

## How City’s Biggest Employers Shape Spatial Development of The Residential Areas – Evidence from Olsztyn, Poland

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**Abstract.** Efficient managing sustainable urban development requires constant observations of trends in the key areas. One of the important areas is undoubtedly directing development of residential areas within the city and its surroundings. Nowadays, increasing incomes and transport mobility of the city citizens enable choosing between living within the city’s borders and building houses in the suburbs. Latter option makes city less compact and generates urban sprawl. As many controversies still arise over sprawling cities, the opposite of the smart growth, the factors behind this process should be monitored. In this article, we focused on spatial dependencies between localization of working and living places, because an access to the workplace seems to be one of the key determinants of choosing the particular place of residence. Therefore we decided to verify the following hypothesis: localization of the biggest employers in the city shapes the development of residential areas in the suburbs, and the influence depends on: current migration trends, specifics of the employers and their activity on the real estate market. The verification was carried out in the city of Olsztyn (Poland), the capital of Warmia and Mazury Province, and included careful analysis of the three city’s biggest employers.

**Keywords:** urban sprawl, suburban areas, commuting.

**Conference topic:** sustainable urban development.

### Introduction and background

Efficient management of sustainable urban development requires ongoing observation of phenomena occurring in areas of vital importance to a city. One of the important issues is development and transformation of residential areas including those located in the neighbourhoods. Development of housing in suburban areas entails commuting to the place of work, i.e. increased burden of shuttle traffic on specific access roads. Currently, higher income and greater transport mobility facilitate choices between living in the city or in suburban areas. This process has almost always accompanied urban development, whereas the term *suburbium* was used to denote development located beyond the walls of the ancient Rome (Bruegmann 2005). Currently, the course of the process, its causes and consequences constitute the object of numerous studies (i.e. Bagiński 2011; Heffner 2011; Kotus, Hławka 2010; Lorens 2005; Zborowski, Raźniak 2013; Brueckner 2001; Brueckner, Largey 2008; Bryant *et al.* 1982; Burchfield *et al.* 2006; Cheshire, Sheppard 2002; Glaeser, Kahn 2003; Irwin, Bockstael 2007; Nechyba, Walsh 2004; Wu 2006; Żróbek-Róžańska *et al.* 2014; Żróbek-Róžańska, Zadworny 2016).

Since the second half of the 19<sup>th</sup> century, the place of residence of the majority of people in western societies has been close to their place of work (Palak 2013). One of the causes for the increased popularity of settlement in the suburban zone was the extension of the distance accepted by employees between their place of residence and their place of work, due to the higher income and popularisation of new means of transport and solutions in the area of transport systems. Currently, the preferred distance of travel to work is 6–20 km, yet the acceptable distance reaches even 50 km<sup>1</sup>. However, the distance itself is not a sufficient determinant – the time of travel seems to be more important. The preferred time is 15–20 minutes, but the acceptable time is even longer – up to 60 minutes (Wheatley 2014). It is assumed that the most intense work travel is enclosed within the 45 minutes isochrone (i.e. Kitowski 1988; Stryjek, Warakomska 1980; Båtevik, Hansen 1995; ESPON 2004; Sakanishi 2006, in: Wiśniewski 2012). For commuters, it is important that the time of travel does not exceed the critical value (*Zatrudnienie w Polsce...* 2007) known as the “critical isochrone” or the maximum acceptable time of travel (Getis 1969). After this level has been reached, the travel intensity plummets. In reference to the space, the distance covered within 45 minutes may mean

<sup>1</sup> According to survey conducted in 2014 by *praca.pl*, 46% Polish people were ready to travel to work up to 20 km, and 23% up to 50 km. More than 50 km travel only 13%. Source: *Praca.pl* 2014.

that the commuters cross the administrative borders of the city on a daily basis, travelling from their places of residence located in suburban areas.

The current migration trends observed in Poland show that evermore people migrate towards rural areas located in the vicinity of cities (*Migracje...*2014). The Polish trend is also noticeable in Warmia and Mazury Province (Żróbek-Róžańska, Zysk 2015). According to statistical data, persons residing in rural areas were dominant among employees living in Warmia and Mazury Province and commuting. Employees chose cities, as opposed to rural areas, three times more frequently as their place of work. The majority of people commuting to the city of Olsztyn lived within the administrative borders of Warmia and Mazury Province (89.7%) and 33.5% of the total number of commuters came from the municipalities of Olsztyn District (*Dojazdy do pracy...* 2011).

On the basis of compilation of the information above, a hypothesis was constructed that development of housing areas in the suburban zone occurs primarily in areas located at a travel distance up to 45 minutes to largest employers located in such a city. On the other hand, the scale of development should depend on the specific character of a company. It seems that companies primarily employing manual labourers should clearly influence the nearest municipalities located within the area designated by the range of the 45 minute isochrone. On the other hand, the range of impact of companies dominated by office workers should be more extensive, as persons with higher education, for whom the local labour market does not offer the possibilities of professional development, more frequently accept longer times of commuting to work (Bjarnason 2014). The influence may be intensified by the pro-employee activity of the employer in the real estate market (e.g. selling own real estate located in specific municipalities to employees). The objective of this article is to verify the above-presented hypothesis on the basis of Olsztyn (Poland) via a detailed analysis of the three largest employers, whose workplaces are located in various parts of this city (southern, eastern and north-eastern section).

## Materials and methods

The study was performed in Olsztyn, the capital of Warmia and Mazury Province, located in the north-eastern part of Poland. In 2016, the area of the city was 8,833 hectares, of which 41% was developed and urban land. In 2015, the number of residents amounted to 173,444 and, in accord with the methodology of the Polish Central Statistical Office; Olsztyn was classified as a large city<sup>2</sup>. The city of Olsztyn is the main centre of the tyre, timber, furniture and food industries. Furthermore, the University of Warmia and Mazury (the only public university) is located in the city; it has 20,000 students on average. In the list of largest employers with respect to the number of employees, the top three positions are occupied by: Michelin Polska S.A. (tyre industry), University of Warmia and Mazury in Olsztyn (university) and Indykpol S.A. (food industry). All three units are located in various parts of Olsztyn, in the vicinity of its administrative borders. In reference to the presented studies of reference literature, the detailed analysis includes an area within the critical isochrone equal to 45 minutes of travel in a car from selected companies. As a result of such assumptions, the majority of municipalities constituting Olsztyn District were within the examined area.

Data procured from the City Office of Olsztyn, the Central Statistical Office and directly from the interviewed employers was used for a comprehensive analysis. The number of all employees for whom the necessary data was collected amounted to 8,646. The analysis was performed in the following stages:

1. The migration trend in Poland, Warmia and Mazury Province<sup>3</sup>, Olsztyn District and the city of Olsztyn was examined.
2. Employment structure of selected employers was analysed.
3. On the basis of the assumption of the 45 minute isochrone, the municipalities, which are the most probable place of residence of employees, were initially selected.
4. Data concerning places of residence of employees of individual selected companies was compiled.
5. The initial selection of municipalities was compared with the municipalities where the employees of examined employers actually reside.
6. With the use of maps, transport routes encumbered with the greatest commuter traffic generated by the commuting employees were designated.
7. Results were analysed and conclusions were drawn.

The analysis was performed with the use of spreadsheets and QGIS software.

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<sup>2</sup> Large city in Poland means city with more than 100,000 residents.

<sup>3</sup> Poland is divided into 16 provinces (NUTS 2), each province is divided into districts (total number is 314 plus 66 cities with the district rights), and each district is divided into municipalities (total 2749). Olsztyn district consists of 12 municipalities and 10 of them is localized within study area.

## Results

The same tendency has been observed in Poland every year of the current century: a decrease in the number of people living in cities and an increased number of rural residents. The same tendency may be observed in Warmia and Mazury Province and Olsztyn District. Between 2004 and 2014, all municipalities in the district recorded an increase in population from 7.51% to 10% (*Stan i struktura... 2015*), whereas the city of Olsztyn has been inhabited by a decreasing population since 2009 (e.g. in 2010, the number of residents amounted to 175,388 people and in 2015 to 173,444).

Because of the necessity of daily travel to work, the choice of a suburban municipality as the place of residence should depend on the convenient distance from the work place. In 2016, the largest employer in the Olsztyn labour market was Michelin S.A., the manufacturer of car tyres. The company was established as a result of purchase of a majority shareholding package of the Polish company Stomil Olsztyn S.A. which, in turn, was established as a result of transformation of the state-owned company OZOS "Stomil" (founded in 1962) in 1992. Currently, this Olsztyn company is one of the largest plants of the Michelin Group in the world and the largest tyre production plant in Poland. In 2016, the company had 4,267 employees in total; a definite majority of them (76%) worked as manual labourers. The plant is located in the eastern part of Olsztyn.

The second position in the labour market in Olsztyn is held by the University of Warmia and Mazury. The history of the university dates back to 1950 when the first tertiary-level school was established in Olsztyn – the Higher School of Agriculture, which in 1972 was renamed the Agricultural and Technical Academy. The University was established in 1999 as a result of the merger of three tertiary-level schools existing in Olsztyn: the Agricultural and Technical Academy, the Higher Pedagogical School and the Warmia Institute of Theology. In 2016, the University had 17 faculties and approx. 23,000 students. The number of employees was 3,259, of whom 56% were academic employees; those remaining were administrative employees and employees working at positions related to serving the University. The University is located in the southern part of Olsztyn.

The third largest employer in Olsztyn is a company operating in the food industry – Indykpol S.A. The history of this company began 1951 with the establishment of the state-owned Ekspozytura Centrali Jajczarsko-Drobiarskiej (Branch Office of the Egg and Poultry Production Headquarters) in Olsztyn, transformed into Olsztyńskie Zakłady Drobiarskie (Olsztyn Poultry Factory). In 1991, the enterprise was privatised and began to operate under the name Indykpol. In 1993, the company changed its organisational form and has been functioning to date as Indykpol Spółka Akcyjna (PLC). After purchase of shares in Eldrob S.A. and Lubdrob S.A., Indykpol S.A. became the leader of the capital group of poultry companies. In 2016, the company had 1,120 employees<sup>4</sup>, among whom 68% held manual labourers' positions. The company is located in the north-eastern part of the city of Olsztyn.

Assuming a limit of 45 minutes of travel to work, with the average speed of driving in Olsztyn during the rush hour amounting to 15 km/h (Piłat 2008), the place of residence located within the administrative borders of the city should be at the maximum distance of 11.25 km from the work place. In the suburban zone, where the speed of driving is greater, the zone may be extended to 45 km (assuming the average speed of 60 km/h<sup>5</sup>). In effect, the research area encompasses the city of Olsztyn and almost all municipalities in Olsztyn District: Barczewo, Biskupiec, Dobre Miasto, Dywity, Gietrzwałd, Jeziorany, Jonkowo, Olsztynek, Purda and Stawiguda. These municipalities are diverse with respect to their location in relation to the city of Olsztyn, as well as prices of real estate. The analysis of prices of real estate for sale has shown that the highest prices of residential real estate (plots and houses) were recorded in Stawiguda and Dywity municipalities, and subsequently in Gietrzwałd and Barczewo. In the remaining municipalities, the prices were significantly lower and showed a decreasing tendency with the increase of distance from Olsztyn.

According to the adopted premises, it was expected that the employees of the examined companies should reside in the following municipalities:

- Michelin S.A.: in the entire area of Olsztyn and in the following municipalities: Barczewo, Dywity, Purda and Stawiguda;
- University of Warmia and Mazury in Olsztyn: in the entire area of Olsztyn and in the following municipalities: Jonkowo, Gietrzwałd, Olsztynek, Purda and Stawiguda;
- Indykpol S.A.: in the entire area of Olsztyn and in the following municipalities: Barczewo, Dobre Miasto, Dywity and Purda.

For the purpose of verifying the hypothesis, information concerning places of residence of all employees whose data is kept in the HR files of the examined employers was compiled and analysed. 8,646 persons were qualified to the first stage; subsequently, sub-sets of people residing in Olsztyn, municipalities within research area and municipalities located outside of the adopted research area were separated. The following results were obtained (see Table 1):

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<sup>4</sup> Data for the whole corporation.

<sup>5</sup> This speed of driving results from own measurements and considers both local speed limits and quality of roads in 2016.

Table 1. The share of employees according to the place of residence  
(Source: Own elaboration on the basis of data from studied units)

The share of employees living in:	Michelin S.A.	Indykpol S.A.	UWM
Olsztyn	66%	43%	68%
municipalities located within research area	20%	13%	17%
municipalities located outside of research area	14%	44%	15%

Content-related verification of the obtained results caused an assumption about absence of reliability of certain data, resulting from the fact that the obligation of updating the place of registered residence in Poland is not enforced. Therefore, it was assumed that persons declaring residence in external municipalities with respect to the examined area are persons who actually reside within the examined area, yet provide a different location as the place of registered residence. Due to the fact that their actual commuter travel cannot be determined, such information was removed and the sample of persons registered within the examined area was subjected to further analysis (see Table 2).

Table 2. The share of employees sample according to the place of residence  
(Source: Own elaboration on the basis of data from studied units)

The share of employees living in:	Michelin S.A.	Indykpol S.A.	UWM
Olsztyn	76.6%	77.4%	81.4%
municipalities located within research area	23.4%	22.6%	18.6%

On average, every fifth examined person resided outside of Olsztyn in places located in a suburban zone. Figure 1 presents the distribution of actual places of residence of employees commuting to work in the tyre production company. Employees of Michelin S.A. who commuted from the suburban zone resided primarily in the Barczewo municipality (25.4%). Slightly smaller proportions were recorded in Stawiguda (14.4%), Dywity (14%) and Purda (12%). The remaining municipalities of Olsztyn District were inhabited by from 3% to 7% of the examined population. In the case of this company, municipalities selected as probable places of residence proved to comply with the actual status.

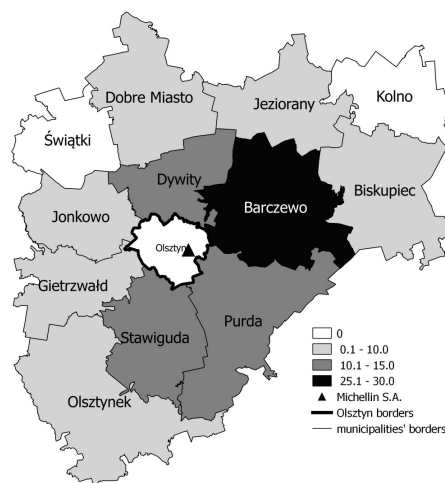


Fig. 1. Spatial distribution of residence intensity of employees of Michelin S.A. in the suburban municipalities of Olsztyn (Source: Own elaboration on the basis of data from Michelin S.A.)

Figure 2 presents the distribution of places of residence of employees commuting to the University. For the employees of the University of Warmia and Mazury in Olsztyn, the most popular municipalities included Stawiguda (27%) and Dywity (18%), and subsequently Barczewo (14%) and Jonkowo (12%). Less popular locations were within the municipalities of Gietrzwałd and Purda (10% each), whereas remaining municipalities constituted a place of residence for a small number of employees residing in the suburban zone (from 1% to 3%). In the case of the University, the actually inhabited municipalities were not fully convergent with the municipalities selected as most attractive on account of travel to work. Even though the popularity of Stawiguda was confirmed, yet according to the adopted method, the employees should not be interested in living in Dywity and Barczewo, whereas they should use the vicinity of the Purda and Gietrzwałd municipalities.

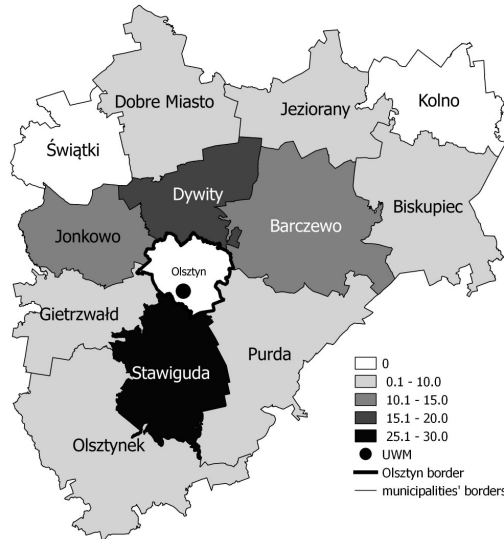


Fig. 2. Spatial distribution of residence intensity of employees of the University of Warmia and Mazury in the suburban municipalities of Olsztyn (Source: Own elaboration on the basis of data from UWM)

Third figure (Fig. 3) presents the distribution of places of residence of employees commuting to the company operating in the poultry industry. The employees of Indykpol S.A. inhabited the vicinity of Barczewo (39%), Dywity (18%) and Dobrze Miasto (11%) in the greatest degree. The remaining municipalities were inhabited from 7% to 3% employees commuting from places located near Olsztyn. In the case of this company, the municipalities selected as places of residence in the majority of cases converged with the actual status – only the potential resulting from the location of Purda has not been utilised.

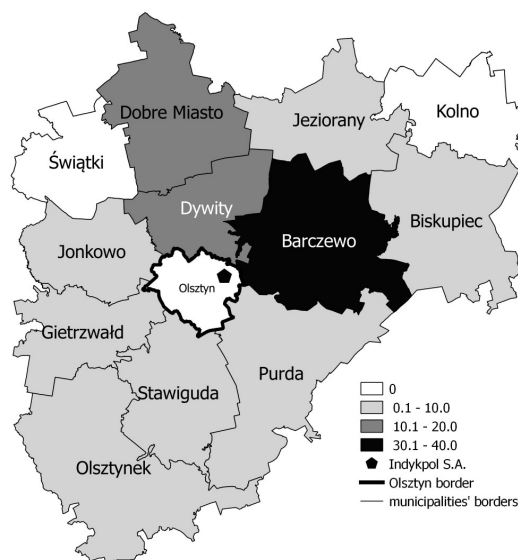


Fig. 3. Spatial distribution of residence intensity of employees of Indykpol S.A. in the suburban municipalities of Olsztyn (Source: Own elaboration on the basis of data from Indykpol S.A.)

The distribution of places of residence may also be influenced by the housing policy of these companies or institutions. Currently, the only entity that has been active in the real estate market is the University. It was the perpetual lease holder of land or owner of land fit for residential development. Some of the landed property for residential development was sold via competitions exclusively for the employees of the University. Plots sold between 2005 and 2015 were located in the area of the city of Olsztyn and Stawiguda municipality, which also influenced the development of this suburban municipality<sup>6</sup>.

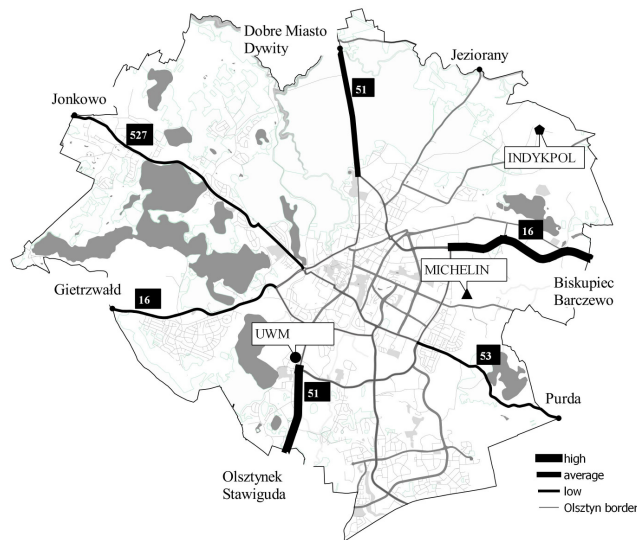


Fig. 4. Intensity of traffic on access roads to Olsztyn caused by employees of Michelin S.A., University of Warmia and Mazury and Indykpol S.A. residing in the suburban zone (Source: Own elaboration on the basis of data from Michelin S.A., UWM and Indykpol S.A.)

Distribution of places of residence of employees working for the largest employers in the city directly determines the burden on transport routes with commuter traffic (see Fig. 4). In the case of Olsztyn, most people travelling on a daily basis from the suburban zone to work at Michelin S.A., the University of Warmia and Mazury or Indykpol S.A. use access road No. 51 along the Olsztyniek-Olsztyn route and No. 16 along Barczewo-Olsztyn; hence, these roads were classified with the highest intensity. Road No. 51 between Dobrze Miasto and Olsztyn is less burdened (average intensity), whereas least burdened is road No. 51 between Gietrzwałd and Olsztyn and No. 53 between Purda and Olsztyn – lowest intensity.

## Conclusions

The performed study has shown that in the case of Olsztyn, the location of main employers influences the development of the housing zone also in the suburban area. In the case of industrial companies where manual labourer positions predominate (Michelin S.A. and Indykpol S.A.), the employees lived in locations enabling travel to work within the assumed time of less than 45 minutes. However, selecting places of residence according to the assumption of the 45 minute isochrone had lesser efficiency in the case of the University of Warmia and Mazury. The causes may include the specific character of the examined entities and the employment structure resulting from them. Both Michelin S.A. and Indykpol S.A. are production companies, employing mainly manual labourers at positions not requiring specific qualifications, whereas characterised by fixed work hours. In this situation, the employer's proximity was of vital importance. On the other hand, almost a half of the employees of the University of Warmia and Mazury are academics, i.e. persons with higher education and specifically profiled qualifications, for whom labour markets delimited by the distance of 45 minutes may be too "narrow" (the dependence between the level of education and the size of the labour market was discussed by, *inter alia*, Sandow, Westin 2010). Furthermore, as shown by the study, educational accomplishments increase the tendency to cover greater distances, whereas higher pay results in the fact that longer time of travel to work becomes economically available (Heldt-Cassel *et al.* 2013; Sandow, Westin 2010; Maoh, Tang 2012). Therefore, it may be assumed that the university employees are ready to travel to work longer from more expensive suburban municipalities where more comfortable housing estates provided with infrastructural facilities are located in comparison to employees of industrial companies. The impact of the location of the University of Warmia and Mazury on the development of the

<sup>6</sup> According to data gathered from the UWM real estate management department.

residential zone in Stawiguda municipality was also intensified by the activity of this entity in the real estate market, due to the fact that the University sold land to its employees located exclusively in the area of two municipalities – Olsztyn and Stawiguda. Concluding – the case study of Olsztyn has shown that there may be a clear dependency between the location of the largest employers and the development of housing zone in the suburban areas. The municipalities inhabited by most employees working for the examined units (namely Barczewo, Dywity and Stawiguda) are, simultaneously, the municipalities which in the last 10 years recorded the greatest growth of population in the entire Olsztyn District (Central Statistical Office). These conclusions may be useful for city authorities wishing to manage a city in a sustainable manner, due to the fact that the daily commuter traffic generates increased burden on access roads connecting these municipalities with the city.

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### Contribution

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work to take public responsibility for the content, including participation in the concept, design, analysis, writing, or revision of the manuscript. Furthermore, each author certifies that this material or similar material has not been and will not be submitted to or published in any other publication before. Alina Żróbek-Róžańska was responsible for the conception and design of the work, analysis and interpretation of data, drafting the article. Sabina Żróbek was responsible for acquisition of data and interpretation.

### Disclosure statement

Authors declare that they have any competing financial, professional, or personal interests from other parties.

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