UNIT LEVEL ASSESSMENT
OF URBAN COMFORT INDICATORS IN THE CRAIOVA AREA

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Abstract. The paper is concerned with a set of indicators that can measure the environmental quality of urban life. Craiova has largely expanded in the last decades, which has generated a range of land management and dwelling problems. This type of rapid development is interfering with the quality of citizens' life, as well as the efficient use of resources of urban environment. In this respect, the paper will try to develop a methodology by using geographical information systems to evaluate the environmental quality and its variation across the Craiova area. The use of this methodology will enable us to cope with some of the specific problems raised by the urban development of the city through a computer distribution of available data, but also a useful tool for local authorities for better urban planning.

Keywords: urban environment, quality indexes, urban development, Craiova, Romania.

Rezumat. Evaluarea Indicatorilor de Confort Urban la nivel de cartier în Zona Craiova. Lucrarea se referă la un set de indicatori care pot măsura calitatea mediului înconjurător a vieţii urbane. Craiova s-a extins foarte mult în ultimele decenii și a generat un set de probleme edilitare și de locuire. Acest tip de dezvoltare rapidă interferează cu calitatea vieţii cetăţenilor, precum și cu utilizarea eficientă a resurselor mediului urban. În acest sens, lucrarea va încerca să elaboreze o metodologie prin utilizarea sistemelor informaţionale geografice pentru a evalua calitatea mediului și variaţia acestuia la nivel de unitate urbană în zona Craiova. Utilizarea acestei metodologii ne va permite să facem faţă unora dintre problemele specifice ridicate de dezvoltarea urbană a orașului prin distribuirea computerizată a datelor disponibile, dar și un instrument util pentru autorităţile locale pentru o mai bună planificare urbană.

Cuvinte cheie: mediul urban, indici de calitate, dezvoltare urbană, Craiova, România.

INTRODUCTION

Urban comfort indicators refer to various measures and factors that assess the quality of life and well-being in urban areas. These indicators help city planners, policymakers, and researchers understand how comfortable, livable, and sustainable a city is for its residents. Common urban comfort indicators include: *air quality* - monitoring pollutants and particulate matter in the air to ensure clean and healthy air for residents; *access to green spaces* - the availability of parks, gardens, and recreational areas for relaxation and outdoor activities; *public transportation* - accessibility and efficiency of public transportation systems, including buses, trains, subways, and bike-sharing programs; *housing affordability* - the cost of housing relative to income, ensuring that residents can afford suitable accommodation; *safety* - crime rates, emergency response times, and overall public safety measures; *education* - the quality and accessibility of schools and educational institutions; *healthcare* - availability and quality of healthcare facilities and services; *noise levels* - monitoring noise pollution and ensuring peaceful living environments; *access to basic services* -availability of clean water, sanitation, and electricity etc.

Jointly, these indicators help assess the overall comfort and livability of urban areas, and cities often use them to make informed decisions and prioritize improvements to enhance the quality of life for their residents.

Many authors, researchers, and urban planning experts have written about urban comfort indicators as a part of urban studies and urban planning literature. The most notable ones and some of their works related to urban comfort indicators are: Jan Gehl, a Danish architect and urban designer, who is known for his work on creating people-friendly cities. His book "Cities for People" explores urban comfort and how urban design can influence the well-being of city residents; Richard Florida, an urban sociologist who has written extensively about the creative class and its impact on urban development and comfort in works like "The Rise of the Creative Class; Donald Appleyard, who addressed the livability and streets' impact on urban comfort with "Livability of Streets in American Cities"; Kevin Lynch, with "The Image of the City" – a work that discusses how people perceive and navigate cities, contributing to the understanding of urban comfort; Jane Jacobs, with "The Death and Life of Great American Cities," discusses community, pedestrian-friendly streets, and the importance of diversity in urban development, all factors contributing to urban comfort.

These authors and their works have made significant contributions to the understanding of urban comfort indicators and how urban design, planning, and policy can influence the quality of life in cities.

The great deal of European cities are developed in a very similar way, which often stimulated population increase and the development of residential and industrial areas. The main consequence of urban rapid growth was the continuous degradation of urban environment and live quality. Urban quality issues are to be analyzed by using systematic approach of the relationships between the different variables of urban environment and temporal dynamic of them (CAVES, 2004; GEHL & SVARRE, 2013; RICHARD, 2017).

RESEARCH MATERIAL AND METHODS

Urban Life Quality Index –I (ULQ). The use of indexes and indicators can become a very effective tool when it comes to the assessment of urban environment quality and life. The indicators can point out the tendency line or trend – a mathematical expression which can indicate the quantity and quality of specific urban elements (INHABER, 1976). The index represents the aggregation of a group of indicators.

It should be specified that compatibility of indicators is important for the validation of comparative studies. Urban-specific indicators can face problems such as specific limitations in the study area (lack of data, perimeter limits and the mathematical conversion of the parameters) so that they could precisely predict the actions to be made for better environmental management.

Data analysis was made by the use of GIS computerized tools so that the final outcome would consist in a better integration of data with several levels of aggregation in the form of maps.

The study was carried out by selecting a unit scale of urban territory that is representative for urban development towards the north-eastern part of Craiova city (Fig. 1). It concentrates the residential area which is limited by the railway system in the south, DN65 C in the west and DN 65F to the eastern limit.

Figure 1. Study area – urban unit scale of Craiova city (original).

The selected perimeter is a residential area which also includes services and transportation functions. It is characterized by places which are more or less attractive, and has an important dynamic due to rapid development and urban space offer. The population has a heterogeneous distribution in space and is concentrated along main transportation lines inside the analysed perimeter.

For the definition of variables (Table 1) and indicators such as: *Ha* (Housing affordability), *Ga* (Green areas accessibility), *Nl* (Noise levels), *Iq* (infrastructure quality) *Bsa* (acces to basic services), *Tp* (public transportation), specific and empirical questions related to the quality of urban services were selected.

The criteria for the acquisition of information were:
1. Comparable Geo-referenced information
2. Postal codes and urban network infrastructure
3. Suitability of the information in the study area.

Table 1. Domains of information.

Domains of information	
1	Urban buildings
2	Urban green areas
3	Urban noise
4	Urban infrastructure
5	Urban services
6	Urban public transportation

The collected outcome variables are shown in table 2. The information related to the affordability of houses was acquired and not introduced in the application, as we did not have enough detail to produce significant spatial differentiation.

Table 2. Variables.

Domains variables	
1	Urban buildings: - type - structure
2	Urban green areas: - size - connectivity - distance
3	Urban noise: - levels - sources
4	Urban infrastructure: - type - length - density
5	Urban services: - water - waist - other utilities
6	Urban public transportation: - number of transportation lines - bus stations

Data was supplied by the Craiova City Council and previous studies of master's students of the Geography Department of the University of Craiova.

Unit level assessment methodology. The main target of the methodology was to perform the spatial analysis of the variables for a minimum urban area. A spatial attribute was assigned to each variable, which could better reflect the distribution of the variables within the study area and the number of occurrences. All the results were standardized in a scale from 0 to 1 as a maximum value for each variable.

The final outcome as a sum of the standardized results of each of the values was calculated, in order to achieve a classification at the urban unit scale proposed in the study (***. PUG. 1998; AVRAM et al., 2010; COCEAN, 2011).

RESULTS AND DISCUSSION

Thus, the process of spatial distribution of the comfort indicators was evaluated according to the available variables, and the resulting classified units were divided in four classes of increasing spatial values - *Nl index*, which indicated the distribution of high levels toward the periphery of the study area, while low level values were recorded in the neighbourhoods located farther away from the main traffic roads and railways (Fig. 2).

This methodology is very dependent on spatial detail and initial data modeling. The basic spatial analysis unit played an important role in the obtained results, in terms of dimension (MARINESCU, 2006; IOJA et al., 2010).

In order to evaluate the *Ga indicator,* we have made the connection between the obtained classification and the features of green spaces (number, size and spatial distribution) (Fig. 3).
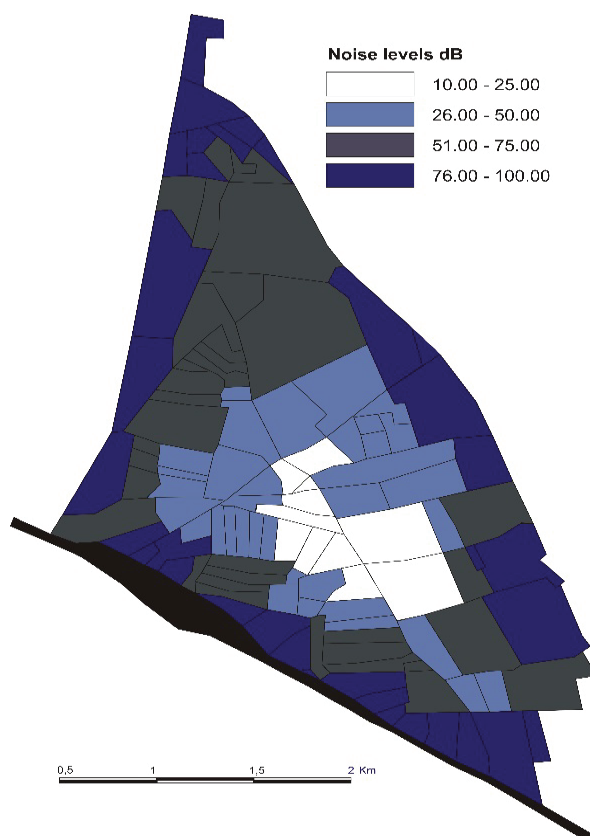
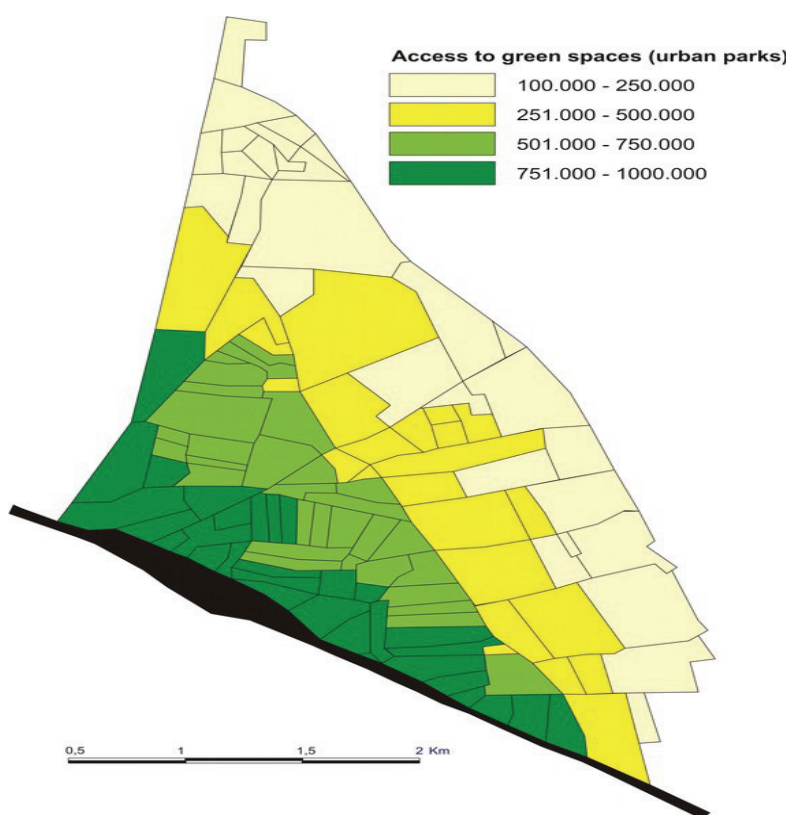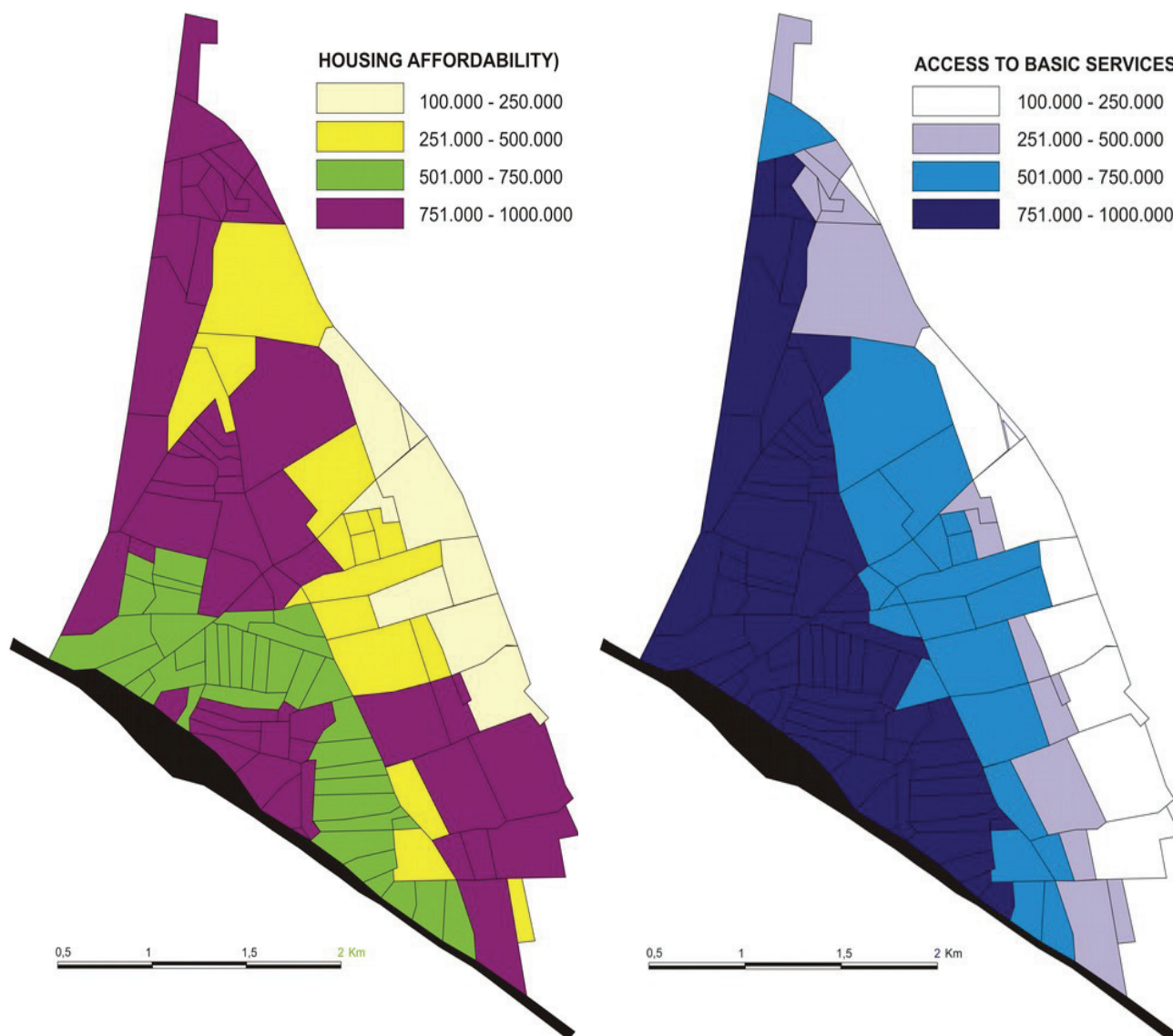Figure 2. Noise level – urban unit scale – (Craiova City Council) (original).

Figure 3. Ga – Urban green spaces accessibility - urban unit scale (original).

The lack of urban green spaces within the perimeter of the analysed unit scale induced the higher values of the *Ga index* towards the main access roads of the area. Meanwhile, the accessibility decreases towards the periphery of the area and indicated higher values in the proximity of urban green structures permanently accessible to the public.

In order to evaluate **Ha** (housing affordability), we related the obtained classification for Access to basic urban services **Bsa.** In this case, the highest values for **Ha** are recorded in the areas where **Bsa** is indicating lower values (Figs. 4, 5).
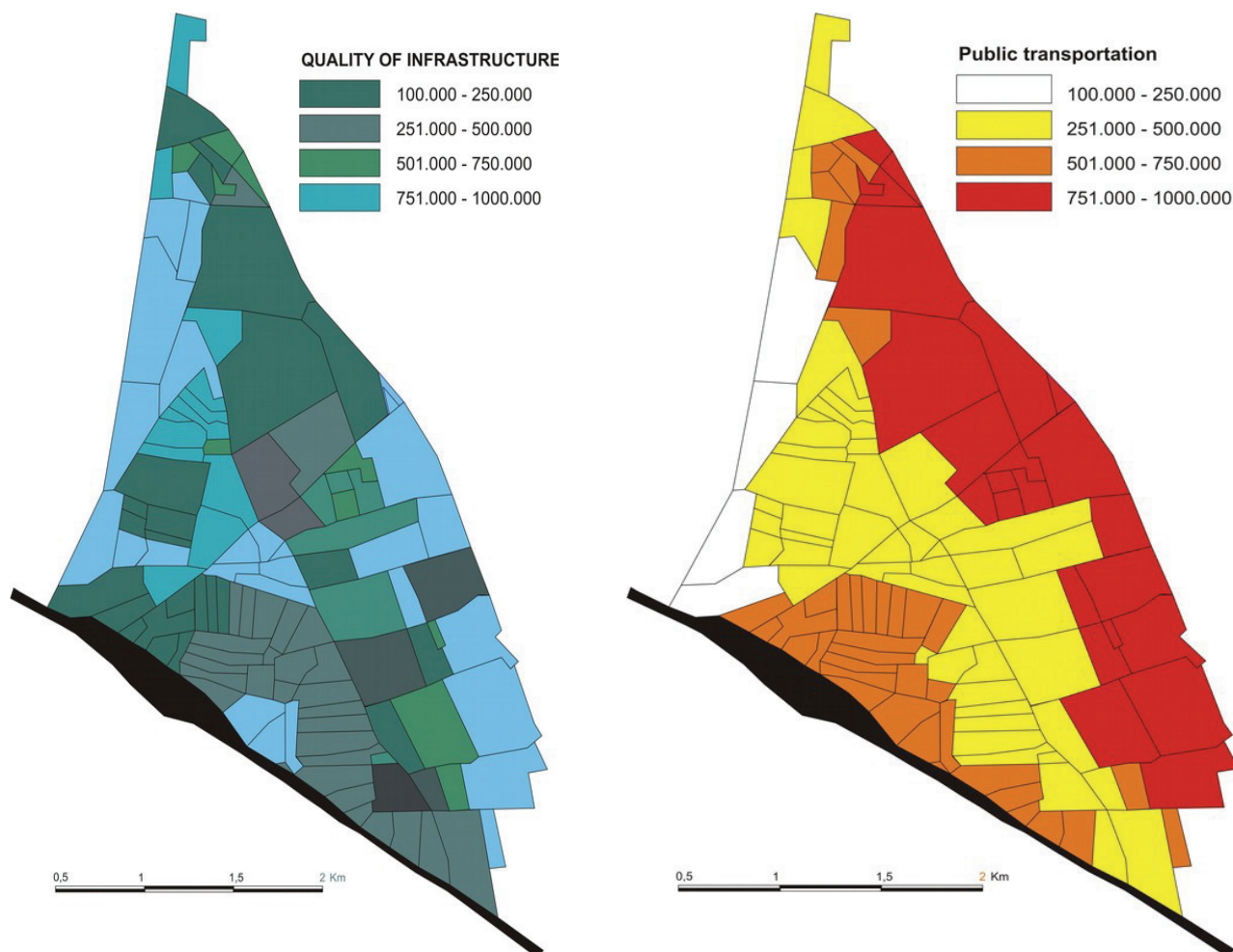

Figures 4, 5. Housing affordability (Ha) and Access to basic services (Bas) (original).

We can see in figure 4 that the areas with the highest values of housing affordability have a lower classification value than the areas with high access to basic services (Fig. 5). The high values of Ha also indicated a general lack of urban structures and facilities. We can conclude that these areas of the city are representative for the chosen variables.

The **Ha** index indicated that, in the areas with lower values of affordable housing, the classification is better than in the other areas and this can be explained by the presence of access to resources, urban services and easy transportation. The areas with the worst classification are indicated to be present in the areas limited by great transportation lines.

Data regarding Infrastructure quality and Public transportation are classified dta in terms of urban comfort and represent a good reason for the hypotheses to relate and evaluate information concerning street categories and types of pavement, but also road system development and functional areas (Figs. 6, 7).

Figures 6, 7. Infrastructure quality (Iq) and Public transportation (Tp) (original).

CONCLUSIONS

Comfort indicators of urban environment can be analysed by identifying the main urban unit levels with unitary features – standardization of urban area sub unitary levels. The available data represent an important variable and enable us to generate hypotheses and explain lack or availability levels of comfort in the urban environment. The use of geographic information is a key instrument which facilitates better management and further analysis of geographic data. Most urban comfort indicators have spatial implications which can be fundamentally explained through GIS.

The methodology we proposed can contribute to the rapid assessment of urban territorial units, also allowing for more accurate analysis, with deeper support of urban study areas.

Future studies should be based on an increased number of domains and variables such as urban functional areas at unit scale. They could also include a more accurate refining process for the definition of influence areas and weights of variables, in order to include values that are more adapted to the community. Further studies should determine the extent of the influence of unit scale level assessment on the final outcomes. This type of study may include cluster analysis in order to evaluate the connection between similar urban areas and determine environmental impacts. The study of comfort indicators can be useful for the decision makers and can contribute to improving the urban environment and living conditions.

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