

Assessment of the walking accessibility of public libraries in Krakow using the E2SFCA approach

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Abstract: *Public libraries play an important role for local neighbourhoods as they function as community hubs. In an ideal case libraries would be located in such a way that a high level of equity in access to them is ensured. This study examines whether or not this equity of access is provided in the case of Krakow where the network of public libraries has recently been reorganised. Besides other methods of measuring accessibility the authors utilise the enhanced two-step floating catchment area approach in order to uncover spatial differences in potential accessibility on foot. Findings from the analyses indicate that, with the exception of the central districts of Krakow, every district is faced with an accumulation of more or less neglected areas. In addition, the work highlights that almost one quarter of Krakow's population is affected by poor accessibility on foot (more than 20 minutes walk) to the nearest library. The study concludes that the variations in access to libraries presented should be considered by local planners in future phases of the planning of new libraries.*

Keywords: *libraries, accessibility, walking accessibility, E2SFCA approach, Krakow.*

submitted: *May 2017*

reviewed: *August 2017*

accepted: *September 2017*



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Introduction

Cities are spatial regions with a varying number of inhabitants. Some areas in the city lose population over time while other parts of the city are growing rapidly, affecting its spatial structure and accessibility to different types of services. Often when new residential areas are developed, especially in countries and cities without effective spatial planning, they lack basic public facilities such as kindergartens, schools, health care units or libraries. Libraries, which will be the special focus of this paper, are site-preferred facilities, which are characterised by “positive place utility close to the facility” (Tsou, Hung & Chang 2005: 427). In other words, people benefit from libraries which are within reach. Thereby it should be noted that place utility declines with increasing distance. Thus, there is a “need to analyse distance and the physical accessibility of a public library to ascertain that the community at large has an equal right to utilise (...) library resources” (Nadzri et al. 2015: 72).

Their accessibility is not only important because of their traditional book borrowing services but also because of their role as community hubs, a role that is being perceived as more and more important. Growing numbers of libraries are re-defining their mission and evolving towards a “third place”,

other than private, home spaces and study- or workplaces, where one can not only study or read a book, but also meet both old and new friends, and engage in social and cultural activities (Aabø, Audunson & Vårheim 2010; Elmborg 2011; Edwards, Robinson & Unger 2013). Libraries are thus more and more frequently considered as key institutions in building and enhancing social capital resources (Vårheim, Steinmo & Ide 2008; Ferguson 2012; Svendsen 2013) through strengthening existing neighbourhood ties thus fostering new relations, especially by integrating new inhabitants in a local community (Elbeshausen & Skov 2004; Audunson, Essmat & Aabø 2011; Vårheim 2011; Johnson 2012). Libraries are expected to play this new, broader role in their communities because firstly, they are perceived as open and safe for different social groups and secondly, they represent cultural institutions with the densest network of units present in both larger and smaller settlements, being closest to large numbers of both urban and rural populations (Murzyn-Kupisz & Działek 2015).

A recent report about Krakow libraries confirms that their users mostly come from the neighbourhoods surrounding them (Gądecki & Knaś 2017). It also envisages that beside their core cultural role, Krakow libraries should also fulfil educational, social and civic functions as local activity cen-

tres. It acknowledges the necessity for public libraries to be physically accessible, however no analysis has been carried out on whether the current network fulfils this role and whether there are under-served areas.

According to the considerations presented earlier, in an ideal case such institutions like public libraries would be located in such a way that they are ensured a high level of equity in access to them. This study analyses whether or not this equity of access is provided in the case of Krakow. Hence, the aim of the study is to uncover spatial differences of potential accessibility within the city of Krakow. The results of the study can subsequently be used in the future as a starting point in the planning phase for new libraries. This could be especially useful as Krakow libraries have recently been reorganised: four district networks (Śródmieście, Podgórze, Krowdrza and Nowa Huta) of municipal libraries were transformed into one city-wide network now called Biblioteka Kraków (i.e. Library Kraków) on January 1st, 2017. After this change, the network consists of one main library, 56 branch libraries all over the city and 8 small library points located in cultural clubs in the eastern part of Nowa Huta. It is a relatively dynamic network and in recent years several branches have been closed, and some moved to new locations (Gądecki & Knaś 2017). It is envisaged that new libraries will be opened in the very near future, so the findings from this paper could support location choices for new facilities.

The content of this paper is structured as follows: first, the existing literature will be reviewed. Second, the method applied is presented – this includes information on all the steps from data collection to actual data analysis. Next, the results of the analysis are presented, followed by a discussion on the overall conclusions on how the outcome of the study can be utilised. In addition, the limitations of this research are highlighted in the final part.

Literature review

The literature review is divided into two sections. The first section deals with different types of accessibility in which it is mainly spatial factors that are presented. In addition, several approaches for measuring spatial accessibility are introduced. The second section focuses explicitly on the spatial aspects of library location. It illustrates what methods were used in the past to measure library access. In addition, the specifications for some of the methods are outlined, as they are important as comparative data for the method implemented in this study.

Types of accessibility and methods of measuring it

In general, following R. Penchansky & J.W. Thomas (1981 as cited in Polzin et al. 2014), there are five different dimensions involved in access: accommodation, affordability, acceptability, accessibility and availability. The two last-mentioned dimensions are spatial dimensions, which will be explained in more detail. The availability dimension simply refers to the supply points and/or their capacity (Polzin et al. 2014: 719). In contrast, accessibility relates to “ease of reach”

and consists of three components: origin, destination and their relationship (Park 2012b: 14). Therefore, comparing both, these approaches can be seen as alternatives to each other (Luo & Qi 2009: 1101), whereas the availability dimension is clearly the simpler one (Luo 2004: 2). Focusing on accessibility¹, it can be noted that there are, in the main, two different types of accessibility, namely revealed accessibility and potential accessibility. Revealed accessibility is connected with the actual utilisation of a particular facility. For instance, P. Polzin et al. (2014: 719) suppose, at least in the context of health services, that this approach is useful for the characterisation of actual demand. In contrast potential accessibility emphasises geographic patterns (Luo 2004: 2). Therefore, this type of accessibility can be used to show spatial differences. The outcome of analysis which makes use of this approach is “considered useful for policies aimed at reducing inequities in access” (Polzin et al. 2014: 720).

There are various methods of measuring spatial accessibility which have been utilised in the past based on this theoretical construct. The five most important methods (or approaches) are mentioned by E. Talen (2003: 183). These include the container, coverage, minimum distance, travel cost and gravity approaches.

The container approach is defined as the „number of facilities contained within a given unit” (Talen 2003: 183). A given unit in regard to the definition could be for example an administrative boundary (Higgs, Langford & Norman 2015: 106). Although this accessibility measurement is easy to calculate and the outcome is interpretable without any problems, this approach has experienced a lot of criticism. One problem of this approach is that it assumes equal access within a region (Luo 2004: 2; Luo & Whippo 2012: 789). In other words, it overlooks inner spatial variation. This can be problematic especially when somebody examines larger research units. Secondly, it does not imply interactions between immediate neighbours and therefore, it does not account for mobility (Dai & Wang 2011: 660). Lastly, the container approach does not include any characteristics such as the size of a facility.

The coverage approach, also known as opportunity-based measures (Park 2012b: 14), is comparable to the container approach, but the unit being considered is derived in a different manner. E. Talen (2003: 183) defines this approach as “the number of facilities within a given distance from a point of origin”, whereas the point of origin normally stands for a centroid of a census area (Donnelly 2015: 281). The centroid provides an approximation of the location of residents. Nevertheless, the disadvantage of not considering the inner spatial “variability of accessibility” (Dai & Wang 2011: 660) remains.

The minimum distance approach measures accessibility by determining “the distance between a point of origin and the nearest facility” (Talen 2003: 183). Obviously, the assumption behind this spatial approach is that individuals are travelling to the closest facility (e.g. library) from their homes

¹ Please note that the term accessibility has a broad meaning and several definitions (Dahlgren 2008: 10; Nadzri et al. 2015: 73; Park 2012: 14) and only parts of it, with the focus on physical access, are presented here.

(Park 2012: 152). The distances are typically calculated using Euclidean (straight-line) or network distances (Higgs et al. 2015: 106). However, this approach does not take into account the fact that people may use more than one facility (Dai & Wang 2011: 660).

Another approach concentrates on travel cost. Travel cost is defined as “the average distance between a point of origin and all facilities” (Talen 2003: 183). Therefore, it solves the major problem of the minimum distance approach and the results (distance units) are rather easily interpretable (Talen & Anselin 1998: 600).

Last but not least E. Talen (2003: 183) refers to the gravity approach. The outcome of the gravity approach is “an index in which the sum of all facilities (weighted by size) is divided by the »frictional effect« of distance”. This approach can also be seen as an integration of regional availability (demand-to-supply ratio) and regional accessibility (interaction between supply and demand) (Ni et al. 2015: 11491). The gravity model assumes that accessibility decreases with an increase in distance in a gravitational way (Joseph & Bantock 1982 as cited in Wan, Zou & Sternberg 2012: 1074)². In contrast to the travel cost approach this provides the possibility of including an additional factor (e.g. size of facility) (Talen & Anselin 1998: 600). It is self-evident that this method requires more computation and is probably not really intuitive. The major drawback, however, is the additional need for specific data. As X. Xiong et al. (2016) mention, irrespective of the data which researchers also need for the other approach (e.g. locations of supply and demand, traffic network), knowledge about travel times must be present. In addition, a special coefficient must be determined which is used in the distance decay function. In the recent past, the gravity model was extended in order to improve the basic version of the model, thus overcoming these weaknesses.

One such extension is the floating catchment area (FCA) technique (Luo 2004). Again, this method was modified and enhanced by several authors, plus it was applied to different research contexts and different scales, for example the two-step floating catchment area (2SFCA; Luo & Whippo 2012), enhanced variable two-step floating catchment area (EV2SFCA; Ni et al. 2015) and kernel density two-step floating catchment area (KD2SFCA; Dai & Wang 2011). As one of these enhanced methods will be implemented in this study, further explanation can be found in the methodological part of the paper.

All in all, as described above, every single approach for measuring accessibility has its own good points and drawbacks. By keeping that in mind, we focus now on papers which have used different approaches to measure library access.

Physical access to libraries

Even though many papers utilise GIS to answer research questions connected with libraries cf. (Luo 2004), academic studies, especially dealing with physical access to libraries, are relatively rare. G. Higgs, M. Langford & R. Fry (2013) provide a good overview of them. For example, they quote K. J. Cole and A. C. Gatrell (1986) who were using the gravity

approach, but they also say that “most of the GIS-based analysis currently conducted is based on assumptions of behaviour, e.g. (that) people attend the nearest library” (Higgs et al. 2013: 26). The authors themselves applied the enhanced two-step floating catchment area (E2SFCA) method, which is also a modified version of the FCA method mentioned above. They used this method to examine variations in the provision of digital services in public libraries in Wales and in particular presented accessibility differences for the city of Cardiff. In addition, another approach was used by K.-W. Tsou et al. (2005). They used the travel cost approach to measure urban public facilities, including public libraries. Probably what K. J. Cole and A. C. Gatrell (1986: 258) had already said many years ago is still appropriate: “There is no consensus in the literature on public-facility location about the measurement of accessibility”. Irrespective of the methods, the outcome and settings implemented are of particular importance in this research. One could question if distance to libraries really does matter when somebody decides to use a library. Although researchers have “varied views on the relation between distance and library” (Nadzri et al. 2015: 73), it is probably one of the most common variables for measuring accessibility (cf. S. J. Park 2012b: 13; Donnelly 2015: 280; Dewe 2006: 109). Beyond that it is also one of the topics that is most argued about (Nadzri et al. 2015: 73). Park (2012b: 17) shows that on the one hand the “registrants use the library nearest to their home”, but on the other hand that some of them “use a more distant library”. From this it follows that distance is important, but accurate prediction is rather difficult. Along with distance, travel time is also an important factor, if not more important, especially in urban surroundings (Park 2012: 152). Moreover, F. Wang & W. W. Minor (2002) show that travel time better represents travel costs than simple straight-line distances. Results of distance analysis show that library users normally live within 1–3 miles (Park 2012: 152 as cited in Palmer 1981; Nadzri et al. 2015: 72; Donnelly 2015: 287f) or to express it in travel times, within about 20 minutes (Park 2012: 162). It should be noted that these numbers are the results obtained in certain research contexts. In addition, there is, of course, a difference between rural and urban areas (Donnelly 2015: 287f). However, the results could at least provide an indication of the size of the buffer which must be set by the researcher for most of the approaches.

Research design

This study applies the above mentioned E2SFCA method to measure potential differences in library accessibility in the city of Krakow. Before the actual method of analysis is described in more detail, a short description will be given of the data collected and the data pre-processing steps performed.

Data collection

Three main units of data were required for the accessibility analysis, namely supply points (libraries), demand points (population number), and the street network. Starting with the supply points, it became clear that Krakow can offer a great number of libraries. Overall 66 public libraries are included

² For more details about the gravity model see Xiong et al. (2016).

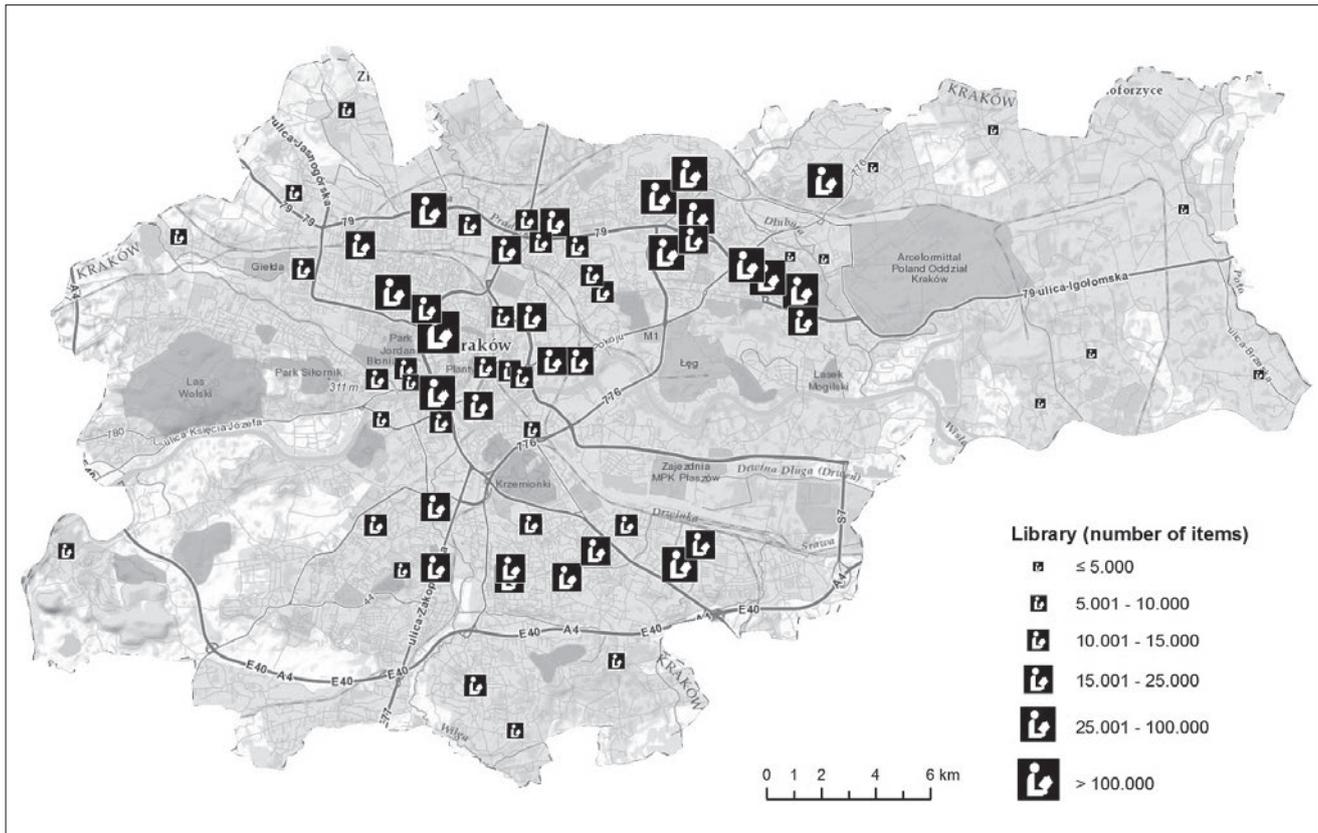


Figure 1 Location of public libraries in Krakow

Source: own research based on statistical data obtained from libraries; map sources: Esri, Here, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetmap contributors, and the GIS User community.

in the analysis. As the aim of the study is to focus on public libraries, special libraries (e.g. university libraries) were ignored. It has already been noted that at the beginning of 2017 all the municipal libraries in four city districts were combined into one city-wide library network with 65 units (Fig. 1). Most of the libraries are located close to the city centre of Krakow or on its edges, where the density of population is the highest. There are numerous and quite large libraries in the large housing estates in Nowa Huta, and in the Northern and Southern parts of the city. There are also a few smaller libraries located near the administrative edge in more suburban settings. In addition, the regional public library (Wojewódzka Biblioteka Publiczna) managed by the regional authorities was taken into account. Although this, the largest public library in the city, serves readers from the whole city and beyond, we have included it in the analysis as it might be the library of choice for many inhabitants in the city centre who can choose it in preference to other relatively smaller municipal libraries.

In addition to the location of libraries, official information about their actual size, in terms of the number of items available, was collected as of December 31, 2016. It became clear that the regional library in the inner city with more than 460,000 items and libraries in the western parts of Nowa Huta with up to 62,000 items are relatively larger than libraries in other parts of the city.

In general, it can be understood that “the greater the level of disaggregation of data, the higher the level of precision in measuring access” (Talen 2003: 184). Therefore, one should

use the least aggregated data available. In the case of population numbers for the above-mentioned study area, detailed data for 2013 were obtained from Krakow’s municipal spatial information system³. Unfortunately these data only include the officially registered population (registered both for permanent and temporary stay) which is not equal to the real population numbers as in some areas it may be higher due to various reasons (e.g. students renting flats), especially in newly developed areas. However, these are the best data that can be obtained from the official public statistics. The corresponding grid consists of 10,436 squares with a size of 100x100m, including a population number attribute. Apart from the size, the grid has the advantage that it only covers areas where people actually live. Hence, in comparison to census tracts, it is not just based on administrative boundaries.

Last, but not least, the street network is a crucial element of the analysis. The “TomTom” street network dataset was provided by courtesy of WIGeoGIS⁴. This street network contains several cost attribute characteristics such as distance or travel time.

Data preprocessing

In preparation for the actual accessibility analysis and apart from the geocoding of the public libraries, one major

³ <http://obserwatorium.um.krakow.pl/obserwatorium/kompozycje/?lang=en>

⁴ <https://www.wigeogis.com/en/home>

calculation was performed in ArcGIS. For each of the given population squares, centroids were created and then allocated the corresponding population number. Hence, in the following analysis centroids are used to represent the location of the demand population. This approximation can be done without any interference in the results, because the squares are relatively small. This step is necessary as the method used requires point features.

Data analysis

Several methods have already been tried to measure accessibility. The E2SFCA method was chosen from among these approaches as it is a method, which tries to incorporate many important factors like the actual numbers of supply and demand. Furthermore it is suitable for examining the accessibility of libraries on a large scale (cf. Higgs et al. 2013). Together with detailed information on places of residence, it leads to a precise spatial representation of accessibility. It can be seen as the most suitable approach when compared to other gravity models as other similar enhanced 2SFCA methods require further specification, for example a “fixed facility-to-population ratio threshold” (Ni et al. 2015: 14494f.). These methods are probably useful when somebody examines accessibility of health care. The supply points could represent hospitals with a limited number of beds. However, in the case of libraries such a strict number does not exist. Therefore, the E2SFCA is applied in this paper. Even though the results (E2SFCA-values) were finally calculated with a free ArcGIS add-in⁵, the underlying background process of this calculation will be summarised⁶ in the following outline. As the name of the method suggests, two steps were carried out.

First of all, the locations of supply and demand points must be identified. The next step is to set a threshold for the catchment around each supply point (library). The different shapes of catchment areas are the result of the actual street network. This catchment area determines which population points are relevant for an individual library. Now a ratio for each library can be calculated by summing up all demand points or rather all residents falling inside the catchment. For instance, this can lead to a fraction of $\frac{1}{1000}$, meaning that 1000 people are within the catchment of this particular library. Instead of the “1” in the numerator other numbers can be assigned in order to consider differences (e.g. size) in the supply points (Fig. 2, step 1).

In the second step catchment areas are generated with the same threshold as before. In contrast to the first calculation, this time the population points are the points of origin. Now, keeping in mind that each library has an assigned value (fraction from step 1), all values within the catchment area of a population point can be summed up. As more libraries fall inside the catchment area, the higher will be the final score for this population point, which in turn is an indicator

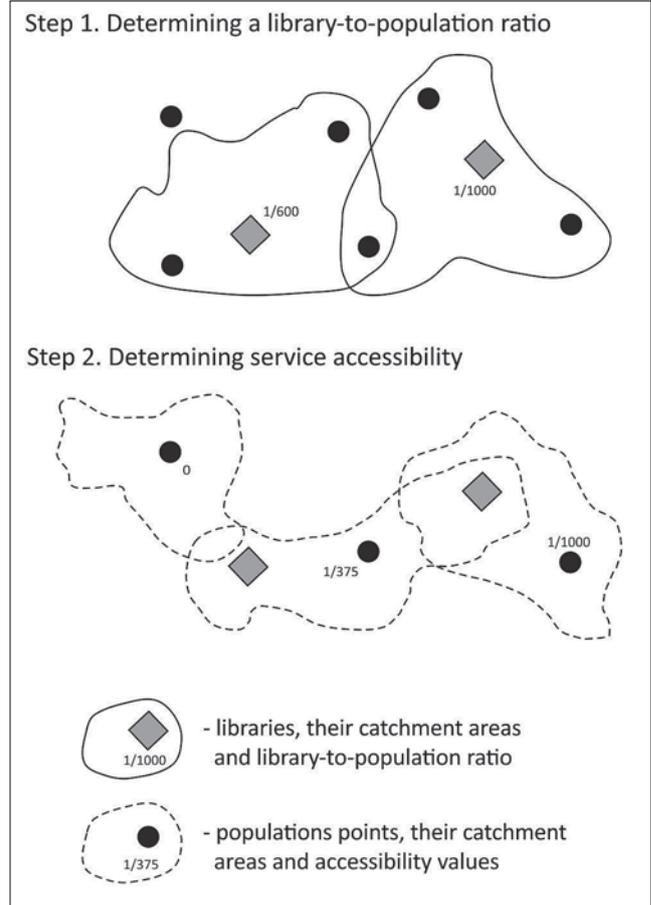


Figure 2 The two steps of the E2SFCA method

Source: own interpretation.

of better accessibility. The enhanced model also considers distance impedance (resistance to movement) by creating subzones within the catchment. This leads to weighted 2FCA-values depending on the distance or travel time between a library and a population point. The final step of the analysis is then to transfer these E2FCA-values back to the initial population squares (Fig. 2, step 2).

Settings

As mentioned above several settings have to be defined. In this analysis, the number of items is incorporated as a measure of size and therefore represents the numerator in the above mentioned library-to-population fraction. Furthermore, a linear distance decay factor⁷ is applied, because there was no information available about the actual behaviour of library users. It follows from this assumption that libraries close to population points will be assessed with a higher value than more distant libraries. As the entire study area can be described as urban and because the focal point lies in local neighbourhoods, a 20-minute walking threshold was accepted. The analysis refers to a scenario where a walking speed of 4 km/h is assumed.

⁵ Download link: https://www.researchgate.net/publication/261398233_USWFCA_An_ArcGIS_101102_Add-In_tool_to_compute_Enhanced_Two-Step_Floating_Catchment_Area_accessibility_scores

⁶ For further and more detailed explanations of the method see Luo and Qi (2009).

⁷ “Distance decay is a phenomenon observed between locations (...) – the further apart they are, the less likely it is that they will interact very much” (Dempsey 2012).

Table 1 Summary of outcomes of different approaches to accessibility

Approach	Indicator	Range (min–max)	Average
E2SFCA	E2SFCA-value	0–52.1	1.4
Coverage	number of libraries within threshold ⁸	0–6	1.0
Minimum distance	distance to the nearest library in minutes	0–122	11.1
Travel cost ⁹	distance to all libraries in the study in minutes	0–20	12.6

Source: own research.

Findings

Apart from calculating E2SFCA-values, results for the coverage, minimum distance and travel cost approaches were also considered (Tab. 1). These numbers provide additional background information regarding library accessibility in Krakow. Thus, before focusing on the ES2FCA approach a few words should be noted about the outcomes of those other approaches.

Beginning with the coverage approach, it became clear that on average only one library is within range of a population point. This small number is a result of many population points with a coverage of zero libraries (almost half of them) when 20 walking minutes is set as a threshold. Still, almost every fifth population point with more than 40 per cent of the population is within range of two or more libraries (Tab. 2). The best coverage with a total of six libraries is observed for one point in the western part of the district of Nowa Huta. This probably demonstrates the relatively good infrastructure planning practices in this densely populated part of the city with large housing estates developed during communist times.

At first sight the results for the minimum distance approach indicate a relatively good overall accessibility as the average walking time to the nearest library is 11.1 minutes. However, a wide range of travel time to the nearest library exists. This can be seen as a first predictor of spatial inequalities of accessibility in Krakow. The maximum walking time (>120min) can be found in the district of Dębniki, the second largest district in Krakow (Fig. 3). The maximum range of the indicator in the travel cost approach is equal to the

threshold of 20 min and calculations were only made for population points within this range. Thus, the results are not in conflict with the previous approach.

Now more detailed results will be discussed placing the focus on the ES2FCA approach. The values of the ES2FCA results are in a range between 0 and 52.1, in which the higher the index values, the better the accessibility. Its average value is 1.4 and it remains relatively low (2.8), even if zero-values are excluded. The results imply that few places exist in Krakow where accessibility is much better than the average in the whole city. These places can mainly be found in the central, inner-city zone of Krakow (Fig. 4). The reason lies not simply in the concentration of libraries in that area, but also in the great number of books offered by the regional library. By way of comparison, it should be noted that this library provides twenty times more books than an average municipal library in Krakow. In addition, it must also be pointed out that the number of people living in this area is a critical factor for the high values. However, there are large areas outside the city centre with low ES2FCA-values or zero-values, which is in line with the result of the coverage approach. In this case, again, a zero value means that the population point is outside any threshold or, in other words, no library is reachable within a 20-minute walking distance. Hence, these areas should be areas of special focus, because they can indicate under-supply of library services.

Higher accessibility is primarily observed close to libraries, however quite high values are also expected further away from them in areas that are covered by several libraries. Nevertheless, due to the greater distance to these libraries, they are negatively affected by distance decay. This leads to

Table 2 Coverage of libraries within 20 minutes threshold

Number of libraries accessible within 20 minute threshold	Populated area in km ²	Share of populated area in %	Population	Share of population
0	51.50	49.8	181,603	24.7
1	32.01	30.9	251,890	34.2
2	11.87	11.5	177,137	24.0
3	5.76	5.6	77,066	10.5
4	2.70	2.6	40,839	5.5
5	0.51	0.5	8,023	1.1
6	0.01	0.0	17	0.0
Total	104.36	100.0	736,575	100.0

Source: own research.

⁸ Numbers were generated from the results of all individual population points.

⁹ Normally distances to all the libraries in Krakow would have been considered. In this case only libraries within the threshold are included.

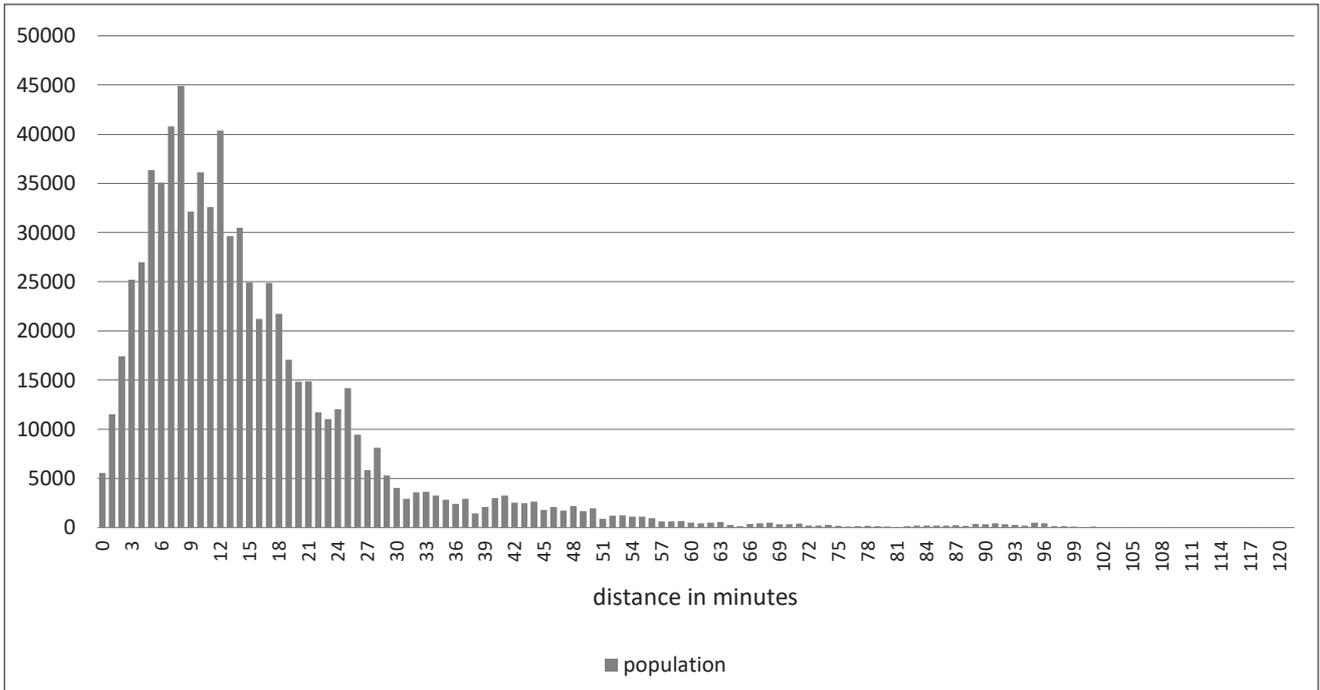


Figure 3 Number of population within a given distance to the nearest library

Source: own research.

smaller E2SFCA-values in these areas. How can the rest of the pattern be explained? For example, even though the east of Nowa Huta is quite far from the centre, the small libraries in cultural clubs provide at least a basic offering to most people in the area. By contrast, and apart from one library

at the edge of the Dębniki district (in Tyniec), a similar offer does not exist in the western part of Krakow. Similarly other parts of Krakow show relatively low values and zero-values: for instance, areas at the eastern edge of Bieżanów-Prokocim or areas along the River Vistula in the Podgórze

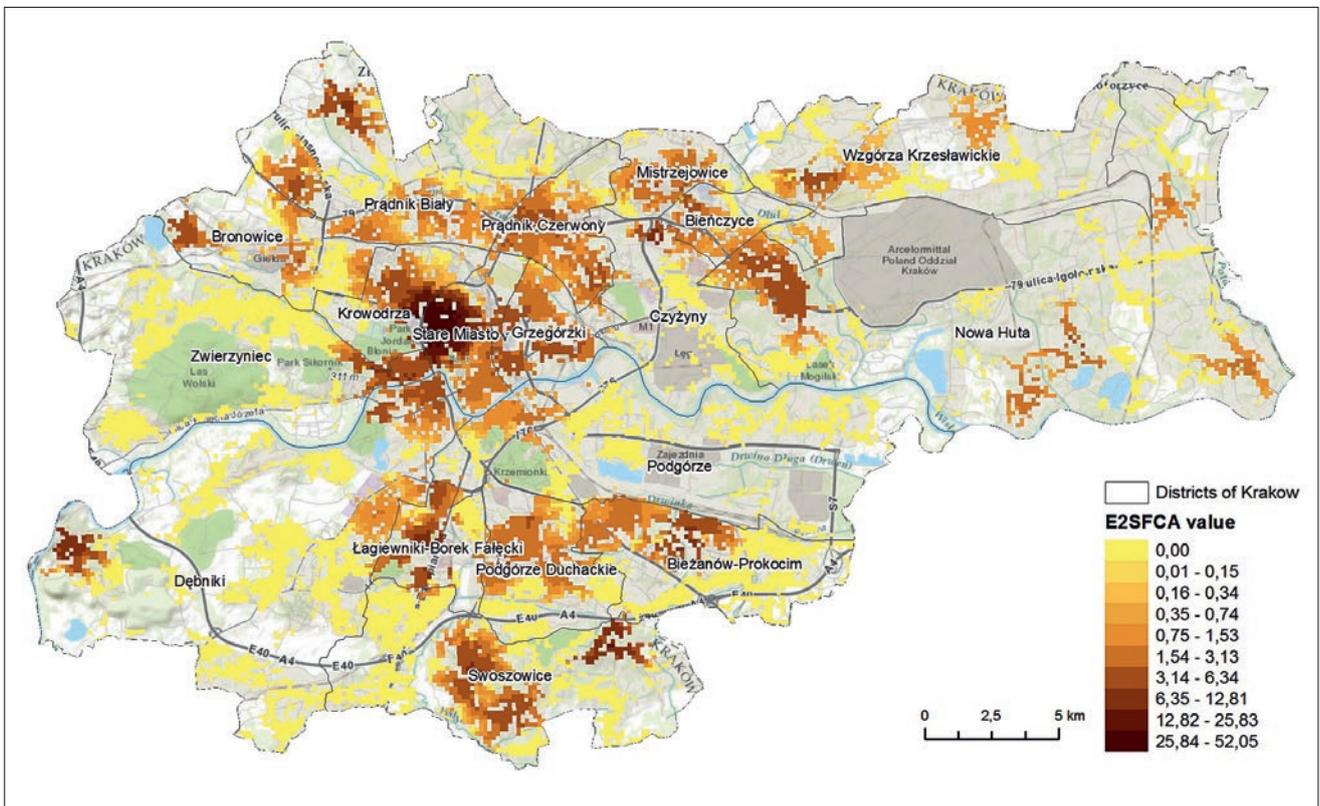


Figure 4 E2FCA-scores for the city of Krakow with a threshold of 20 walking minutes and linear distance decay

Source: own research; map sources: Esri, Here, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetmap contributors, and the GIS User community.

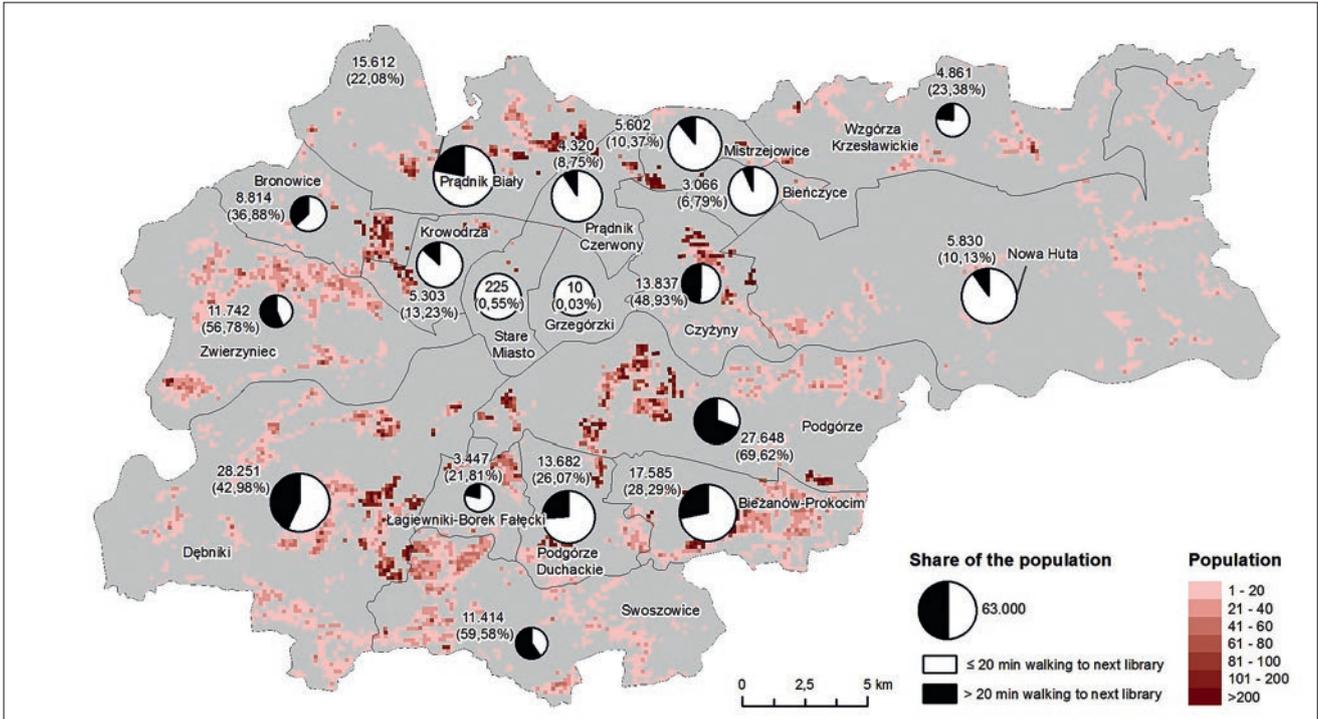


Figure 5 Overview of disadvantaged districts in Krakow

Source: own research.

district. Beyond that, there are more regions with a tendency to have inadequate provision as shown on the map.

However, those areas must be differentiated as the squares do not represent the same numbers of inhabitants. Thus, the populations of areas beyond a 20-minute walk to libraries were mapped to show how many people are actually affected by under-supply in each area (Fig. 5). The total share of 49.0% of squares with an E2SFCA-value of zero represents more than 181,000 of all the residents considered, representing 24.7% of the population of Krakow. However, concentrations of squares with high numbers of population should be considered a priority in improving library services. They are problematic, because in these parts of the city a large number of people must walk (or drive) longer distances to a library. These densely populated neighbourhoods suffer from a lack of opportunities and so they can benefit from libraries as local cultural centres. At the same time, neither should one overlook less densely populated areas of the city with low accessibility to libraries in a situation where people living in similar areas in other parts of the city have such access. In total, areas with dispersed population also constitute a large proportion of the undersupplied population with more than 20 minutes walking distance to the nearest library (Fig. 6).

The areas with combined low accessibility to libraries and high density of population are usually either located at the edge of large housing estates developed before 1989 (for example areas in the districts of Bieżanów-Prokocim, Podgórze Duchackie, Bronowice and Czyżyny) or represent more recent urban development (for example Ruczaj and Kliny in the Dębniki district, Górka Narodowa in the Prądnik Biały district, or Mały Plaszów in the Podgórze district).

Overall, it becomes obvious that with the exception of central districts (Stare Miasto and Grzegorzki), every district is faced with an accumulation of more or less neglected areas. The smallest shares of undersupplied population are observed in four north-eastern districts: Bieżczyce, Prądnik Czerwony, Nowa Huta and Mistrzejowice. As was mentioned above, these large post-war housing estates built in the vicinity of Nowa Huta steel works were planned in a manner which gives their inhab-

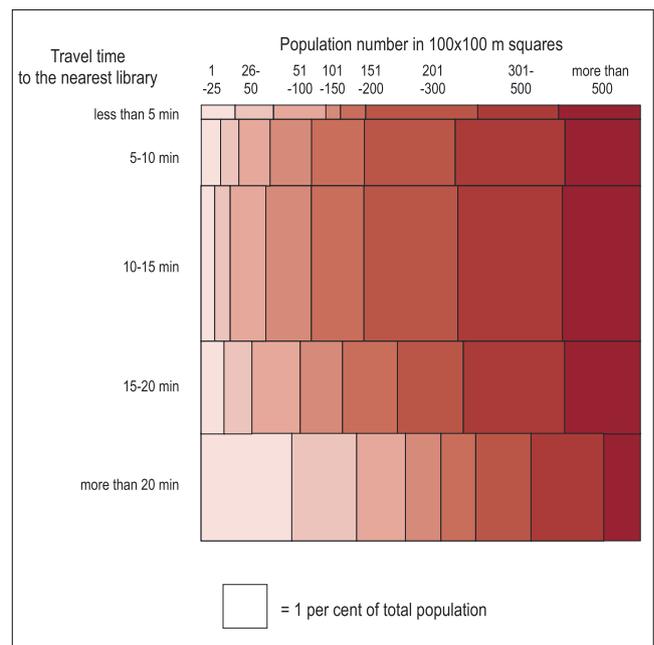


Figure 6 Structure of population density in different zones of travel time to the nearest library

Source: own research.

itants good access to basic public infrastructure. Good access to libraries suggests that these amenities have been preserved after 1989. However, three districts should be highlighted here, namely Podgórze, Swoszowice, and Zwierzyniec, as having the highest shares (more than half) of the population at over the 20 minutes threshold. Additionally, two other districts of Dębniki and Czyżyny also have a considerable share (40–50%) of people with a great walking distance to the nearest library.

Conclusions

The aim of this research was to identify differences concerning the accessibility of public libraries in the city of Krakow. This was achieved with the help of the E2FCA-method. Districts and areas with relatively good and relatively poor accessibility were exposed. In addition to this approach, other methods were considered to present a more comprehensive approach.

From a methodological perspective, it became obvious that the assumptions made in the study, and therefore the selection of the settings, are crucial to the outcome. This study was focused on walking as a mode of travel because it was seen as the most significant when analysing accessibility for library users within the surrounding neighbourhoods and districts. It is clear that the incorporation of other means of transport would potentially have led to different results. It should be noted that it is also matter of definition which areas are labelled as disadvantaged. For some people travelling a longer time or distance might be more acceptable than for others. Some people may use library services after work

or use other public or private services in the city centre or district centres. However, if we focus on the community role of libraries, walking accessibility remains crucial.

It must also be mentioned that the results are affected by the boundary problem. The population data used merely considers the inhabitants of the administrative area of Krakow, without including those living in the neighbouring towns and villages. Thus library-to-population ratios are in the end slightly overrated for some libraries leading to minor inaccuracies when final values were calculated. However, since the main aim was to analyse accessibility in the context of libraries as local cultural centres for given neighbourhoods, the boundary problem should not be considered as crucial.

Overall the central parts of Krakow can be described as the least problematic, while on the contrary it seems that the western parts of Krakow and parts of Podgórze are the most neglected. However, it should be noted that the internal variation of the city districts regarding accessibility to libraries is fundamental. In other words, not all inhabitants of the above mentioned districts are facing an inadequate situation. Hence, the visualisations presented in the form of maps are important as they show these variations in detail. The results can be especially interesting for local planners. As mentioned above, local authorities should consider locating public facilities such as libraries in such a way that all their residents have as equal accessibility as possible to them. Not only because good access to book borrowing services can help in building local human capital, but also because libraries could play an important role as community hubs integrating neighbourhoods. Hence, these neglected areas should be put in focus in the case of relocation or future phases of planning for new libraries.

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