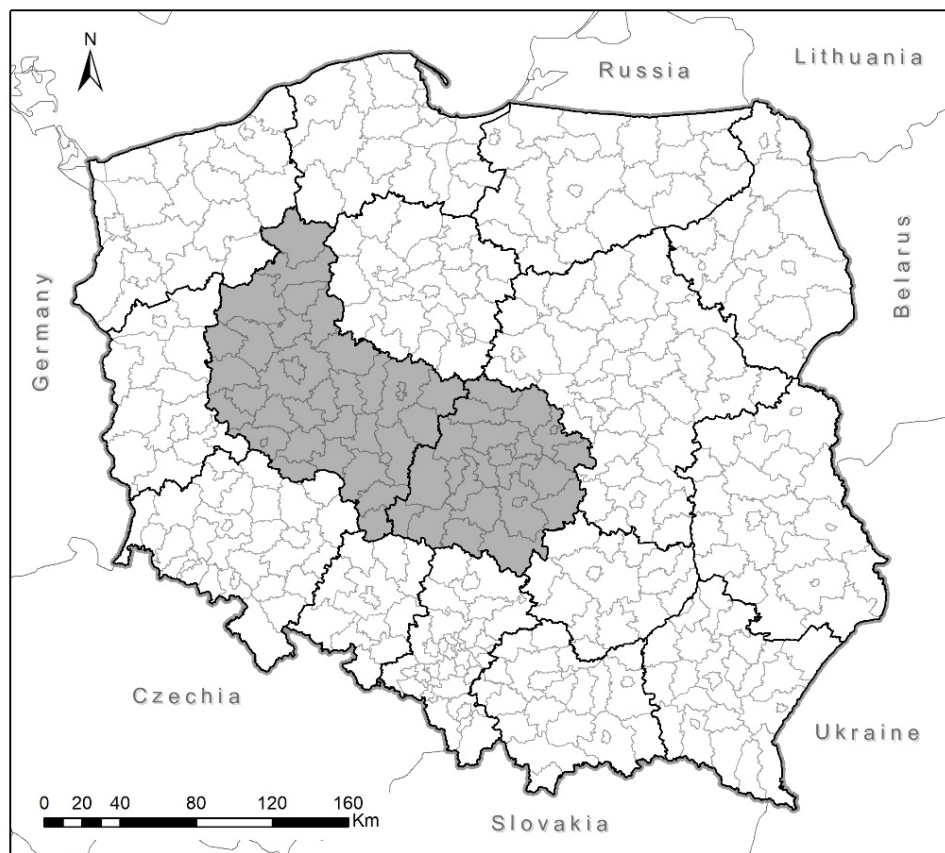


Fig. 1. Location of Wielkopolskie and Łódzkie Voivodeships constituting the subject of this study against the background of Poland. *Source:* own study.

The unit of comparison used in the study is the county within its administrative boundaries. Łódzkie Voivodeship with its capital in Łódź is divided into 21 counties, Wielkopolskie Voivodeship is divided into 31 counties with the city of Poznań as its capital (fig. 1).

The following problem questions were formulated in the course of the research:

- 1) Are the analyzed counties in Wielkopolskie and Łódzkie Voivodeships more attractive for investment in terms of land use planning (administrative and legal) or in relation to transport accessibility?
- 2) Which of the counties in Wielkopolskie and Łódzkie Voivodeships offer the best conditions for investment, considering exits from national roads and motorways as well as land use planning?

It was also established that, along with the increase in the location attractiveness, the offer price of a property increases. Each data analysis took into account several characteristics, in addition to market characteristics and the location or land use planning, also each time the area of the property offered for sale and the unit offer price (per 1m²).

Using the method of direct observation, a database of offer prices for the sale of land properties intended for investment purposes, in the counties of Łódzkie and Wielkopolskie Voivodeships was created. The database includes offers published on the following websites: www.olx.pl and www.otodom.pl, in the period from the beginning of June to the end of December 2022, which were described in terms of their location and planning conditions. The dataset was analyzed and statistical measures such as arithmetic mean, minimum value, maximum value, median, standard deviation, range, Pearson's simple linear correlation were used. The data were collected in the course of writing the master's thesis by Cyganek (2023), prepared at the University of Environmental and Life Sciences in Wrocław, majoring in Geodesy and Cartography.

Individual observations were checked in terms of the intended use of the real estate listed in the local development plan or, in the absence of a plan, based on an issued zoning decision and designation in the study on the conditions and directions for spatial development of the municipality. In the classification of attractiveness from the planning perspective, the following values were assigned:

- value 1, only in the case of the Study of conditions and directions for spatial development being valid,

- value 2 – when the decision on development conditions has additionally been issued,
- value 3 – when the area is covered by a local spatial development plan.

In terms of transport accessibility, the classification of counties took into account the distance from transport nodes providing access to expressways and motorways and the number of exits from individual expressways and motorways.

The following software was used to process the acquired data: Microsoft Office Excel spreadsheet, Microsoft Office Word, Numerical Taxonomy and ArcMap. Methods such as comparative, graphical, descriptive and basic statistical measures were used to formulate conclusions. The description leaves out the definitions of basic statistical measures, such as: arithmetic mean, maximum value, minimum value, median, range, and standard deviation, a high value of which indicates a large dispersion of observations (Cewe et al., 2005). The study also used Pearson's simple linear correlation and taxonomic methods. In the case of simple linear correlation, the correlation coefficient between two characteristics of a given variable takes values from -1 to 1. When the value is less than zero a negative correlation occurs, when it equals zero there is no correlation, and when it is greater than zero a positive correlation is recorded (Czaja & Ligas, 2010).

The taxonomic method used in the study allows for the classification of objects featuring more than one characteristic. The research used Ward's method, which involves determining the distance between clusters. This method consists in creating two groups of objects combined into one group in such a way as to reduce, as much as possible, the sum of the squares of standard deviations covering all objects of these two groups from the center of gravity of the newly formed group (Prus & Król, 2017).

This assumption allows for the joint analysis of several market characteristics. The presented research jointly analyzed the following characteristics:

- the average unit price offered, the size of the real estate and the investment land use from the planning perspective,
- the average unit price offered, the area of the property and access to the main traffic routes,
- the average unit price offered, the area of the property, investment land use (planning) and access to the main traffic routes.

3. Results

3.1. The characteristics of observations

As a result of the regional market observation, 544 land sales offers were obtained, including: 237 in Łódzkie Voivodeship and 307 in Wielkopolskie Voivodeship. Statistical measures were established both for the entire analyzed area and for the individual voivodeships. Due to the occurrence of outliers (over- and underestimated against average prices), some data were removed based on the standard deviation and the average value of offer prices. Finally, 460 real estate

sales offers remained in the database, of which 199 were from Łódzkie Voivodeship and 261 from Wielkopolskie Voivodeship. The basic statistical measures have been summarized in Table 1.

Based on the analysis of the compiled statistical measures, it has been observed that the average transaction prices, the maximum price, the standard deviation and the median reach very similar values.

Taking into account the area of the plots intended for service activities offered for sale and their average offer prices, a cartogram presenting the spatial distribution of the data was prepared (Fig. 2).

Table 1

Statistical measures of commercial real estate sale offers separately in Wielkopolskie Voivodeship and Łódzkie Voivodeships after final database cleaning for each voivodeship.

Calculated measures	Łódzkie Voivodeship			Wielkopolskie Voivodeship		
	Price [USD]	Area [m ²]	Unit price [USD/m ²]	Price [USD]	Area [m ²]	Unit price [USD/m ²]
Average	374 472.85	9012	52.20	322 675.19	8632	49.58
Minimal	6667.41	450	1.50	11 061.14	320	7.82
Maximal	2 433 449.70	40000	196.64	2 598 260.61	40000	193.13
Standard deviation	449 541.09	8358	46.09	376 474.22	8317	41.45
Median	216 306.64	6500	39.14	191 234.73	5607	34.57
Range	2 426 782.29	39550	195.14	2 587 199.48	39680	191.31
Number of offers		199			261	

Source: own study.

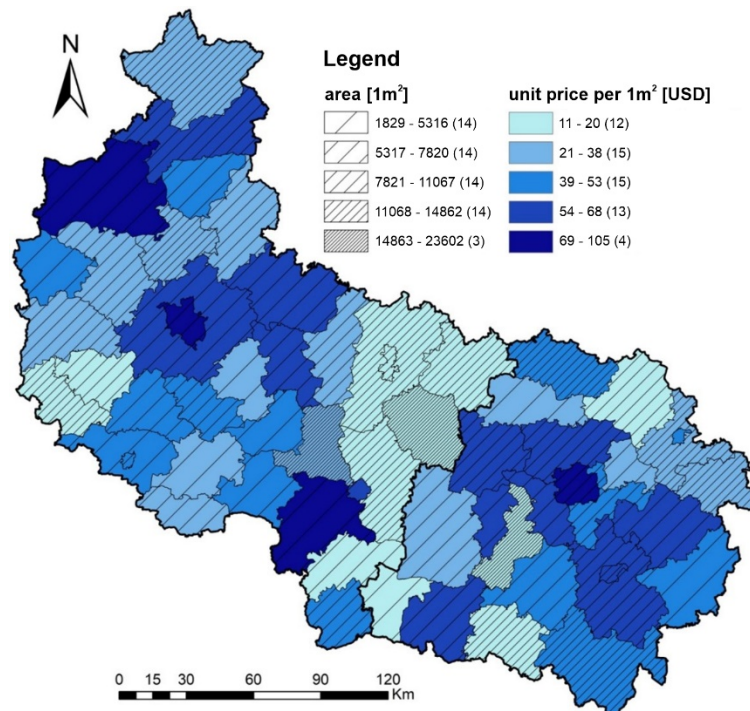


Fig. 2. Average area and average unit price of commercial real estate offered for sale in individual counties of Łódzkie and Wielkopolskie Voivodeships in the period from July to December 2022. Source: own study.

It can be noted that the largest average plot area was found in three counties and ranged from 14863 m² up to 23602 m². These are: Turek County, Pabianice County and Pleszew County. In turn, the smallest average areas occurred in the following counties: Gostyń, Ostrów Wielkopolski, Wieruszów, Środa, Opoczno, Czarnków-Trzcianka, Łęczyca, Zduńska Wola, Krotoszyn, Międzychód, Jarocin and Leszno, and also in two cities with county rights: Kalisz and Skierniewice. In the case of the average unit price, the lowest values were recorded in 12 counties, i.e.: Ostrzeszów, Koło, Grodzisk Wielkopolski, Wolsztyn, Konin, Turek, Kalisz, Wieruszów, Pajęczno, Łask and the township of Kalisz,

whereas the highest average unit prices were in: Czarnków-Trzcianka County, Ostrów Wielkopolski County, and also in the cities of Poznań and Łódź. Thus, the highest offer prices were observed in and around the voivodeship capital cities and in two counties with convenient transport accessibility and, at the same time, presenting a high level of economic development.

Having analyzed the spatial distribution of counties in Wielkopolskie and Łódzkie Voivodeships based on the standard deviation of offer prices and the area of plots intended for service activities offered for sale, it was found that it takes on significantly higher values in the south of the area covered by the study (Fig. 3).

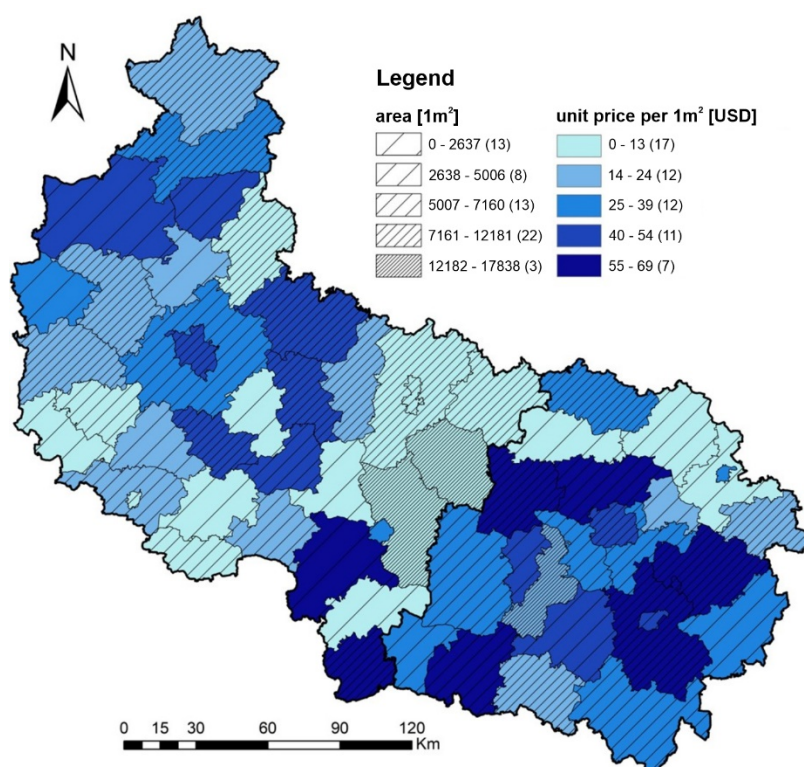


Fig. 3. Standard deviation of the value of the real estate area and the offer unit price in individual counties of Łódzkie and Wielkopolskie Voivodeships. Source: own study.

In the case of standard deviation regarding the real estate area, the highest values were found in the following counties: Turek, Kalisz and Łask, while the lowest values occurred in such counties as: Ostrzeszów, Skierniewice, Gostyń, Łęczyca, Pleszew, Wolsztyn, Środa, Międzychód, Ostrów Wielkopolski, Czarnków-Trzcianka, Oborniki and in the cities of Skierniewice and Kalisz. In the case of offer unit price, the smallest standard deviation was observed in as the counties of: Ostrzeszów, Skierniewice, Gostyń, Łęczyca, Pleszew, Środa, Wolsztyn, Koło, Turek, Konin, Kalisz, Grodzisk, Wągrowiec, Łowicz, Rawicz and also in the cities of Konin and Leszno, whereas the largest were noted in

the following counties: Piotrków Trybunalski, Poddębice, Zgierz, Tomaszów Mazowiecki, Wieleń, Kępno and Ostrów Wielkopolski. The standard deviation takes on significantly higher values in the counties of Łódzkie Voivodeship than in Wielkopolskie Voivodeship.

3.2. Attractiveness of investing in real estate measured by the sale offer price

The next stage of the research consisted in carrying out a detailed analysis of the real estate sales offers, in terms of the selected market characteristics, and also examining the influence a given characteristic has on

the unit price. For this purpose, Pearson’s linear correlation and taxonomic methods were used to facilitate the interpretation of the obtained results. The focus was mainly on such characteristics as plot area, offer unit price, access to main traffic routes, as well as the investment site development in terms of planning. Pearson’s correlation analysis findings are presented in the table below (Table 2).

Based on the compiled research results, it can be noted that a weak correlation is true for almost all correlations of the analyzed characteristics. The only exception occurs when combining the unit price and the number of exits, where the correlation is average. These findings allow for proceeding to further analyses using taxonomic methods.

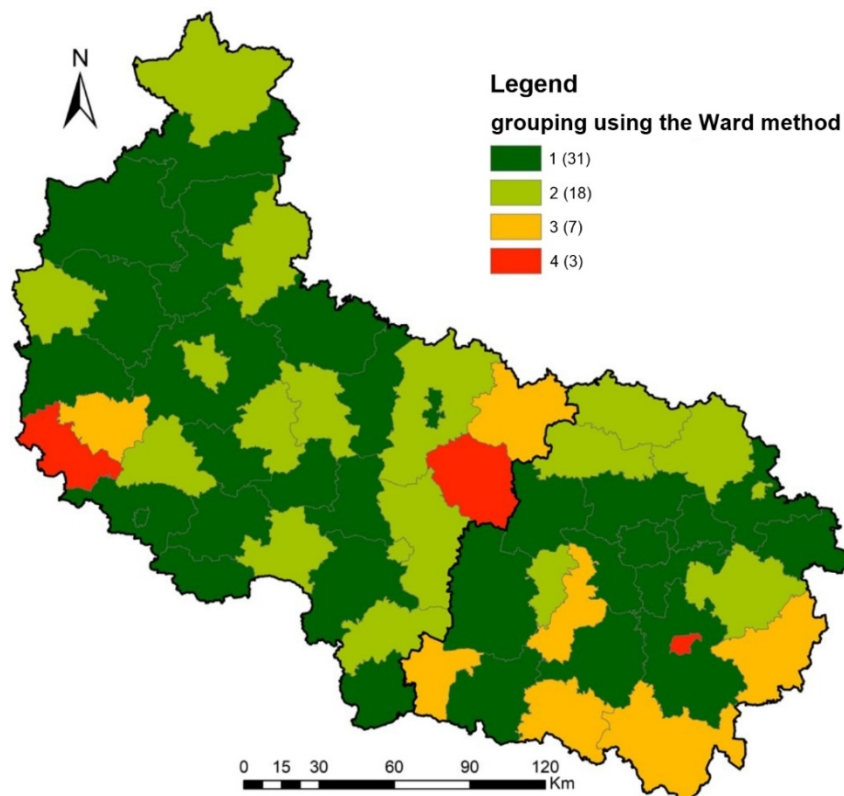
Taking into account three characteristics, i.e.: offer unit price, plot area and land use planning, it was established that the lowest prices are offered in counties classified as Type 3, i.e. the following counties: Koło, Wieruszów, Grodzisk, Opoczno, Łask, Pajęczno and Radomsko. Out of these seven counties, five are situated in Łódzkie Voivodeship and the remaining two in Wielkopolskie Voivodeship. In this type of counties, the unit price is between USD 1.50 and 10.21 per 1 m², while the plot area ranges from 1086 to 32900 m². The properties located in these counties are not attractive for investment, which is reflected in their low sale offer price. In these counties, the vast majority of offers provide only the study of spatial development conditions and directions (Fig. 4).

Table 2

Pearson’s simple linear correlation for the data set

Compared characteristics	Pearson’s coefficient value
Unit price vs. area	0.2795
Unit price vs. the number of exits	0.3739
Unit price vs. land use planning	0.2764
Area vs. the number of exits	0.0372
Area vs. land use planning	0.0154
Land use planning vs. the number of exits	0.0961

Source: own study.



Comparison of features: unit price [in USD], area [m²], preparation of the area for investment in planning documents (local spatial development plan and study of conditions and directions of spatial development of the commune)

Fig. 4. Investment attractiveness of the counties in Wielkopolskie and Łódzkie Voivodeships determined based on the real estate sales offer prices, real estate area and land use planning. Source: own study.

The best-rated county type is Type 1, which includes most of the analyzed area, mainly in the central part of Łódzkie Voivodeship as well as the northern and central part of Wielkopolskie Voivodeship. In these areas, all offers provide the study of spatial development conditions and directions and a local development plan; the average area of a commercial real estate is 6896 m² and the average unit price amounts to USD 64.23 per 1 m².

The next analyzed component was the following group of characteristics: unit price, area and access to the main traffic routes. Based on the analysis, it was determined that the most favorable location was found in the counties included in Group 1 (Type 1). In this case, the large size of the plots and easy access to the main traffic routes were the decisive factors. A relatively high average offer price, reaching a maximum of USD 148.25 per 1 m², confirms the attractiveness of

investing in commercial real estate located in the indicated areas (counties). The above-described type includes counties mainly from the northern part of Łódzkie Voivodeship and the northern, south-western and eastern parts of Wielkopolskie Voivodeship (Fig. 5).

The analysis shows that Type 3 counties characterized by the lowest average unit price are considered the least favorable. In Type 3 counties, none of the offers have access to the main traffic routes and the average real estate size is 9791.61 m². It includes the following counties: Ostrzeszów, Koło, Wieruszów, Grodzisk, Opoczno, Chodzież, Łask and Pajęczno. These counties are mosaic-like, distributed mainly on the periphery of the voivodeships.

The next stage of the conducted analyses involved comparing such characteristics as unit price, area, access to the main traffic routes and land use planning (Fig. 6).

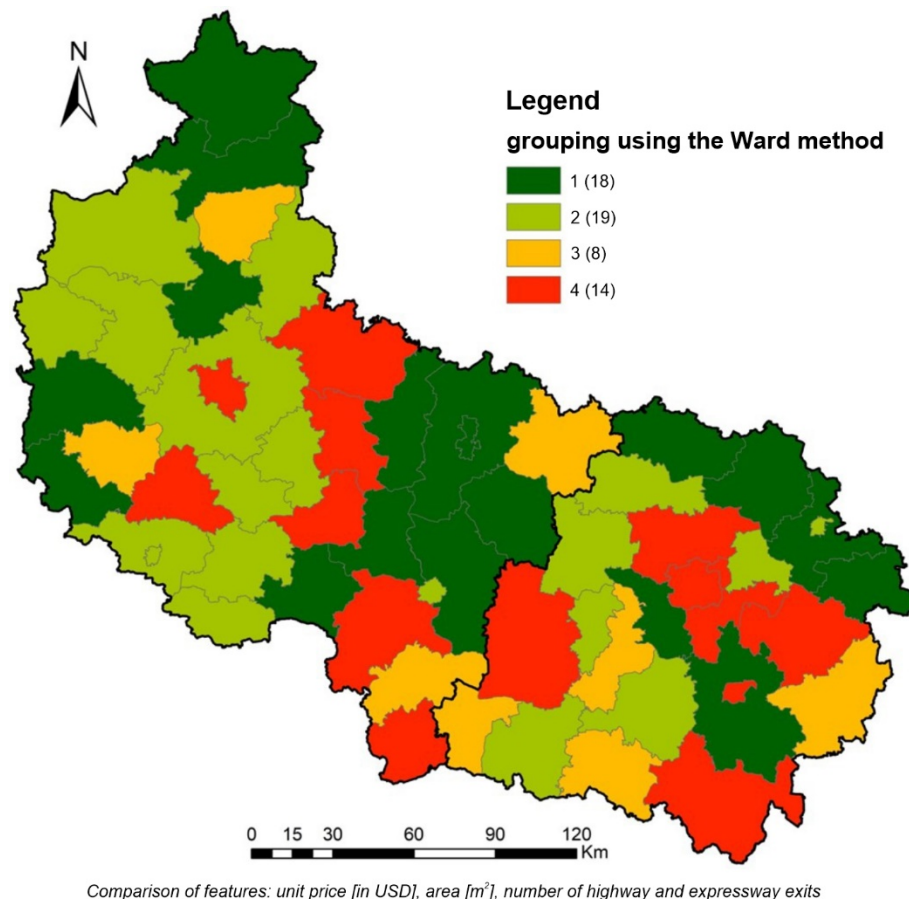
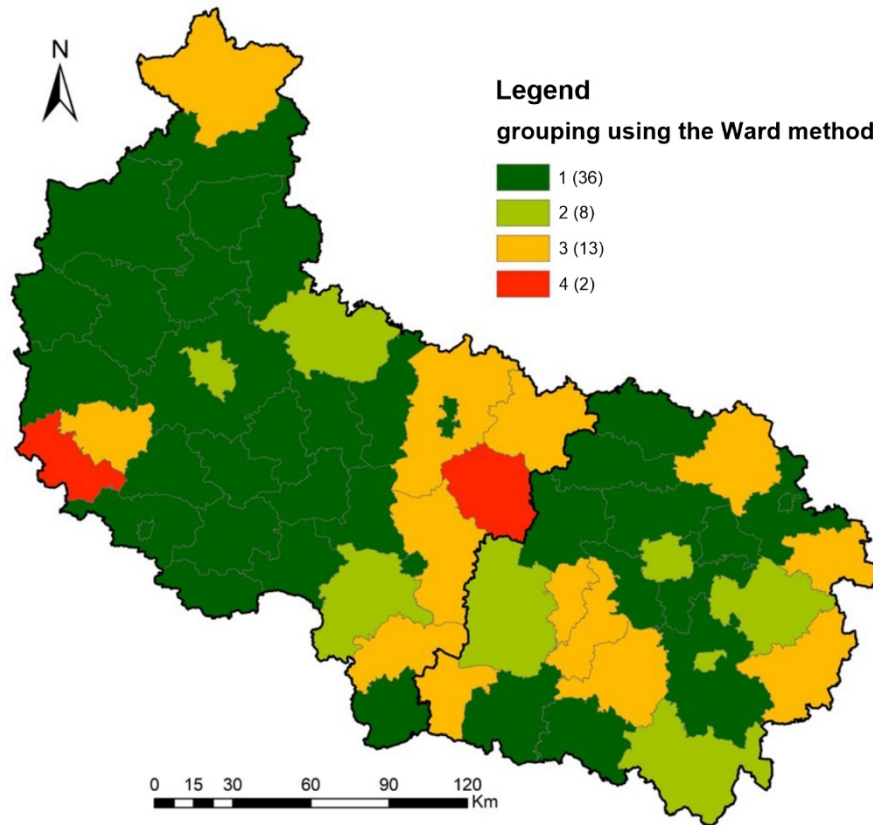


Fig. 5. Investment attractiveness of the counties in Wielkopolskie and Łódzkie Voivodeships determined based on the real estate sales offer prices, area and access to the main traffic routes. *Source: own study.*



Comparison of features: unit price [in USD], area [m²], number of highway and expressway exits, preparation of the area for investment in planning documents (local spatial development plan and study of conditions and directions of spatial development of the commune, decision on development conditions)

Fig. 6. Investment attractiveness of the counties in Wielkopolskie and Łódzkie Voivodeships determined based on the real estate sales offer prices, area, land use planning and access to the main traffic routes. *Source:* own study.

The most favorable is Type 1, covering counties with an average unit price of USD 55.46 and an average area of 6084.69 m². Some of the properties are situated in the localities with access to a single exit from an expressway or motorway, and all offers provide the study of spatial development conditions and directions as well as zoning decisions or a local development plan. This means that all sites are prepared, in terms of planning, for the implementation of commercial investments.

Although Type 2 properties offered for sale are characterized by the highest average price of all of the analyzed types, they have the smallest area, which translates into an increase in the average offer price. Small areas are less likely to be suitable for the service type of developments. In this case, land use planning varies to a great extent and is present in all three options. On the other hand, access to approx. 3 exits from expressways or motorways is an advantage of most of the offers included in this type.

The worst-rated Type 3 counties feature the lowest average price and the second lowest average area. Most of the analyzed offers do not have access to major

traffic routes and land development is as diversified as in the case of Type 2.

The next identified county type is Type 4, for which the average unit price is USD 38.84 per 1 m². This county type was rated very low in terms of location because the respective offers do not provide access to any expressways or motorway exits, and land development is as diversified as in the two aforementioned types.

4. Discussion

It is axiomatic that information is needed to support real estate decision making and it is equally true that this information has become progressively easier to obtain and grown substantially in volume and detail (Jin & Gallimore, 2010). The presented research differentiates counties in Wielkopolskie and Łódzkie Voivodeships regarding the groups of market characteristics indicated in the methodology. The analysis showed that in the counties without access to main traffic routes, the unit price is lower and goes up along with the increasing number of exits from expressways and motorways. However, there are

exceptions, e.g., Czarńków-Trzcianka County in Wielkopolskie Voivodeship with an offer price ranging from USD 69 to USD 105 per 1 m², and Zduńska Wola County in Łódzkie Voivodeship (the average offer price ranges between USD 54 and USD 68 per 1 m²). Land development for investment purposes has a certain influence on the offered sales price, however, this is lower than that of convenient transport accessibility.

The conducted research allowed us to answer the formulated problematic questions. The first question concerns indicating whether the analyzed counties are more attractive for investment purposes in relation to land use planning (administrative and legal) or in terms of transport accessibility. The analysis revealed that the majority of counties were rated favorably regarding land development for investment purposes from both a formal and legal (planning) viewpoint. In total, they make up 31 counties out of a total of 59. They form a compact group in Wielkopolskie Voivodeship, and along with Type 2, fill almost the entire area of Wielkopolskie and Łódzkie Voivodeships (total of 49 counties). An unfavorable situation occurs in the south of the analyzed area, in the counties of Koło, Wieruszów, Grodzisk, Opoczno, Łask, Pajęczno and Radomsko.

The assessment of attractiveness in terms of the available number of exits from national roads turns out much worse. Only 18 counties were classified as Type 1, characterized by high transport attractiveness. The spatial distribution is also different from the one presented in the development planning documentation. Transport accessibility was rated the best in the central and southern parts of the area under analysis.

Answering the next question, the best conditions for investment, considering the number of exits from national roads and motorways as well as planning, were found in counties located in the western part of the analyzed area. These counties constitute a compact group in Wielkopolskie Voivodeship and are definitely the dominating ones in this part of the analyzed area. In Łódzkie Voivodeship, only the counties centered around the voivodeship capital city of Łódź can be assessed favorably. The number of counties evaluated as attractive (Type 1) is 36 in total, and together with the Type 2 counties, their number amounts to 44. Certainly, there is a close correlation between the location attractiveness for commercial purposes and the investment location along with both formal and legal site preparation. These factors turn out to be the main strategic guidelines in shaping the economic policy of the location.

5. Conclusions

Commercial real estate offered for sale differs in terms of market characteristics (land use planning, access to main roads, area) and unit offer prices.

Based on the three analyses conducted using the Ward method, the least favorable results were found in the areas of Type 3 and Type 4 counties. In turn, the most favorable location and the best land use planning were observed in the Type 1 counties. The location attractiveness, assessed through the prism of transport accessibility and land use planning from both formal and legal perspective, was correlated with the offer price of commercial real estate.

The amount of the offer price does not always confirm the assumption that the higher the offer price, the better the investment conditions. Sometimes a small area of the property rules out the possibility of implementing investments requiring large areas, therefore, having also analyzed this feature, the high price does not always confirm the investment attractiveness of the plots offered for sale.

The decision about the location of a particular enterprise in a given space usually brings about far-reaching, long-lasting and often irreversible effects on its further operation (Szymańska & Płaziak, 2014). The final choice regarding the purchase of a commercial real estate (intended for service, retail, or office purposes) should be preceded by examining the legal requirements for the investment location in an individual country as well as the formal and legal status, including the real estate development planning determinants. This will significantly shorten the preparation period for the implementation of construction.

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