

Jacek Soltys

Gdańsk University of Technology
e-mail: jsoltys@pg.edu.pl
ORCID: 0000-0003-3192-9181

SCENARIOS IN THE DEVELOPMENT STRATEGIES OF LARGER CITIES IN POLAND

SCENARIUSZE W STRATEGIACH ROZWOJU WIĘKSZYCH MIAST W POLSCE

DOI: 10.15611/pn.2019.2.08
JEL Classification: O21

Summary: Planning prepares decisions and future actions. Therefore, future conditions should be considered in planning, in particular strategic planning, due to its long-term nature. To accomplish this, certain prognostic methods should be applied. A scenario method is seen as one of the most useful prognostic method, especially in cases when social and institutional behaviour plays a crucial role. The aim of the paper is an analysis and evaluation of the application of scenarios in the development strategies of larger cities in Poland (more than 100 thousand inhabitants). Scenarios were prepared in 13 out of the 39 cities. All these scenarios were analyzed. The scenarios were formulated with the intuitive logics method. Most scenarios do not fully meet the scenario definition because of the insufficiency of the sequences of events presented on the timeline. The author discusses some methodological problems concerning the creation of scenarios and the problems in using scenarios, and gives some recommendations.

Keywords: cities, development strategy, forecasting, scenarios, strategic planning.

Streszczenie: Planowanie ma na celu przygotowanie decyzji i przyszłych działań. Dlatego należy uwzględnić w nim uwarunkowania, zwłaszcza w planowaniu strategicznym, ze względu na jego długoterminowy charakter. Aby to osiągnąć, należy zastosować metody prognostyczne. Jako jedna z najbardziej użytecznych metod tego typu postrzegana jest metoda scenariuszy, zwłaszcza w przypadkach, gdy kluczowe znaczenie mają zachowania społeczne i instytucjonalne. Celem artykułu jest analiza i ocena zastosowania scenariuszy w strategiach rozwoju większych miast w Polsce (ponad 100 tysięcy mieszkańców). Na 39 takich miast scenariusze przygotowano w 13 z nich. Wszystkie zostały przeanalizowane. Były one sformułowane przy użyciu metody intuicyjno-logicznej. Większość scenariuszy nie całkiem spełnia definicję scenariusza z powodu niedostatku sekwencji zdarzeń przedstawionych na osi czasu. Autor omawia niektóre problemy metodyczne dotyczące tworzenia scenariuszy i problemy ich stosowania oraz podaje pewne rekomendacje.

Słowa kluczowe: miasta, strategia rozwoju, prognozowanie, scenariusze, planowanie strategiczne.

1. Introduction

Planning prepares future actions. Therefore, recognition of the future is very important in the planning process, especially in strategic planning, due to its long-term nature. The future should be recognized on an objective basis. To accomplish this, certain prognostic methods can be applied. The scenario method is seen as one of the most useful prognostic methods, particularly in cases when social and institutional behaviour plays a crucial role [Chojnicki 1988]. In some publications, scenarios are not considered as forecasts (e.g. [Chermack et al. 2001; Godet 2006]), but in others, they are [Cieślak 1993; Kania-Gospodarowicz 1993; Scott, Armstrong cited in Stoner, Wankel 1986]. The author of this paper considers scenarios as a kind of forecast.

The oldest and one of the best scenario definitions was formed by Kahn and Wiener who defined a scenario as a possible, often hypothetical, sequence of events constructed in an internally consistent way for the purpose of focusing attention on causal processes and decision points (cited in [Torrieri, Nijkamp 2005]). In many definitions, the following words: *stories*, *series of stories*, *series of events* are the keywords [Chermack 2001; Vleugel, cited in Torrieri, Nijkamp 2005]. The word *scenario* is often misused, especially when it is used to describe future states (images, situations). Taking into account the meaning of the term *scenario* used to describe a certain process (sequences of events), it is claimed that the description of a future state could be considered as an element (a single scene) of a scenario only if this state was elaborated by a logical description of a course of events. A description of a state determined without thinking in terms of the causes and effects, but considered as coherent assumptions could be regarded as *quasi scenarios* [Soltys, Lenzion 1999]. Scenarios have been used in strategic planning mostly in business, but also in corporations, public institutions and territorial entities.

Many publications consider the scenario theory and methods [e.g. [Amer, Daim, Jetter 2013; Bradfield et al. 2005; Godet 2006, Durance, Godet 2010; Stojanović, Mitković, Mitković 2014]. Most methods of creating scenarios for cities described in literature belong to quantitative methods: e.g. modeling urban development for land use, transportation, and environmental planning (e.g. [Waddell 2002; Barredo et al. 2003; Zegras, Sussman and Conklin 2004; Hosseinali, Alesheikh and Nourian 2013; Lee, Newman, Park 2018; Shen et al. 2018]). Other methods are also described (e.g. [Khakee 1991; Song, Ding, Knapp 2006; Fernández Güell, Redondo 2012; Chakraborty, McMillan 2015; Goodspeed 2017]). Many publications discuss scenarios for specific cities (e.g. [Khakee 1991; Song, Ding, Knapp 2006]) or city regions [e.g. Docherty, McKiernan 2008; Petrov et al. 2011; von Wirth et al. 2013]. Lee, Newman and Park [2018] describe scenarios of vacant land changes—in two cities. There are only few publications analyzing larger sets of scenarios (e.g. [Chakraborty, McMillan 2015; Goodspeed 2017]). The intention to describe and analyze a set of scenarios prepared in Poland was one of the motives to take up the topic presented.

The **range** of research presented included scenarios applied in the strategies for the development of larger cities in Poland (more than 100 thousand inhabitants) listed in Table 1. The **aim** of the paper is the analysis and evaluation of the scenarios and their application in the development strategies. Methodological issues, not the content regarding specifics of the cities, were the main object of the author's interest. The **Methods** of the presented research included the study of the strategic plans and study of literature, as well as the generalization of the author's own experiences that were applied for the evaluation of scenarios according to the following criteria:

- the place and the role of the scenarios,
- the number and kind of scenarios as well as the criteria for their differentiation,
- the methods of scenario building and the way of scenario presentation,
- the answer to the question of whether the causal relationship is shown.

2. Characteristics of the scenarios studied

For 39 cities with a population of over 100 thousand, scenarios were prepared in 12 of them (Table 1). All these scenarios were analyzed. Not all scenarios are in the latest strategies.

Table 1. Cities, their strategies for development and scenarios analyzed – general information

City	Population in thous.	Year of adopting the strategy	Horizon of the strategy	Number of scenarios	Kind of scenarios
Wrocław	634	2010	2030	3 4	optimistic, pessimistic, neutral ^a <i>according to figure 1^b</i>
Katowice	302	2005	2020	1	<i>unnamed^c</i>
Białystok	295	2011	2020+	3	optimistic, pessimistic, most likely ^c
Częstochowa	230	2009	2025	2	optimistic, pessimistic
Radom	217	2008	2020	3	optimistic, pessimistic, moderate
Gliwice	184	2007	2022	2	optimistic, pessimistic
Olsztyn	174	.	2015	2	optimistic, pessimistic
Bielsko-Biała	173	2012	2020	2	desirable, undesirable
Rybnik	140	2015	2020	2	positive development, cautionary
Elbląg	122	2014	2020+	1	<i>unnamed</i>
Płock	122	2018	2030	3	optimistic, pessimistic, intermediate
Opole	120	2012	2020 ^d	1	most likely (<i>annual</i>)

^a economic, ^b political, ^c scenarios of external conditions, ^d scenario for 1 year only.

Source: [Bednarek, Latacz, Piwowarczyk 2009; Medeksza 2016; Miasto Rybnik 2015; Mordak, Tetlak, Rawski 2008; Rada Miasta Katowice... 2005; Rada Miejska 2012, ResPublic 2017; Samorząd Miasta Gliwice 2011; Scenariusze ...; *Strategia rozwoju Opola...* 2012; Uchwała ... 2014; Urząd Miejski w Białymstoku 2010; <https://www.wroclaw.pl/rozmawia/strategia-wroclaw-2030-scenariusze>; Local Data Bank].

The most common **place** of scenarios in the planning process is the point after the SWOT analysis or other elements of diagnosis. In Katowice, Białystok and Bielsko Biała, scenarios are placed before the SWOT analysis.

In two cities there are only scenarios of future external conditions. In other cities the **content** of the scenarios include both external conditions and the city's development, whereas in most cities with element of strategies - actions and policies – are defined to varying degrees in different cities, mainly in optimistic scenarios.

The **number** and **kind** of scenarios from the point of view of criteria for their differentiation are shown in Table 1. In most cities the number of scenarios is smaller than three, while the number of scenarios from three to four is recommended in literature (e.g. [Van der Heiden, Wack, cited in Chermack, Lynham, Ruona 2001]). In Wrocław there are two sets of scenarios: economic and political.

In nine cities there are boundary scenarios: mainly optimistic and pessimistic, in Bielsko-Biała - desirable and undesirable, in Rybnik – positive development and cautionary. In four cities there is also a third scenario: neutral, moderate, intermediate or most likely. In three cities there is only one scenario: most likely or unnamed. The most interesting criterion for differentiation is in political scenarios for Wrocław. These scenarios fill four fields of a table, which was created from the crossing of two axes: the vertical axis of Eros (god of love) and the horizontal axis of Thanatos (god of death) (Figure 1) [Medeksza 2016].

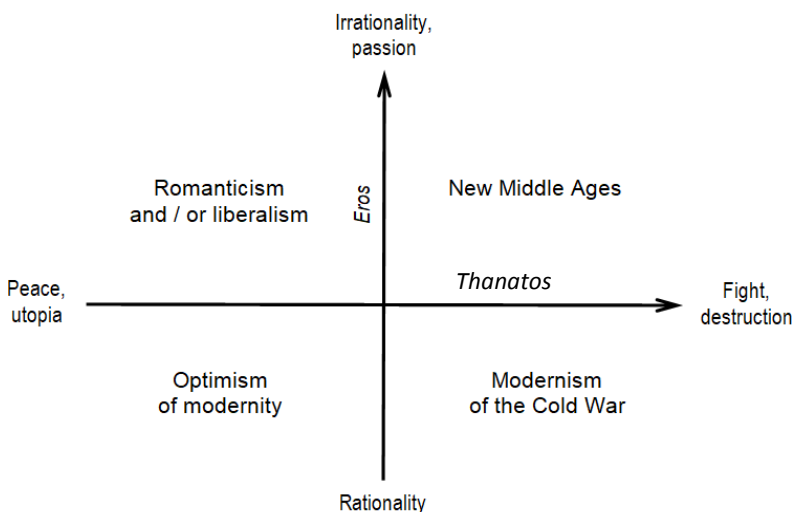


Fig. 1. Differentiation of political scenarios for the future of Wrocław

Source: [Medeksza 2016].

3. Methods of scenario building and presentation

In five documents, the scenario building **method** is not described. In Gliwice the only information is that scenarios were prepared during workshops. In Częstochowa the list of features of the city and their systemic environment (divided into stable and controllable variables in the long and medium period) was prepared as an element of the method. In Białystok the strength, direction of changes (growth, stagnation or regress) of individual variables (states, processes named as factors, trends) in the systemic environment of the city and their likelihood were assessed as an element of the Delphi method. In Elbląg, scenarios were built during workshops in the frames of three types of strategies (aggressive, conservative and defensive). By integrating these three approaches to strategy, one scenario was created.

The method applied for building of scenarios as part of the Foresight for Płock (the most described and the most complex) is based on the Research Project¹ and later research [Sołtys 2008]. The first phase of this method – creating a base – derives from Godet [1985] and includes the choice of variables and defines relations between them, which allows understanding the mechanisms of changes. A list of variables was created by contractor's experts, then consulted and supplemented by panels composed of local experts. A list of key variables, strongly aggregated or most important, were created. For simplification, relations between variables were identified only for key variables. The scenarios were formulated in two stages: (1) for the economic, political and legal environment (2) for Płock. For the environment, different combinations of the values of key variables in their logical time sequence were analyzed, creating seven so-called main lines of scenarios of environment. Three main lines were selected as appropriate for three kinds of scenarios: optimistic, intermediate and pessimistic, for creating main lines of scenarios for Płock. Full scenarios (quasi-scenarios rather than the proper ones) containing all variables for the chosen main lines, were developed by intuitively defining states or variables, or the direction of their changes, using the results of the Delphi study [ResPublic 2017].

All the methods used for scenario building can be classified as heuristic [Godet, 1994]; according to more recent literature they belong to the intuitive logics approach [Bradfield et al., 2005].

There are considerable differences in the volume of scenarios. Their range includes 1-32 pages (Table 2). The ways used for the **recording** of scenarios and their **presentation** are also described in Table 2. In most cities, scenarios have been presented by texts in points. There are tables only for Olsztyn and Płock in which each row contains a single, separate variable, the use of a set of the same variables is

¹ KBN 7T07F02914 *Scenariusze jako element metody określania uwarunkowań i kierunków zagospodarowania przestrzennego obszarów lokalnych (Scenarios as an element of a method for description of conditions and directions in local territories' spatial development)*, 1998-99, Gdańsk University of Technology, Faculty of Architecture [Sołtys, Lenzion 1999].

seen. In the case of Płock only the left column contains the name of the variable, and others columns – their values. In Płock the values of all variables are given only in the tables; sentences describing only some variables indicate also the most important cause-and-effect relationships. It was considered that describing all the variables in the text would excessively lengthen the descriptions, reduce their clarity and increase the monotony. In Bielsko-Biała, elements of scenarios were presented for each of the four priorities (fields) of the strategy.

Table 2. The ways of scenarios' presentation

City	Pages	The way of scenarios' presentation
Wrocław	6 ^{a c}	Text in points for external and internal factors, events, processes
	8,2 ^{b c}	Text in sentences according to 7 questions + recommendations
Katowice	1,2	Text in sentences
Białystok	7	Tables: 1) list of processes: strength of influence, probability of changes; 2) key processes (events) and their strength of influence in 5 spheres in 3 scenarios
Częstochowa	3	Classification of features in table, text in points in 3 columns (scenarios)
Radom	9	Text in sentences – assumptions and results for each scenario, for pessimistic scenarios also counteraction
Gliwice	1	Text in points in 2 columns for 2 scenarios
Olsztyn	4,3	Table
Bielsko-Biała	8	Text in points or sentences for each of 4 priorities
Rybnik	2	Text in points, horizontal rubrics for 8 fields, 2 columns for 2 scenarios
Elbląg	4	Lists of activities and effects separately for each of four spheres, diagram illustrating general dependencies
Płock	32	Text in sentences only for some variables, tables for all variables
Opole	2,2	Table: factors (events) in points, probability of their occurrence in figures, more detail describing and effects in sentences

^a economic, ^b political, ^c published in the Internet; full document, not published, is large.

Source: as in Table 1.

4. Problems, discussion

In most strategies the role of the scenarios is described. For example, the scenarios are one of the foundations for formulating a list of opportunities and threats (in Opole), a list of strategic challenges (in Bielsko-Biała), a vision (in Rybnik); they allow a transition from the SWOT analysis to the objectives, ensuring the consistency and validity of the planned intervention (in Elbląg).

The question arises of whether a different strategy should be prepared for each scenario. However, there is only one strategy in all of the documents examined, and this is a common solution in public strategic planning. Strategies are mainly related to the optimistic scenario (possibly also intermediate). For some pessimistic

scenarios it would be impossible as contradictory to them, e.g. in Bielsko-Biała one of the scenarios assumes the inconsistent implementation of the city's sustainable development policy, including the lack of defining development goals and rules for the implementation of spatial policy. Some strategies' assumptions are universal for minimizing the effects of threats and enable the use of opportunities. The separate list of preventions is prepared for the pessimistic scenario only in the strategy for Radom.

The analyzed scenarios do not fully meet the scenario definition. They describe states and processes, but the same throughout the whole scenario, without stages of the described processes, changes of trends (apart from Płock), and without sequences of the events presented on the timeline. There are mainly short sequences of events in separate sentences. The biggest number of linked factors and events in one sentence or one paragraph is seven [Radom]. In most cases it is difficult to recognize which contents are the result of intuitive simulations of processes as logical sequences of events, and which of them are rather the author's opinions about the future, adjusted to the character of a given scenario.

It is difficult to grasp cause-and-effect relationships for many variables related to each other. Replacing a large set of variables by key variables and building the main lines from them, then developed (as in Płock) could be one of the ways to deal with this problem. Another way is to use the formal methods aided by computer. The lack of knowledge of advanced methods is probably an obstacle in using them. Labour intensity can be another barrier to the use of some methods, for example, the application of the full method described by Durance and Godet [2010] takes 12-18 months.

Noteworthy are scenarios other than marginal ones, which, among the scenarios analysed, appeared only in Wrocław. The way they were defined as a combination of two (sometimes three) criteria in Poland prevails at regional level, which occurs also in other countries. There is a formal method for choosing criteria of scenarios differentiation and definition [Nulpponen 2016].

The division of the records of some scenarios into domains can be considered a disadvantage, especially in the strategy for Bielsko-Biała, where it concerns the whole of the document. Such a system limits the complexity of thinking in creating strategies.

Each way of presenting scenarios has its advantages and disadvantages. One table for all scenarios is a good way to compare them, but showing the causal relationships in a table is difficult. On the other hand, a text in sentences is worse for the comparison of scenarios and better for the description of causal relationships, but not the best, because the relationships are not exposed. A flowchart is the best way for showing the causal relationships, but it was used only in Płock for external variables.

5. Conclusions

Using scenarios in the strategic planning in territorial entities in Poland is not a common practice. From 39 larger cities (more than 100 thousand inhabitants), scenarios were prepared only for 12. In most cities there are boundary scenarios: optimistic and pessimistic or similarly named. In some cities there is also a third scenario between them. Only in the case of Wrocław, the prepared set of scenarios was different from the boundary one. The scenarios were formulated with the intuitive logic approach. Text in points was the most common way of presenting scenarios. Only two cities used a set of the same variables.

It is recommended to apply the following elements of the scenario methods:

- Using the same set of variables for each scenario variant, identification of relations between at least the key variables (the most significant, strongly aggregated) and preparing the so-called main lines of the scenarios as sequences of events using a small number of key variables;
 - Using various methods for scenario presentation, among others tables for comparing of scenarios, and flowcharts for showing the causal relationships.
- The following future research would be desirable:
- empirical – a critical analysis and assessment of using scenarios in the practice of strategic planning in other countries;
 - theoretical – systematization of empirical cases, modification of the methods, and searching for new methods.

Bibliography

- Amer M., Daim T.U., Jetter A., 2013, *A review of scenario planning*, *Futures*, vol. 46, pp. 23-40.
- Barredo J.I., Kasanko M., McCormick N., Lavallo C., 2003, *Modelling dynamic spatial processes: Simulation of future scenarios through cellular automata*, *Landscape and Urban Planning*, 64(3), pp. 145-160.
- Bednarek S., Latacz A., Piwowarczyk M., 2009, *Częstochowa 2025 Strategia rozwoju miasta*, Załącznik do Uchwały Nr 520/XLV/2009 Rady Miasta Częstochowy z dnia 24 sierpnia 2009, Urząd Miasta Częstochowy, Biuro Strategii Rozwoju Miasta, Częstochowa.
- Bradfield R., Wright G., Burt G. Cairns G., Van Der Heijden K., 2005, *The origins and evolution of scenario techniques in long range business planning*, *Futures*, 37, pp. 795-812.
- Chakraborty A., McMillan A., 2015, *Scenario planning for urban planners: Toward a practitioner's guide*, *Journal of the American Planning Association*, vol. 81(1), pp.18-29.
- Chermack T.J., Lynham S.A., Ruona W.E.A., 2001, *A Review of scenario planning literature*, *Futures Research Quarterly*, vol. 17, no. 2, pp. 7-31.
- Chojnicki Z., 1988, *Terytorialny system społeczny*, *Biuletyn KPZK PAN*, vol. 138, pp. 29-49.
- Cieślak B., 1993, *Organizacja procesu prognostycznego*, [in:] M. Cieślak (ed.), *Prognozowanie gospodarcze: Metody i zastosowania*, PWN, Warszawa.
- Docherty I.W., McKiernan P., 2008, *Scenario planning for the Edinburgh city region*, *Environment and Planning C: Government and Policy*, vol. 26, no. 5, pp. 982-997.
- Durance P., Godet M., 2010, *Scenario building: Uses and abuses*, *Technological Forecasting & Social Change* vol. 77, pp. 1488-1492.

- Fernández Güell J.M., Redondo L., 2012, *Linking territorial foresight and urban planning*, Foresight, 14(4), pp. 316-335.
- Godet M., 1985, *Prospective et planification stratégique*, Economica, Paris.
- Godet M., 1994, *From Anticipation to Action: A Handbook of Strategic Prospective*, United Nations Educational, Paris.
- Godet M., 2006, *Creating futures: Scenario Planning as a Strategic Management Tool*, Economica, Paris.
- Goodspeed R., 2017, *An Evaluation Framework for the Use of Scenarios in Urban Planning*, Working Paper WP17RG1, Lincoln Institute of Land Policy.
- Hosseinali F., Alesheikh A.A., Nourian F., 2013, *Agent-based modeling of urban land-use development, case study: Simulating future scenarios of Qazvin city*, Cities, vol. 31, pp. 105-113. <https://www.wroclaw.pl/rozmawia/strategia-wroclaw-2030-scenariusze> (25.07.2018).
- Kania-Gospodarowicz A., 1993, *Scenariusze*, [in:] M. Cieślak (ed.), *Prognozowanie gospodarcze*, Wydawnictwo Akademii Ekonomicznej, Wrocław.
- Khakee A., 1991, *Scenario construction for urban planning*, Omega, vol. 19, issue 5, pp. 459-469.
- Lee J., Newman G., Park Y., 2018, *A comparison of vacancy dynamics between growing and shrinking cities using the land transformation model*, Sustainability, vol. 10 (5), art. no 1513.
- Local Data Bank, Główny Urząd Statystyczny (25.07.2018).
- Medeksza Ł., 2016, *Foresightowe scenariusze przyszłości dla Wrocławia*, http://miastoprzyszlosci.wroclaw2016.pl/wp-content/uploads/2017/01/T_0_Postscriptum.pdf (6.08.2018).
- Miasto Rybnik, 2015, *Strategia Zintegrowanego Rozwoju Miasta Rybnika do roku 2020: Projekt dokumentu*, Rybnik.
- Mordak R., Tetlak M., Rawski J., 2008, *Strategia rozwoju miasta Radomia na lata 2008-2020*, WYG International Sp. z o.o., Warszawa.
- Nulpponen J., 2016, *Scenario analysis in strategic regional land use planning*, Master's thesis, Lahti University of Applied Sciences, Faculty of Technology.
- Petrov L.O., Shahumyan H., Williams B., Convery S., 2011, *Scenarios and indicators supporting urban regional planning*, Procedia – Social and Behavioral Sciences, vol. 21, pp. 243-252.
- Rada Miasta Katowice, Prezydent Miasta Katowice, 2005, *Strategia Rozwoju Miasta „Katowice 2020”*, Załącznik do uchwały nr LII/1068/05 Rady Miasta Katowice z dnia 19 grudnia 2005 r., Katowice.
- Rada Miejska, Prezydent Miasta, 2012, *Strategia rozwoju Bielska-Białej do 2020 roku*, 2012, Załącznik nr 1 do Uchwały Nr XX/496/2012 Rady Miejskiej w Bielsku-Białej z dnia 26 czerwca 2012 r., Bielsko-Biała.
- ResPublic, 2017, *Strategia Płocka. Foresight dla Płocka. Scenariusze rozwoju Miasta, 2017*, Warszawa/Płock.
- Samorząd Miasta Gliwice, 2011, *Strategia zintegrowanego i zrównoważonego rozwoju miasta Gliwice do roku 2022: Aktualizacja*, Załącznik do uchwały nr XV/298/2011 Rady Miejskiej w Gliwicach z dnia 22.12.2011 r., Gliwice.
- Scenariusze rozwoju*, [in:] *Strategia rozwoju Olsztyna*, <http://www.e-bip.pl/file.ashx?hash=000000010000002F00010822000000010010000020050404144336003444C329> (7.08.2018).
- Shen L., Du L., Yang X., Du X., Wang J., Hao J., 2018, *Sustainable strategies for transportation development in emerging cities in China: A simulation approach*, Sustainability, vol. 10(3).
- Sołtys J., 2008, *Metody planowania strategicznego gmin z uwzględnieniem aspektów przestrzennych i rozwoju zrównoważonego*, Monografie 87, Wydawnictwo Politechniki Gdańskiej, Gdańsk.
- Sołtys J., Lendzion J., 1999, *Scenariusze jako element metody określania uwarunkowań i kierunków zagospodarowania przestrzennego obszarów lokalnych*, Wydział Architektury Politechniki Gdańskiej, Gdańsk.
- Song Y., Ding C., Knapp G., 2006, *Envisioning Beijing 2020 through sketches of urban scenarios*, Habitat International, vol. 30, issue 4, pp. 1018-1034.
- Stojanović M., Mitković P., Mitković M., 2014, *The scenario method in urban planning*, Facta Universitatis, Series: Architecture and Civil Engineering, vol. 12, no. 1, pp. 81-95.

- Stoner J.A.F., Wankel C., 1986, *Management*, Prentice Hall International Inc., London.
- Strategia rozwoju Opola w latach 2012-2010*, 2012, Załącznik do Uchwały nr XXXV/549/12 Rady Miasta Opola z dnia 18 grudnia 2012 r.
- Torrieri F., Nijkamp P., 2005, *Scenario Analysis in Spatial Impact Assessment: a Methodological Approach*, [in:] S.R. Curwell, M. Deakin, M. Symes (eds.), *Sustainable Urban Development*, Routledge, London, pp. 43-61.
- Uchwała nr XXXI/910/2014 Rady Miejskiej w Elblągu z dnia 30 września 2014 r. w sprawie przyjęcia „Strategii rozwoju Elbląga 2020+”, 2014, Elbląg.
- Uri A., 2016, *Sketch Tools for Regional Sustainability Scenario Planning*, National Cooperative Highway Research Program, Project 08-36, task 117, [http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36\(117\)_FR.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-36(117)_FR.pdf) (20.02.2018).
- Urząd Miejski w Białymstoku, 2010, *Strategia Rozwoju Miasta Białegostoku na lata 2011-2020 plus*, Załącznik do Uchwały Nr LVIII/777/10 Rady Miejskiej Białegostoku z dnia 13 września 2010 r., Białystok.
- von Wirth T., Hayek U.W., Kunze A., Neuenschwander N., Stauffacher M., Scholz W., 2014, *Identifying urban transformation dynamics: Functional use of scenario techniques to integrate knowledge from science and practice*, *Technological Forecasting & Social Change*, vol. 89, pp. 115-130.
- Waddell P., 2002, *UrbanSim: Modeling urban development for land use, transportation, and environmental planning*, *Journal of the American Planning Association*, vol. 68(3), pp. 297-314.
- Xiang W.N., Clarke K.C., 2003, *The use of scenarios in land use planning*, *Environment and Planning B: Planning and Design*, vol. 30, issue 6, pp. 885-909.
- Zegras C., Sussman J., Conklin C., 2004, *Scenario planning for strategic regional transportation planning*, *Journal of Urban Planning and Development*, vol. 130(1), pp. 2-13.