Supplementary Material – D: Descriptive Statistics and Correlation Analysis

From a statistical point of view, in order to gain insights related to the data trends, a descriptive statistical analysis was performed against each variable under consideration. Specific Key statistical indicators were taken into account, such as the mean, median, and standard deviation, by their computation providing a better understanding of the data distribution whilst also increasing the comprehension about how accessibility and other services vary across Bucharest's districts.

More than this, the *<<seaborn>>* library was used in order to explore the relationships between the selected variables for walkability and bikeability, possible only with the help of correlation matrices.

Following this, a geospatial analysis of accessibility was conducted. The *<<geopandas>>* library was utilized to visualize the average accessibility—both by foot and bicycle—across Bucharest's districts. Data were categorized into time intervals (e.g., 0–5 minutes, 5–10 minutes, 10–15 minutes), allowing for the identification of areas with high or low accessibility. The resulting maps provided a clear visualization of the spatial distribution of accessibility over time.

Summary of the information in Table A.1.:

* High mean values with regards to variables such as CEF (cultural activities) and LF (educational institutions) suggest a good accessibility in most areas
* Lower mean values for variables like CMAF (transportation hubs) and SPF (food supply sources) highlight less accessibility to these facilities on foot.
* High standard deviations for variables like EWF (restaurants, 16.97 minutes) and LF (educational institutions, 15.13 minutes) reflect the presence of a significant variability in accessibility across areas.
* Very low minimum values, sensibly close to zero, explain regions that either have limited access facilities, such as SSF or SF, or do not benefit from these access facilities at all
* Median values, such as CEF’s 26.94 minutes, show that at least half of the city's areas have relatively good access to cultural activities.

Table A.1. Summary statistics for the considered variables – on foot

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std. dev. | Min | Q1 | Median | Q3 | Max |
| AAF | 17.30 | 13.02 | 3.51 | 8.16 | 13.54 | 22.84 | 131.26 |
| CEF | 30.07 | 18.44 | 1.36 | 15.65 | 26.94 | 41.34 | 127.25 |
| LF | 19.91 | 15.13 | 2.44 | 9.36 | 14.9 | 26.17 | 144.97 |
| CF | 19.03 | 16.09 | 0.81 | 7.55 | 14.23 | 25.91 | 123.58 |
| ARF | 14.93 | 15.27 | 0.79 | 6.24 | 10.44 | 18.91 | 142.43 |
| SF | 18.24 | 13.48 | 0.62 | 10 | 14.2 | 23.27 | 144.43 |
| EWF | 18.16 | 16.97 | 0.85 | 7.26 | 13.02 | 23.9 | 134.49 |
| SSF | 14.58 | 12.65 | 1.17 | 6.21 | 10.3 | 19.77 | 120.55 |
| SPF | 11.36 | 10.69 | 0.77 | 5.14 | 8.5 | 14.52 | 128.94 |
| CMAF | 9.41 | 11.57 | 0.59 | 3.84 | 5.97 | 10.7 | 117.92 |

Summary of the information in Table A.2.:

* Lower mean values with regards to bicycle access, compared to walking , suggest the existence of a greater distances to the facilities, yet wider coverage using bicycles (e.g., CEB mean of 12.32 minutes for cultural activities).
* High standard deviation values indicate significant variability in accessibility, with some areas having much better or worse access (e.g., EWB standard deviation of 6.50 for restaurants).
* Usually, as the literature is stating, the median values are generally lower than the mean, this indicating a skewed accessibility distribution, meaning that there are certain regions that benefit from a significant better access.
* Bicycle access improves overall accessibility by enabling residents to cover greater distances compared to walking.
* Large variability in maximum and minimum values highlights uneven access to facilities across different areas of the city.

Table A.2. Summary statistics for the considered variables – on bike

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Mean | Std. dev. | Min | Q1 | Median | Q3 | Max |
| AAB | 7.32 | 4.97 | 1.95 | 4.02 | 5.84 | 9.1 | 52.49 |
| CEB | 12.32 | 6.84 | 1.08 | 7.31 | 11.16 | 16.33 | 48.5 |
| LB | 8.19 | 5.75 | 1.05 | 4.33 | 6.33 | 10.35 | 58.01 |
| CB | 7.90 | 5.95 | 0.75 | 3.73 | 6.23 | 10.26 | 48.06 |
| ARB | 6.55 | 5.72 | 0.26 | 3.29 | 4.86 | 7.96 | 57.2 |
| SB | 7.85 | 5.21 | 0.2 | 4.75 | 6.36 | 9.68 | 58.14 |
| EWB | 7.63 | 6.50 | 0.65 | 3.63 | 5.74 | 9.48 | 55.08 |
| SSB | 6.23 | 4.91 | 0.62 | 3.01 | 4.69 | 8 | 48.18 |
| SPB | 5.05 | 4.36 | 0.42 | 2.53 | 3.88 | 6.22 | 52.44 |
| CMAB | 4.20 | 4.61 | 0.42 | 1.94 | 2.85 | 4.74 | 47.2 |

Summary for Figure A.1.:

* Strong correlations: between AAF and CEF (0.88), suggesting that improved foot accessibility amplifies access to cultural activities; AAF and LF (0.92), reflecting the fact that the areas with better overall foot accessibility also have superior access to educational facilities.
* Moderate correlation: CEF and CMAF (0.59), indicating the fact that areas with better access to cultural activities have moderately better access to transportation hubs, most likely being influenced by urban congestion in Bucharest.
* These correlations highlight how accessibility improvements in one area can positively impact access to related facilities.

A chart of different colors

Description automatically generated with medium confidence

Figure A.1. Correlation matrix for foot accessibility

Summary for Figure A.2.:

* Strong correlations: AAB and CEB (0.87), indicating that improved bike accessibility amplifies access to cultural activities by bike; AAB and LB (0.92), reflecting the fact that the areas with better overall bike accessibility also have superior access to educational facilities.
* Moderate correlations: CEB and SPB (0.69), indicating the fact that areas with relatively good access to cultural activities by bike also have moderate access to supply sources; ARB and CMAB (0.61), indicating that areas with better bike access to outdoor activities also have moderate access to transportation hubs.
* These correlations highlight the strong link between bike accessibility and the availability of various facilities in Bucharest.

A chart of different colors

Description automatically generated with medium confidence

Figure A.2. Correlation matrix for bike accessibility