

Smart Cities in Poland

Towards sustainability and a better
quality of life?

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6 Economic and financial determinants of the quality of life in Central and Eastern Europe cities

6.1 The economics of Smart Cities in Central and Eastern Europe

Economic and managerial factors are important determinants of the development of smart urban structures, as they directly determine the investment and technological capabilities of each city. Previous studies also indicate that urban structures are, by definition, privileged in terms of access to financing and the rate of economic growth. Kóňa et al. (2020), using Slovakia as an example, show that Slovak cities considered or aspiring to be smart are characterized by a very good economic situation compared to the country as a whole. Bratislava, in particular, stands out in this regard, but Košice, Banská Bystrica and Zvolen are not far behind. These entities are separated by quite a considerable distance from the economic indicators describing Slovakia's economic development. It is also notable that the country's capital, the aforementioned Bratislava, towers over the other cities equally in terms of innovation, leaving the other cities far behind. The described results allow us to conclude that smart cities – even in developing economies – are characterized by economic conditions that favor the implementation of smart urban solutions. Nevertheless, it should be emphasized that these conditions are more modest than in developed economies due to their lower level of economic development.

A broader study – conducted within the Visegrad Group (Poland, Hungary, Czech Republic, Slovakia) by Janusz and Kowalczyk (2022) – shows, in turn, that Czech cities (Prague, Brno, Ostrava and Plzeň) are best at implementing the Smart City concept, and cities in eastern Poland (Kielce, Rzeszów, Lublin) are weakest. The authors also argue that the Czech Republic's success is primarily due to the efficient implementation of e-government, significant economic and social potential, as well as the good state of the labor market, including openness to labor migrants. On the contrary, among the reasons for the failure of the cities of eastern Poland, they mention primarily the depopulation process in economically

less developed areas and the systematic aging of the population in this part of Poland.

Janusz and Kowalczyk (2022) – like the aforementioned Kóña et al. (2020) – draw attention to the very large development gap between the capitals of the Visegrad Group countries and other cities, which should be bridged by directing financial support from the European Union to less developed regions, so that the Smart City concept has a chance to develop in a fully sustainable manner. The authors also identify key problems in the implementation of the Smart City concept, which are limited investment funds, lack of interest in long-term planning, centralization of decisions and lack of legislation supporting the development of smart city solutions.

The lack of a strategic approach to managing smart cities in developing economies is also demonstrated by Tantau and Santa (2021) in a comparison of SC development in Romania and Austria. The authors point out that Austrian cities have had and implemented holistic SC strategies for years, while in Romanian cities, the idea of SC is piecemeal and pilot in nature. For example, Vienna (the capital) of Austria has a strategy for Smart City development in the 2050 perspective.

Similar conclusions are reached by Naterer et al. (2018) who analyzed the strategies of Slovenian cities and related their content to the Europe 2020 Strategy. They noted that Slovenian documents are of poor quality and do not comply with European guidelines. This not only causes development and adaptation problems but also makes it difficult to set and control the directions of city authorities.

In addition, Varró and Szalai (2022) emphasize that in CEE cities, Smart Cities development patterns prevailing in developed economies cannot be uncritically adopted due to post-socialist institutional remnants. They also note that the basic priorities in the creation of smart city solutions in the analyzed region should be digitalization and economic and energy transformation. They consider European Union funding for infrastructure projects as an important determinant of the aforementioned processes.

In turn, research by Ban et al. (2022) shows that the economic problems associated with developing smart cities in developing economies are labor market constraints. In the case of Romanian metropolises (Oradea – analyzed by the aforementioned researchers), these are low wages and the lack of desirable jobs, especially those based on modern information and communication technologies.

However, the links between economic development and smart urban solutions are not everywhere confirmed. Indeed, a study by Popova and Popovs (2022) conducted in the Latvian economy shows that smart city economic growth directly affects only smart urban communities. The

researchers did not confirm hypotheses indicating its impact on smart living, mobility and environment. This allows an optimistic conjecture that smart city solutions can also be successfully created in developing economies.

Similar observations are made in the course of Senetra and Szarek-Iwaniuk's (2020) research. The authors note that small cities can also develop intensively and keep up with larger units, provided that they operate in a network in which knowledge and experience are exchanged. An example of such interaction is the Polish Cittaslow Network they analyzed, in which they manage to improve indicators of socioeconomic development despite differences in development potential.

The review shows that the development of smart cities in Central and Eastern Europe is possible and is taking place in many countries. Nevertheless, it is hampered by financial barriers. Management and organizational conditions, which are largely a legacy of the previous centrally planned economic system, are also an obstacle. It seems that financial problems can be offset by support for infrastructure projects from the European Union, while strategic and administrative difficulties should be worked on through the adaptation of good practices and consistent, long-term action.

6.2 Economy and finance in Polish Smart Cities – statistical perspective

This section presents an analysis of economic and financial conditions from a statistical perspective for 16 provincial cities. In this perspective, reference is made to three key indicators illustrating the situation of the surveyed units considered as:

- current in the context of budget income per capita (this is a key indicator of the wealth of local government units in Poland, it is used in comparative analyses and in the process of distributing subsidies and grants from the central budget; it reflects the current financial situation of the surveyed cities and the current possibilities for financing the development of smart urban solutions);
- strategic by looking at property expenditures per capita (this is a measure of an entity's commitment to urban infrastructure development that defines its investment capacity);
- debt illustrating the scale of the budget deficit/surplus in relation to total revenues (this is an indicator that, on the one hand, reflects the sufficiency of budget funds and, on the other hand, informs about the scale of debt accumulation in the case of budget deficits).

Thus, income per capita in 16 provincial cities in 2021 is shown in Figure 6.1. The highest value of the analyzed indicator characterized Warsaw

– the capital of Poland. In all other cities, it was below PLN 10,000. In addition to the capital city, the following units stood out from the rest in terms of income: Wrocław, Poznań and Opole with a budget income per capita exceeding PLN 9,000. The indicated units are large regional economic centers, which translates directly into their financial situation. They are also cities located in the western part of Poland considered to be a region better developed economically than the provinces located in the east of the country.

It is also worth noting that Wrocław and Warsaw – cities most often recognized as smart in international rankings (De Falco, 2019; Orłowski, 2021; Baran et al., 2022) – top the list. Thus, these are undoubtedly privileged entities in terms of wealth, which is certainly a convenience for them in the process of financing investments in the development of smart urban infrastructure. After all, as has been emphasized, the development of smart urban infrastructure requires significant capital investment (Biancardi et al., 2021).

The lowest value of budget income (less than PLN 7,000) was in Gorzów Wielkopolski and Toruń. Łódź and Białystok were also cities with fairly low budget income per capita. These are entities far less frequently mentioned in the rankings of smart cities, which do not have as much economic power as Warsaw or Wrocław. Less industrialization and population are associated in this case with lower budget revenues from income

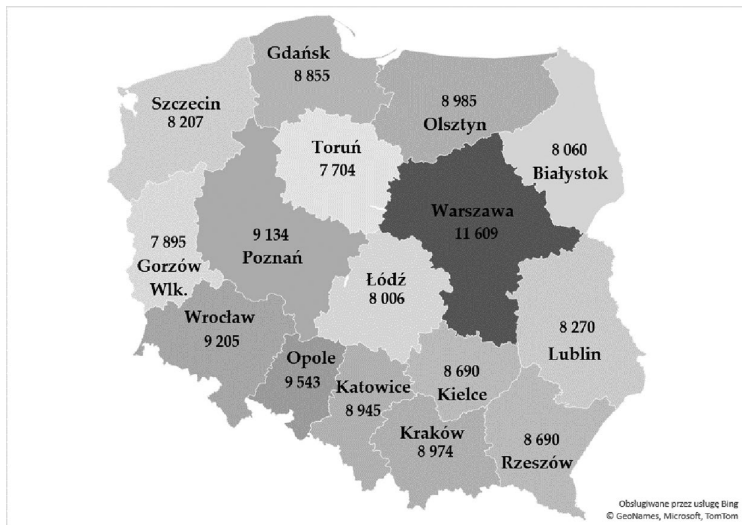


Figure 6.1 Budget revenue per capita in provincial cities in Poland in 2021 [in PLN].

Source: Own compilation using a map from Microsoft Excel based on information from the Local Data Bank.

and local taxes and can hinder the development of smart cities to a significant extent, since, as the previous chapters show, the creation of advanced technological and infrastructural solutions requires access to significant sources of financing (Blanck and Ribeiro, 2021; Jonek-Kowalska and Wolniak, 2021).

With the above statement in mind, Figure 6.2 shows the amount of property expenditures in the surveyed provincial cities in 2021.

The leaders in the above list were: Opole, Szczecin, Poznań and Gorzów Wielkopolski. Thus, the leaders included not only cities with a high degree of industrialization. Gorzów Wielkopolski, despite its low total budget revenues, devoted a significant part of them to property expenditures, which is a good indication of the strategic decisions of the city authorities, who are trying to improve the city's existing infrastructure.

Cities located in eastern Poland allocated considerably less funds for property expenditures. This region included two entities with the lowest level of the analyzed indicator (below PLN 1,000). These were Białystok and Olsztyn. This confirms the fairly common opinion about the division of Poland into region A (western, wealthier) and region B (eastern, poorer). It may also mean fewer opportunities for the development of smart urban solutions in economically less developed areas. It is interesting, however, that such regularity will not always occur, as evidenced by the example of Białystok, which is developing intensively and is sometimes

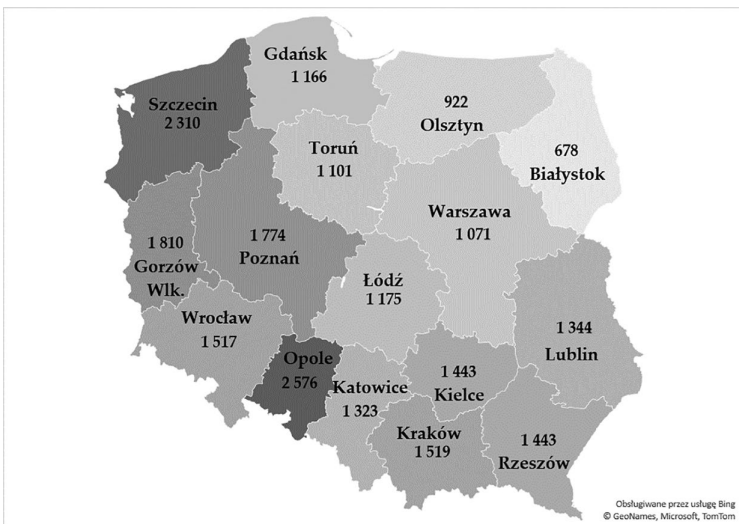


Figure 6.2 Property expenditures per capita in provincial cities in Poland in 2021 [in PLN].

Source: Own compilation using a map from Microsoft Excel based on information from the Local Data Bank.

mentioned in the literature and rankings as a contender for the title of fully smart city. Indeed, it should be remembered that the creation of smart city infrastructures also depends to a large extent on the efficiency and effectiveness of city management (Drapalova and Wegrich, 2020; Grossi et al., 2020; Lim et al., 2022; Park and Yoo, 2022), and favorable economic conditions are only one of the factors promoting their creation.

In the final stage of statistical analysis, reference was made to the sufficiency of budget resources, defined in relative terms as the ratio of deficit/surplus to total income. The value of this indicator for the surveyed provincial cities is shown in Figure 6.3.

According to the data presented in Figure 6.3, only 7 of the 16 analyzed cities had a budget deficit, with the highest level of this deficit in relation to total income recorded in Opole, Kraków, Szczecin and Gorzów Wielkopolski, which means that the entities listed above as leaders in property expenditures were implementing them at the expense of increasing the city's debt. This exposes the scope of Polish cities' financial problems.

Notably, many Polish cities have significantly increased the level of total debt in recent years as a result of the need to obtain an own contribution to finance infrastructure investments from European Union projects (mainly roads, rail routes, environmental protection) (Czykier-Wierzbą, 2009; Mrozińska, 2017). This contribution was raised through

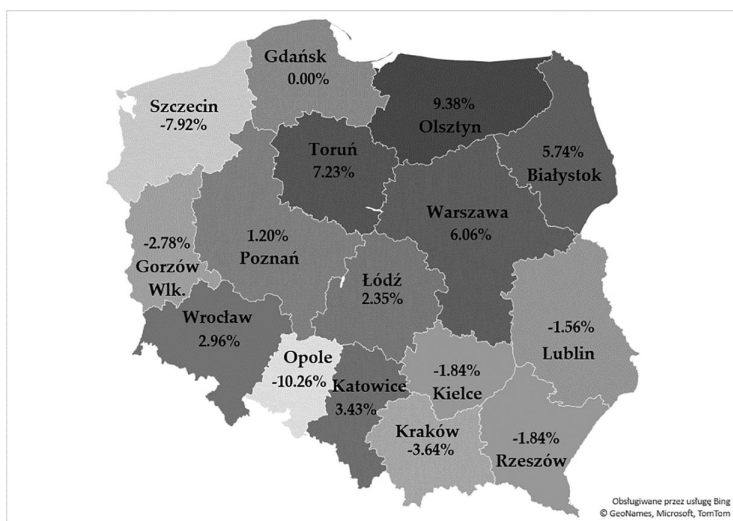


Figure 6.3 Budget deficit(-)/surplus(+) in relation to total budget revenues in provincial cities in Poland in 2021 [in %].

Source: Own compilation using a map from Microsoft Excel based on information from the Local Data Bank.

the issuance of municipal bonds and bank loans to the local government sector (Adamiak et al., 2012; Janeta, 2012; Hajdys, 2019). In many cases, the repayment period for this debt is estimated to be from a dozen to even several decades (Jonek-Kowalska and Turek, 2022). Hence, any additional budget deficit is a serious burden on the financial situation of Polish cities and may make it difficult to finance the property needs of future generations.

The map in Figure 6.3 also distinguishes four cities with the highest budget surplus (Olsztyn, Toruń, Warsaw and Białystok). Such a situation, of course, does not result in an increase in the city's debt and the need to seek deficit financing, but it is nevertheless difficult to assess it as correct, since public finance assumes annual budget balance (no surplus and no deficit). The high value of budget residuals may be an indication of poor budget planning or failure to carry out assumed tasks. This situation can be partially justified by the COVID-19 pandemic, but nevertheless its prolonged occurrence is not desirable.

In summary, the economic situation of Polish provincial cities is quite diverse. Large cities and those located in western Poland are characterized by better development conditions. Cities with a high level of property expenditures often finance infrastructure expansion from the budget deficit at the expense of increasing debt in the long term. In addition, the current and future economic situation (the COVID-19 pandemic; the Russia-Ukraine war, the conflict between national authorities and the European Union) is not conducive to the development of smart urban structures. Already the financial situation of local authorities and residents is deteriorating. Inflation is growing intensively, and unemployment is emerging. The economic recession is expected to deepen in 2023–2024. An important – for the community and the authorities – factor mitigating the effects of the economic crisis could be funds from the National Recovery and Resilience Plan obtained from the European Union (Dziembala and Kłos, 2021; Miernik, 2021), provided that the Polish government obtains an agreement with the European Commission, which is very difficult to obtain under the current political conditions and which further complicates the current economic situation.

6.3 Economic and financial conditions in Polish cities – survey perspective

In the next stage of the research, economic and financial considerations were presented from the perspective of municipal authorities based on surveys. A summary of the results including budget, investment and local labor market factors is included in Table 6.1.

Thus, on average, the stability of the city's economic situation was rated slightly higher than average by respondents, with 'good' being the

Table 6.1 Basic statistics for assessments of financial and economic conditions

<i>Evaluated conditions</i>	<i>Arithmetic mean</i>	<i>Mode</i>	<i>Median</i>	<i>Standard deviation</i>	<i>Coefficient of variation</i>
FINANCIAL					
Stability of the city's economic situation	3.68	4.00	4.00	0.89	24.34%
City's debt	3.14	3.00	3.00	1.03	32.76%
Overall investment attractiveness of the city	3.80	4.00	4.00	0.93	24.33%
Promotion of the city in terms of attracting new investors	3.71	4.00	4.00	1.01	27.22%
Possibility to get support for investment from the city funds	2.82	3.00	3.00	1.22	43.26%
ECONOMIC					
Labor costs at the local level	3.26	3.00	3.00	0.72	22.09%
General employment opportunities in the city	3.36	3.00	3.00	1.09	32.44%
Financial support instruments for the unemployed	3.22	3.00	3.00	1.04	32.30%
Loans for the creation of new jobs	2.48	3.00	3.00	1.29	52.02%
Social assistance for the unemployed	3.36	4.00	4.00	0.80	23.81%

Source: Own elaboration based on questionnaire surveys.

predominant rating, and responses between cities did not differ significantly. The surveys were conducted before the COVID-19 pandemic and the Russia-Ukraine war and therefore in good economic conditions during a phase of intensive economic growth (Wieczorek, 2017; Napiórkowski and Radło, 2022), which undoubtedly influenced respondents' final assessment of the cities' financial situation.

At this point, it is worth explaining that the budget of Polish municipalities is fed by their own revenues obtained from local fees and taxes (Dziemianowicz et al., 2018; Kossowski and Motek, 2021). Cities (urban

municipalities) also share in income tax from individuals living in them and income tax from businesses operating on their territory. In addition, these units receive subsidies and grants from the central budget depending on the level of their own income – the lower it is, the higher the level of government support (Czempas, 2017; Głowicka-Wołoszyn et al., 2017).

It is clear from the above that the income of cities depends on economic development and industrialization and thus on local and central tax revenues (Jonek-Kowalska, 2018; Wichowska, 2021). For this reason, economic recession significantly affects the financial situation of Polish municipalities and poses a very serious risk to their development. Taking into account the rather difficult starting point of the surveyed cities related to functioning in a developing economy with relatively short free market traditions, the current crisis (Papińska-Kacperek, 2021) may threaten the development of smart city structures, since the Smart City concept is itself quite elitist, and it is difficult to think about its implementation under conditions of unsatisfied basic living needs of residents. Therefore, it can be expected that investments in this area will be put on hold for several years and possibly return to their continuation during the period of economic recovery (Kostyk-Siekierska, 2021).

Continuing with the description of the survey results, it can be noted that the assessment of the level of debt fell far short, which may imply an underestimation of the relationship between the expanding level of liabilities and the current budget situation and may be due to a tenure cognitive perspective that covers only the period until the next election. After all, as already mentioned, nationwide data show that the debt of the local government sector has been growing for many years, and in some cases, the repayment period of this debt reaches several decades (Wichowska, 2019; Wojtowicz and Hodzic, 2021; Białek-Jaworska, 2022), which undoubtedly poses a threat to current financial stability as well.

The evaluation discrepancies also relate to perceptions of the investment situation. Indeed, respondents gave a good rating for the city's overall investment situation. On the contrary, with regard to details, they were already more critical. They rated the city's promotional activities worse, and the possibility of obtaining investment support from city funds for investors was rated by them as unlikely.

Thus, based on the results obtained, it can be concluded that the overall economic and investment image of the city is quite good in the eyes of the authorities, but individual activities and their results no longer arouse so much enthusiasm. It is worth noting that such a duality of opinion may not serve as an objective assessment of the situation and may result in the buildup of economic problems and discouragement of investors from establishing operations in the city. This is because both entrepreneurs and residents evaluate the decisions and actions of the city authorities in the context of their detailed effects rather than intentions and generalities.

The ultimate quality of life is also affected by actual rather than potential management effects (Wolek and Hebel, 2019; Denis et al., 2021).

The assessment of the city's labor market from the city government's perspective is slightly better than average for both employers and employees. Indeed, respondents rated the level of labor costs in the city as average, as did employment opportunities. Financial support instruments for the unemployed, including social assistance for the unemployed, were also rated slightly better than adequate.

Interestingly, respondents rated very poorly the possibility of active support for the unemployed and investors in the form of loans for the creation of new jobs. This is an offshoot of an elaborate system of social assistance based on direct, not necessarily targeted, transfers of money to the unemployed and other social groups at risk of economic exclusion. Such a system of support – virtually devoid of incentive and activation instruments – can pose a serious threat to the social and economic development of cities. It also does not encourage entrepreneurship and innovation, which, like the circumstance indicated above, does not serve the development of smart cities.

Based on the above observations, one can conclude that Polish cities pay rather little attention to creating good conditions for investment. Meanwhile, this is the key to improving the local labor market and economic development. In the context of the budget principles described earlier, it is also a prerequisite for obtaining higher budget revenues from local and central taxes.

Poor economic development is particularly evident in cities where the restructuring of traditional industries has resulted in the liquidation of many large enterprises (mining, metallurgy, shipbuilding, etc.) and where attempts to build new economic structures have not been entirely successful. Such a situation is a derivative of the rather low innovativeness of the Polish economy and the enterprises operating in it. This makes it impossible to cope with modern technological challenges necessary to create advanced solutions in the area of information or telecommunications technologies. As a result, these cities are often doomed to depopulation and economic and social degradation (Szafrńska et al., 2019; Gołata and Kuroпка, 2022). For these reasons, in this monograph the authors would like to draw attention to the relevance of knowledge and technology transfer, commercialization of scientific research results, innovation and entrepreneurship for the development not only of the economy as a whole but also of local and regional socioeconomic centers (Grimaldi et al., 2021; D'Amico et al., 2022).

In the course of further analysis, the survey results were contrasted with the size and wealth of the surveyed cities. An assessment of the relationships that occurred in this regard is included in Table 6.2.

The analysis found a fairly large number of statistically significant relationships between the studied determinants and the size and wealth of

Table 6.2 Basic statistics for assessments of financial and economic conditions

<i>Evaluated conditions</i>	<i>Spearman's rank correlation coefficient</i>	
	<i>Population</i>	<i>Income level</i>
FINANCIAL		
Stability of the city's economic situation	0.2339**	0.3987**
City's debt	0.0733	0.0987
Overall investment attractiveness of the city	0.3057**	0.3209**
Promotion of the city in terms of attracting new investors	0.3008**	0.2911**
Possibility to get support for investment from the city funds	0.3524**	0.3216**
ECONOMIC		
Labor costs at the local level	0.1617**	0.1817**
General employment opportunities in the city	0.3551**	0.3705**
Financial support instruments for the unemployed	0.3007**	0.2506**
Loans for the creation of new jobs	0.2307**	-0.1976**
Social assistance for the unemployed	0.1586**	0.0614

* $p < 0.05$; ** $p < 0.01$.

the surveyed cities. However, most of these relationships are of a weak or moderate nature, meaning that the number of residents and the level of income are related to the economic and financial situation of the city, but they are not relationships of a key nature.

Thus, the city's financial stability is most strongly correlated with the level of income, which seems quite obvious, since a higher level of income means spending sufficiency, greater development opportunities, and a lower risk of budget deficits and increased debt. So, cities with higher incomes, including those described in the first section, are more likely to develop and implement the infrastructural solutions of the Smart City concept.

According to respondents, higher incomes and a larger population also contribute to a more attractive investment image for the city. They also have a positive impact on the possibility of obtaining investment support from the city budget. It is worth adding, however, that while higher incomes directly affect the possibility of subsidizing city stakeholders, they do not necessarily determine the possibility of investment development, which also depends on the creativity and innovation of entrepreneurs or the local community. As an example, there are many smaller and less affluent localities that, taking advantage of their unique characteristics and resources, have thrived by creating new jobs and contributing

to intensive local development (an example is the small town of Zator located in southern Poland, where one of the largest and most modern amusement parks in Europe has been created).

The responses also indicate that the size of the city and its wealth are related to promotion in terms of attracting new investors. It is difficult to agree completely with such a deterministic perception of this aspect. Undoubtedly, one hears about large and recognizable cities more often and more, but smaller regions also have their competitive advantages in the form of significant investment areas or lower costs of doing business. In addition, promotion, including its form, scope and strength of impact, depends directly on the initiative of the city authorities and local government actions taken in this regard. Adopting a passive stance in which failure is assumed in advance is certainly not appropriate and not conducive to development.

When analyzing the respondents' answers, it is also worth noting the lack of correlation between income and population and the level of city indebtedness. This confirms the previously described and widespread tendency for Polish cities to become indebted regardless of their size and wealth. Only the reasons for this may differ in this case. For smaller and poorer cities, rising indebtedness may be a result of a lack of funds to finance current budget expenditures. In large cities with higher incomes, it may result from financing property expenditures.

In assessing the economic factors determining residents' quality of life, the strongest correlations were in the impact of city size and wealth on employment opportunities. This is a reasonable observation due to the greater industrialization of large cities. These units are therefore able to offer their residents richer job opportunities and often higher wages.

Interestingly, the study shows that financial support options for the unemployed are more closely correlated with the size of a city than with its wealth as expressed by per capita income level. Nevertheless, as the population and income level increase, the unemployed can count on a greater range of financial support instruments. It is worth adding, however, that additional social assistance for the unemployed is weakly and insignificantly related to the size of the city and its wealth, respectively. This may mean that the already described rather wide range of social support is characterized by similar availability in both large and small cities.

A statistically significant but weak correlation relationship was found in the case of the dependence of the possibility of obtaining a loan for the creation of new jobs on the size and economic situation of the city, with a negative correlation in the case of the economic situation of the city, suggesting that the availability of this form of support is greater in smaller cities than in large entities. Entrepreneurs can therefore count on fairly even access to development funds, although unfortunately, from

the assessment of this determinant described earlier, it is very limited. Newly emerging and expanding business entities must therefore rely primarily on their own ability to maintain business, which certainly does not encourage their creation and is not conducive to the development of smart urban structures.

The survey results presented in Table 6.2 also indicate a low correlation of local labor costs with the city's population and per capita income level. From the point of view of urban sustainability, this is good news, since the situation assessed in this way provides equal opportunities for all employees and employers regardless of the location and demographic and economic characteristics of the city. Nevertheless, combined with a low assessment of local labor costs – indicating their unattractiveness – this is not entirely positive information.

Consequently, based on the results of the surveys, we can conclude as follows:

- Of the financial considerations for living in the city, the possibility of obtaining investment support from the city's funds was rated the worst, and the promotion of the city in terms of attracting new investors was rated the best, although certainly the latter will not compensate for real help in establishing and developing a business.
- Among the economic determinants, the lowest rating was given to the possibility of obtaining a loan for the creation of new jobs, and the best rating was given to the general conditions of employment in the city and social assistance for the unemployed, which clearly indicates the passivity of forms of assistance for the unemployed and the low level of support for startups, especially small and medium-sized enterprises.
- There are many statistically significant relationships between city size and wealth and financial and economic determinants of quality of life, but they are weak and moderate in nature.
- The size of the city most strongly determines the possibility of receiving investment support from city funds and the overall employment opportunities in the city.
- The city's wealth is most strongly correlated with the stability of the city's economic situation and overall employment opportunities in the city.

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