

Elżbieta Chączyńska

The conversions of the city structure and their influence on the demographic phenomena

Bulletin of Geography. Socio-Economic Series nr 15, 143-154

2011

Artykuł został opracowany do udostępnienia w internecie przez Muzeum Historii Polski w ramach prac podejmowanych na rzecz zapewnienia otwartego, powszechnego i trwałego dostępu do polskiego dorobku naukowego i kulturalnego. Artykuł jest umieszczony w kolekcji cyfrowej bazhum.muzhp.pl, gromadzącej zawartość polskich czasopism humanistycznych i społecznych.

Tekst jest udostępniony do wykorzystania w ramach dozwolonego użytku.

ELŻBIETA CHADZYŃSKA

WROCLAW UNIVERSITY OF TECHNOLOGY, POLAND

THE CONVERSIONS OF THE CITY STRUCTURE AND THEIR INFLUENCE ON THE DEMOGRAPHIC PHENOMENA

DOI: 10.2478/v10089-011-0010-0

ABSTRACT. The process of socio-economic change, which started in Poland in 1989, began the series of modifications in the structure of Polish cities. These changes embrace the economic sphere and the social sphere, as well as the habitable environment. The changes occurring in Polish cities resemble the processes present in settlement systems in highly developed countries. They take place, however, with some delay which is caused by the movement from the centrally controlled economy to the market economy and all the problems associated with it.

The aim of the presented article is to show the influence of occurring changes on the socio-economic development and demographic situation apparent in small towns of the Wrocław Metropolitan Area (WrMA). The attempt of evaluation of factors promoting the development was undertaken. The value of chosen characteristics was analyzed for the set of small towns of Dolnośląskie voivodship. The analysis of chosen quantities common for demographic phenomena in a longer time cross-section (1995–2008) pinpoints the irregularity of development of specific towns, which may result in negative effects for the whole area in the future.

KEY WORDS: Poland, Wrocław Metropolitan Area, Dolnośląskie voivodship, small towns, urbanization, demographic changes.

INTRODUCTION

The city as a specific settlement unit is the place of realization of a predominant social and economic activity of human beings and it changes constantly. The processes of change are usually dynamic and are often connected with the overcoming of many obstacles, of inner and outer character. The transformations of cities, which have been taking place for ages, have caused lots of changes concerning the function of cities and their roles. In consequence, it required specific

modifications in their morphology, resulting from the necessity of adjustment to current conditions. The mentioned phenomena have caused changes of activities and living conditions of inhabitants. It is strictly apparent in the number of citizens and the dynamics of its change, the density of population and wandering moves of citizens living in urbanized areas. The following phases of urbanization were responsible for a great number of structure conversions in cities, resulting in changes in the economic and social sphere.

The process of socio-economic changes, which started in Poland in 1989, began the series of modifications in the structure of Polish cities. These changes embrace the economic sphere and the social sphere, as well as the habitable environment. The changes occurring in Polish cities resemble the processes present in settlement systems in highly developed countries. They take place, however, with some delay which is caused by the movement from the centrally controlled economy to the market economy and all the problems associated with it. The sources of such phenomena are very complex and stem from the civilization changes and from the structural-economic changes (Szymańska, 2007). The mentioned events overlap with the processes of globalization and movement from the economy of stock processing to the economy based on knowledge. In the face of new challenges particular importance is the current and future community towns, its level of education and entrepreneurship, as specific capital which had made a substantial contribution to the development of the city.

The aim of the presented analysis is to show the influence of occurring conversions on the economic and social development and demographic changes apparent in small towns of the Wrocław Metropolitan Area. The attempt of evaluation of factors promoting the development was undertaken. The value of chosen characteristics was analyzed on the set of all small towns of Dolnośląskie voivodship. The analysis of selected quantities common for demographic phenomena in a longer time cross-section (1995–2008) pinpoints the irregularity of development of specific towns, which may result in negative effects for the whole area in the future.

STRUCTURE OF CITIES CONVERSIONS AS THE RESULT OF URBANIZATION

The urbanization phase connected with industrialization in Western Europe was characterized by a great number of extraneous population in the area of the city centre and city districts and the decrease in the number of inhabitants at the suburbs. In further stages of the urbanization development, bigger spatial expansion of city areas and the change of their inner structure are observed. Dynamic processes of urban arrangement inner split occur, present in the development

of city surrounding areas, in which the social functions, typical for cities, develop. The quick development of suburban areas was called suburbanization. This process has contributed to a gradual removal of socio-economic activities from the centre and the development of satellite units, in which the domestic architecture and economic activities were situated – these were the contributors to the reverse of urbanization. The output of this reverse process is seen in the creation and development of multi-centre metropolitan regions inhabited by a bigger proportion of population from a given country (Grzeszczak, 1996).

The crisis of central areas in a great number of cities has contributed to the outflow of work in order to restore their past function by means of revitalization and, in consequence, the attraction of the rich to the central areas (Słodczyk, 2002). The centre once again becomes an attractive place and the location of modern economic branches in place of older, terminating functions take place. Still, the development of peripheries and satellite centre is present. Those phenomena belong to the phase of reurbanization. The above-mentioned phases vary in the degree of spatial structure changes, and the distribution of population and places of work. The passage from one phase to another is connected with the relocation of a broadly understood human activity and its spatial distribution in different areas (Domański, 2000; Szymańska, Biegańska, 2011).

The dynamic development of Polish economics, after joining the international market, has created conditions for come into being of metropolitan areas. Nowadays, this process is present in a form of migration, especially of young and educated people living in central districts and multi-family housing to the metropolitan areas. The causes of this phenomenon are different. The most common one is the quality of the environment, lack of turmoil, cheaper land and apartments (Warczewska, Warzewski, 2000).

In the surrounding of big cities – in Poland too – the processes of suburbanization occur along with the expansion of economic activity in the area of adjacent gmina (administrative region of the 3rd order). Not all gminas have equal possibilities for development in this situation. A lot of factors have to be taken into account. Together with the changes caused by the movement from industrial economics to the knowledge-based economics, the location factors of new investments change. Apart from so called ‘hard factors’ such as the price of ground, the cost of rent, costs of electricity, and costs of labour, ‘soft factors’ are also mentioned – social capital, quality of administration, climate for the activity, possibilities of education, the image of the city – among which the quality of public space, number and type of cultural objects and the living conditions are present. Each area has got its specific qualities resulting from the neighbourhood of different areas, natural conditions and the usefulness of this area for the development of different activity types.

THE CHARACTERISTICS OF THE AREA UNDER RESEARCH

The analysis embraced Dolnośląskie voivodship small towns in the period 1995–2008 (Fig. 1) (1). The introductory analyses of the population changes in small towns showed that the positive increase of the population occurred only in towns which belong to the Wrocław Metropolitan Area and in the town of Prochowice. The analysis concerned only those towns in order to find a relationship of possibilities and directions of development due to the location of the metropolis. The synthetic approach, which takes into account different characteristics of the examined towns, was also used to analyze the whole area of the Dolnośląskie voivodship. The Wrocław Metropolitan Area is a part of Dolnośląskie voivodship, in whose territory is located 91 towns, including 70 small towns with less than 20 thousand of inhabitants.

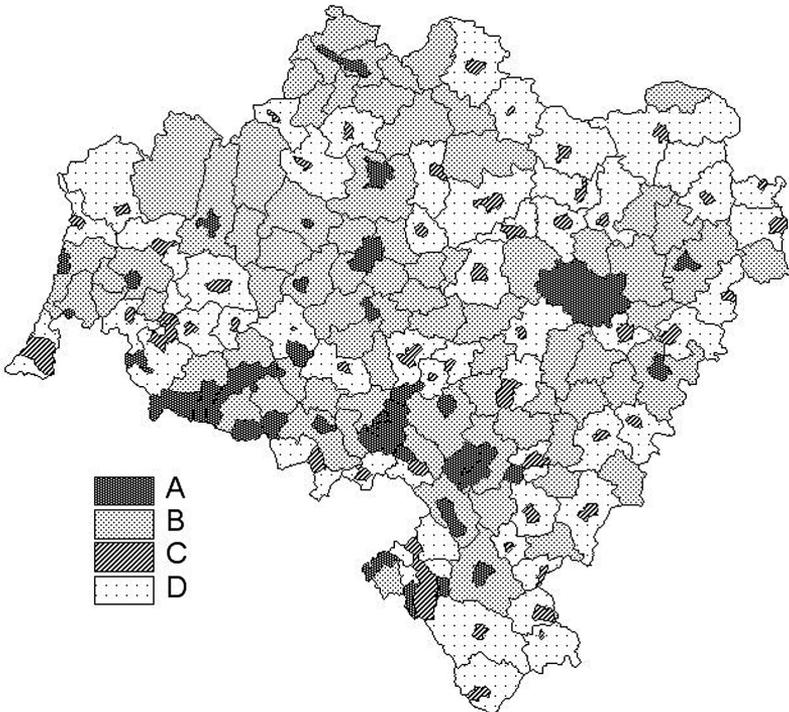


Fig. 1. Dolnośląskie voivodship – cities/towns and gminas
 Explanation: A – urban gmina; B – rural gmina; C – town in urban-rural gmina;
 D – rural district in the urban-rural gmina

Source: Developed by author based on data from Central Statistical Office

A part of the analyzed data concerns the period of 1995–2008. Due to the fact that such towns as Prusice and Siechnice, as well as Bogatynia with the population drop below 20 thousand people were included in the set in 2002, the closest existing data were adopted for them. Out of 70 small towns 18 are classified as urban gminas, the rest of them are situated on the area of urban-rural gminas. The demographic forecast prepared by Urząd Statystyczny (Statistical Office) in Wrocław predicts that by the year 2030 the population of Dolnośląskie voivodship will have systematically decreased. According to the prediction the number of people living in towns will have decreased by about 5%. The decrease of population in Wrocław, (the biggest in the 1990s), is causatively connected with the increase of the population in the gminas surrounding the metropolis.

The analysis of the development directions and demographical changes connected with them was limited to small towns only. Three groups of towns were taken into account: all small Dolnośląskie voivodship towns, towns which are situated in the Wrocław Metropolitan Area (Bierutów, Brzeg Dolny, Jelcz Laskowice, Kąty Wrocławskie, Międzybórz, Milicz, Oborniki Śląskie, Sobótka, Strzelin, Syców, Środa Śląska, Trzebnica, Twardogóra, Wiązów, Wołów, and Żmigród) (Fig. 2), and towns which are located in the indirect neighbourhood of Wrocław and which have the strongest connections with the metropolis (Kąty Wrocławskie, Środa Śląska, Brzeg Dolny, Sobótka, Oborniki Śląskie, Trzebnica, Jelcz Laskowice, Siechnice, Strzelin, and Wiązów).

The Wrocław Metropolitan Area was set up in 1999. At the beginning it consisted of 6 powiats (administrative region of the 2nd order) (i.e., oleśnicki, oławski, średzki, trzebnicki, wołowski, and wrocławski). After the admission of the *Decree dated at 27th March 2003* (Ustawa z 27 III 2003 roku o planowaniu

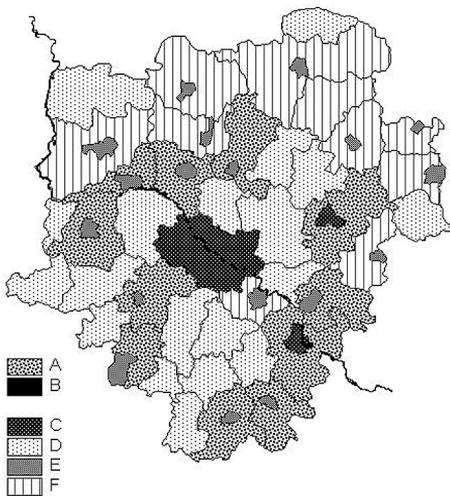


Fig. 2. The Wrocław Metropolitan Area – the location of small towns

Explanation: A – the surrounding of Wrocław; B – Odra river; C – urban gmina; D – rural gmina; E – town in urban-rural gmina; F – rural district in the urban-rural gmina

Source: Developed by author based on data from Central Statistical Office

i zagospodarowaniu przestrzennym), which introduced the obligation plan preparing of metropolitan area, in its boundaries there were 8 poviats and 43 gminas (Ossowicz, Polański, 2005). The area consists of Wrocław, which is the central city, two medium-size towns, Oleśnica and Oława, and 18 small towns. Wrocław as a central point of the metropolitan area has a high degree of urbanization and industrialization. To the local centers there should be included Oława, Oleśnica, Trzebnica, Milicz, Kąty Wrocławskie, Brzeg Dolny, Środa Śląska, Wołów, and Sobótka (Fig. 2). In the metropolitan area the dominant role belongs to Wrocław, where live 60% of all the population of the agglomeration. In the 1990s in the area of this agglomeration the structure of employment was changed. The main trends in Wrocław include decline in production activities and the increase in the number of workers employed in trade and services. In selected gminas surrounding Wrocław increased while the share of working in manufacturing operations (Jelcz-Laskowice, Brzeg Dolny, Kąty Wrocławskie) and maintains a high share of employed in trade and services. In the gminas of away from the centre there is a decrease in the number of working in a productive activity. Those changes show that a given spatial-economic structure has been built up, in which the central city and the surrounding towns have formed peculiar socio-economic profiles. Between Wrocław and the surrounding areas a network of contacts has been created due to which the process of the metropolitan development is present, which influences in a much bigger degree the development of the metropolitan area. The number of realized so far, as well as the projected changes allows to specify Wrocław as the city of high dynamics of changes in the structure. Those changes concern almost all spheres of life: communication infrastructure, services, building of dwelling-houses, green belt, and others. The spatial-economic structure of the Wrocław Metropolitan Area is the result of long-term accumulation of agglomeration effects and deglomeration processes (Korenik, Rogowska, 2007). Small and medium-size towns developing in the surrounding of Wrocław and the whole metropolitan area are of great importance.

THE ANALYSIS OF CHOSEN PARAMETERS

The analysis of the population change in the whole set of small Dolnośląskie voivodship towns shows that in the years 1995–2008 the positive increase of the population occurred mainly in towns which belong to the Wrocław Metropolitan Area. In towns from outside of the area only Prochowice had a positive population increase. It implies that the attractiveness of the area near Wrocław is quite high (Table 1). Within the compass of years 1995–2008 the highest increase of population was observed in Wiązów – 9.11%, Kąty Wrocławskie – 8.14% and in

Table 1. The change of the population number in small towns of WrMA in the years 1995–2008

No.	Territorial unit	1995	2000	2005	2008	Change	Change in%
53	Milicz	12.538	12.269	12.069	11.898	−640	−5.10%
54	Bierutów	5.282	5.210	5.102	5.065	−217	−4.11%
55	Międzybórz	2.332	2.285	2.333	2.358	26	1.11%
56	Syców	10.421	10.749	10.745	10.632	211	2.02%
57	Twardogóra	6.808	6.878	6.883	6.858	50	0.73%
58	Jelcz–Laskowice	15.370	15.158	15.253	15.340	−30	−0.20%
59	Strzelin	13.336	12.663	12.223	12.165	−1.171	−8.78%
60	Wiązów	2.141	2.250	2.225	2.336	195	9.11%
61	Środa Śląska	8.702	8.811	8.793	8.912	210	2.41%
62	Oborniki Śląskie	7.846	8.274	8.461	8.475	629	8.02%
63	Prusice	–	2.212	2.201	2.244	32	1.45%
64	Trzebnica	12.132	11.998	12.177	12.356	224	1.85%
65	Żmigród	6.383	6.461	6.597	6.540	157	2.46%
66	Brzeg Dolny	13.905	12.926	12.836	12.816	−1.089	−7.83%
67	Wołów	12.284	12.363	12.309	12.269	−15	−0.12%
68	Kąty Wrocławskie	5.088	5.236	5.415	5.502	414	8.14%
69	Sobótka	6.664	6.688	6.769	6.873	209	3.14%
70	Siechnice	–	3.979	3.841	3.851	−128	−3.22%

Source: Developed by author based on data from Central Statistical Office

Oborniki Śląskie – 8.02%. It is worth mentioning that the increase occurred not only in towns but also in rural gminas surrounding Wrocław (Fig. 3). The data concerning the years 2005–2008 for the gminas confirm further increase of the population in Kąty Wrocławskie and Oborniki Śląskie.

The analysis of the socio-economic activity in towns situated in the area of WrMA is based on two kinds of parameters. The first kind shows aspects such as the inflow of population, the migration balance and new residential buildings completed per 1,000 inhabitants. The second one of taken into account are economic indicators: the number of entities of national economy per 1,000 inhabitants and the percentage of workers in relation to the population of working age. The next indicator is the number of shops per 1,000 population. The above mentioned indicators specify the development of endogenous or exogenous functions. Their scale exemplifies the development of services sector in towns

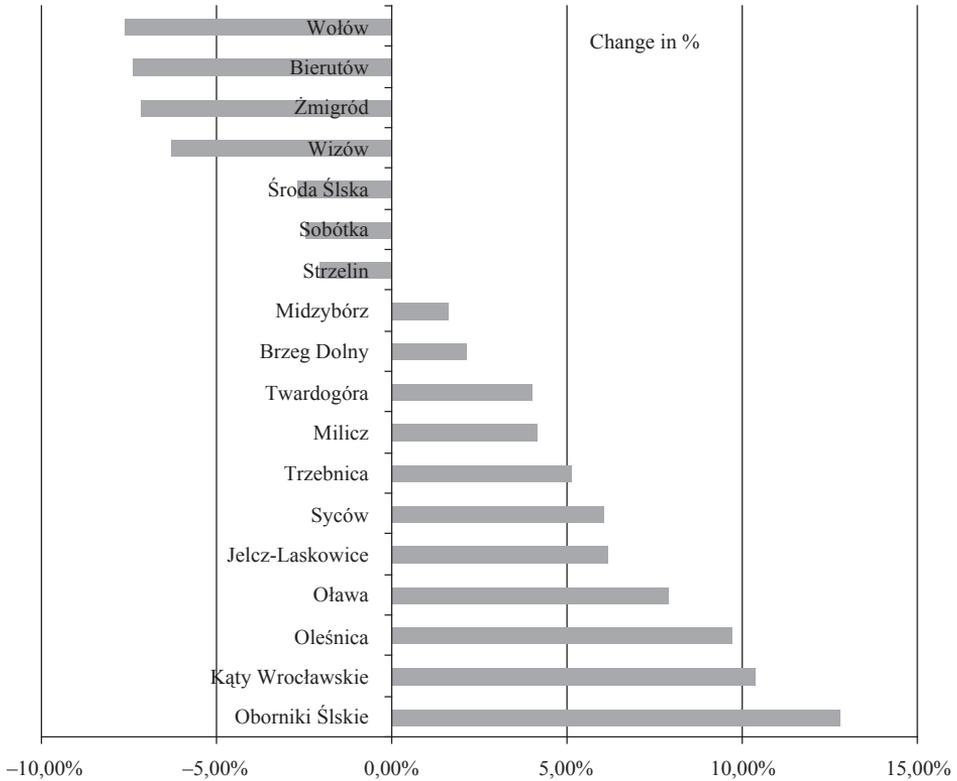


Fig. 3. The change in the number of population in gminas belonging to WrMA in the years 1995–2008

Source: Developed by author based on data from Central Statistical Office

and the occurrence of their own zone of influence. The values of all parameters have been ranked and the respective rank values have been summed up.

In the ranking method the six enumerated constituents were used as the stimuli (the sum of ranks – Table 2). The towns which were considered in the analysis can be divided into groups taking into account the criterion of distance from Wrocław. To the first group belong small towns, strictly connected with Wrocław, located in its vicinity and which are under no influence of any other big city. There are as following: Kąty Wrocławskie, Środa Śląska, Brzeg Dolny, Sobótka, Oborniki Śląskie, Trzebnica, Jelcz-Laskowice, Siechnice, Strzelin, and Wiązów (Bagiński, 1993: 13; Masztalski, 2005: 107). For those towns the name ‘surrounding of Wrocław’ was adopted (Litwińska, 2007: 133). The rest of the towns of WrMA lie more than 30 kilometers away from the centre. The positive migration balance and intensively developing building industry can

indicate the development of residential function. In the vicinity of big cities there are formed satellite towns which constitute the subsidiaries of the central city. This phenomenon can be analyzed by observing the size of the population inflow and the migration balance. When observing the size of the migration balance in the analyzed cities in 2008 we can see that the positive balance refers mainly to Wrocław (183 people) and the towns from its neighbourhood, i.e., Kąty Wrocławskie (69), Oborniki Śląskie (51), and Środa Śląska (48). Among the towns more than 40 kilometers away from Wrocław the positive migration balance occurred in Wołów (54). In the conversion of the migration balance for 1,000 citizens the first place belongs to Kąty Wrocławskie, then Wiązów and Oborniki Śląskie with Środa Śląska and Wołów. In most of the towns the migration balance was negative in 2008. The worst situation was in Międzybórz

Table 2. Socio-economic indicators in towns of WrMA in 2008 – ranking method

Gminas	Ranks						The sum of ranks
	I	II	III	IV	V	VI	
Środa Śląska	6	4	3	13	10	1	37
Kąty Wrocławskie	1	1	1	16	8	11	38
Trzebnica	5	7	9	5	11	3	40
Oborniki Śląskie	2	3	16	3	6	13	43
Wołów	9	5	10	18	2	4	48
Strzelin	8	9	13	11	5	2	48
Wrocław	14	8	5	1	3	18	49
Jelcz-Laskowice	7	13	4	8	12	10	54
Oława	13	12	8	6	16	8	63
Wiązów	3	2	18	20	9	15	67
Międzybórz	10	21	2	14	14	6	67
Oleśnica	11	11	14	2	17	19	74
Sobótka	4	6	20	15	19	12	76
Milicz	12	18	12	7	20	9	78
Siechnice	21	10	6	21	1	21	80
Syców	20	19	15	4	18	5	81
Żmigród	16	14	21	17	7	7	82
Twardogóra	15	16	11	12	15	14	83
Brzeg Dolny	17	17	7	9	13	20	83
Prusice	18	20	19	10	4	16	87
Bierutów	19	15	17	19	21	17	108

Explanation: I – influence per 1,000 residents; II – migration balance per 1,000 residents; III – percentage of working people in relation to the number of working age population; IV – number of entities of national economy per 1,000 residents; V – number of residential buildings completed per 1,000 residents; VI – number of shops per 1,000 residents

Source: Developed by author based on data from Central Statistical Office

(−7.21 per 1,000 residents), Prusice (−7.13), Syców (−6.40), and Milicz (−6.30). The negative migration balance was also observed in several towns from the area surrounding Wrocław, i.e., in Brzeg Dolny (−3.75), Jelcz-Laskowice (−1.69), Siechnice (−0.26), and Strzelin (−0.08).

In some towns together with the negative migration balance the decrease of the number of entities of national economy recorded in REGON (Krajowy Rejestr Urzędowy Podmiotów Gospodarki Narodowej, National Official Business Register) occurred, counting per 1,000 residents. This type of situation was present in Milicz and Bierutów. The decrease of the number of entities of national economy occurred also in Trzebnica and Wołów. In Milicz and Bierutów also the situation of the residential building does not present the best. Number of residential buildings completed per 1,000 inhabitants places them at the end of the list of analyzed towns.

SUMMARY

On the basis of the conducted analysis it is apparent that some of the towns cannot attract new citizens and potential investors, as well as new housing investments in their area. The evidence of this situation is seen on the exemplary indicator of migration balance per 1,000 residents. The population inflow connected with the development of building industry can be observed in Wołów, where the number of entities of national economy decreased, but the number of population and the number of residential building completed increased. Good economic situation in building industry occurred in Siechnice, Strzelin and Oborniki Śląskie. The comparison of the analyzed indicator values shows that there was increase of the most of analyzed indicators, although their level was diversified. There are noted better conditions in towns which are located in the closest surrounding of Wrocław. A kind of interdependence is present here: the possibilities of development depend on the location in the communication network and influence of the neighbourhood of a big city.

Small and medium towns which are in the zone of interdependence of a big regional city such as Wrocław are distinguishable by large diversity in the scope of socio-economic activity. Most of them have problems with gaining new residents and potential investors. Despite some dangers coming from dynamically developing labour market in Wrocław, some of the small towns develop independently. In the Wrocław Metropolitan Area to such towns belong Kąty Wrocławskie (Zuzajska-Żyśko, 2007) and Jelcz-Laskowice (3). For towns situated in the zone of interdependence of big agglomerations the chance is in the development of functions which are not present in a big city or which cannot be

established by such a city. Such functions are as following: sport and recreation, relax, tourism, and residential function. Some towns in the surrounding of Wrocław have developed furniture industry and the best example is Międzybórz. Among the analyzed towns big possibilities of development of tourism there are in Wołów (big acreage of forests, i.e., Park Krajobrazowy Doliny Jezierzycy, Landscape Park of Jezierzycy Valley) (Chądryńska, 2005/2006) and Oborniki Śląskie (as large areas of forests and microclimate). There is not observed a very good situation in Milicz and Bierutów, where the decrease of most of the indicators was registered.

Taking into account a synthetic approach to all analyzed indicators (Table 2), the best conditions for inhabitants and investors are in towns near Wrocław such as Kąty Wrocławskie, Środa Śląska, Oborniki Śląskie, Trzebnica, Strzelin, and Wołów located 43 kilometers away from Wrocław. The weakest towns according to the analysis are Bierutów, Prusice and Brzeg Dolny.

The undertaking of actions which lead to the sustaining of existing ones with the elimination of harmful effects on the environment and the implementation of new functions, all of these give the chance of development with the usage of accessible values, which can be a possibility of development for towns that have not formed their own profile.

NOTES

- (1) The list of conventional signs in the Fig. 1: grey colour – urban gmina, spotted colour – rural gmina, dark spotted colour – town in the urban-rural gmina, bright lined colour – rural district in the urban-rural gmina.
- (2) The list of conventional signs in Fig. 2: bright spotted colour – rural gminas, dark grey – small towns, dark spotted colours – urban gminas, dark-light colour – the surrounding of Wrocław, white-lined – the remaining gminas.
- (3) Those two cities occur also when analyzing broader area such as Dolnośląskie voivodship or the area of Poland.

REFERENCES

- Bagiński, E.** 1993: Rodowód nowego miasta Jelcz-Laskowice, Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej.
- Chądryńska, E.** 2005/2006: Zmiany struktury i perspektywy rozwoju wybranych małych miast dolnośląskich. In: Heffner, K. and Marszał, T. editors, *Małe miasta – studium przypadków*, Łódź: Uniwersytet Łódzki, pp. 143–155.

- Domański, R.** 2000: Zasady geografii społeczno-ekonomicznej, Warszawa: Wydawnictwo Naukowe PWN.
- Grzeszczak, J.** 1996: Tendencje kontrurbanizacyjne w krajach Europy Zachodniej. In: *Prace Geograficzne IGiPZ PAN*, Nr 167, Wrocław: Continuo.
- Korenik, S. and Rogowska, M.** 2007: Funkcjonowanie małego miasta w granicach obszaru metropolitalnego (przykład Siechnic). In: Heffner, K. and Marszał, T. editors, *Małe miasta w obszarach metropolitalnych*, Warszawa: KPZK PAN, pp. 104–115.
- Litwińska, E.** 2007: Wybrane wskaźniki społeczno-ekonomiczne do badania wpływu metropolii na małe miasta (przykład Wrocławia). In: Heffner, K. and Marszał, T. editors, *Małe miasta w obszarach metropolitalnych*, Warszawa: KPZK PAN, pp. 131–146.
- Masztański, R.P.** 2005: Uwarunkowanie rozwoju przestrzennego struktury przestrzennej małych miast Dolnego Śląska po 1945 roku, Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej.
- Ossowicz, T. and Polański, T.** 2005: Planowanie Wrocławskiego Obszaru Metropolitalnego. In: Markowski, T. editor, *Planowanie i zarządzanie w obszarach metropolitalnych*, 221, Warszawa: KPZK PAN, pp. 244–256.
- Ślódzcyk, J.** 2002: Wielkość miast i ich struktura przestrzenna w świetle kryteriów rozwoju zrównoważonego. In: Ślódzcyk, J. editor, *Przemiany bazy ekonomicznej i struktury przestrzennej miast*, Opole: Uniwersytet Opolski, pp. 323–326.
- Szymańska, D.** 2007: Urbanizacja na świecie, Warszawa: Wydawnictwo Naukowe PWN.
- Szymańska, D. and Biegańska, J.** 2011: Fenomen urbanizacji i procesy z nim związane. In: Ślódzcyk, J. and Śmigielska, M. editors, *Procesy urbanizacji i ich uwarunkowania na początku XXI wieku*, Opole: Uniwersytet Opolski, pp. 13–38.
- Warczewska, B. and Warczewski, W.** 2000: Analiza gospodarki podwrocławskich gmin pod kątem suburbanizacji aglomeracji wrocławskiej. In: Bagiński, E. editor, *Wrocław i strefa przymiejska jako układ osadniczy*, Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej, pp. 129–155.
- Zuzańska-Żyśko, E.** 2007: Małe miasta w strefie oddziaływania ośrodków regionalnych. In: Heffner, K. and Marszał, T. editors, *Małe miasta w obszarach metropolitalnych*, 232, Warszawa: KPZK PAN, pp. 62–78.

CORRESPONDENCE TO:

Elżbieta Chądzyńska
Wrocław University of Technology
Department of Architecture, Town and Country Planning
Bolesława Prusa 53/55, 50–317 Wrocław, Poland
phone: +48 713 206 354
[e-mail: elzbieta.chadzynska@pwr.wroc.pl]