

Preprint, the final version of the article that has been transferred to the journal's production team.

To cite this article: El Boujjoufi, I. Saadi, M., Torrekens, C., & Teller, J. (2026). Mosques in Belgium: Spatial Distribution, Agglomeration Patterns and Underserved Areas. *Cities*, 174. <https://doi.org/10.1016/j.cities.2026.107026>

## **Mosques in Belgium: Spatial Distribution, Agglomeration Patterns and Underserved Areas**

### **Abstract**

Mosques play a central role in the organization of Muslim communities and the structuring of urban spaces. This study explores the socio-spatial elements associated with mosque locations in Belgium and highlights the disparities in their geographical coverage, particularly the lack of mosques in certain areas, at different scales. A binary logistic regression model was used. The results confirm that the presence of Muslim populations is a variable strongly associated with mosque presence. In addition, a tendency for mosques to cluster has been observed, with mosques tending to be located close to pre-existing mosques. Located in residential areas, close to facilities such as schools and shopping centers, they contribute to the transformation of these areas into veritable urban ecosystems, where religious practices, community activities, and economic dynamics converge, redefining physical and symbolic centralities. The model developed in this study also identified areas lacking mosques, mostly located on the periphery of historic urban centers, often urbanized at the end of the 19th century and the beginning of the 20th century. This article provides an analytical framework for better understanding the local dynamics of mosque locations in urban environments. It reveals new perspectives for urban planning and the socio-spatial comprehension of Islamic places of worship.

### **Keywords**

Mosque, Mosque in Belgium, Mosque in Europe, Islam in Europe, Belgium, Mosque and city, Urban Mosque

## 1. Introduction

The visibility of Islam in Europe has steadily grown regarding various aspects (Allievi, 2010, 2014; Göle, 2011; Torrekens, 2007, 2024). Moving from a discreet presence, often confined to peripheral or converted spaces, to a more central and residential location (Allievi, 2009; Cesari, 2005; Dassetto, 2013; Gale & Naylor, 2002; Kuppinger, 2014; Tamimi Arab, 2013), this growing visibility has profoundly transformed the religious geography of European cities and reignited debates on the compatibility between secularized catholic heritage and the public expression of the Muslim minority (Göle, 2016; Cesari, 2013; Maussen, 2009). Muslim communities in Europe have shaped a distinct urban landscape, profoundly transformed the uses and perceptions of public spaces, and redefined the boundaries between private and public spheres. Against this background, the spatial distribution of mosques provides a valuable insight into the processes of integration, negotiation, and territorial marginalization in Western Europe (Cesari, 2005; Gale, 2013; Chiodelli & Moroni, 2017). This shift is evident in the mosques' central role within the social and political framework of Muslims in Europe. The European Mosque is a vital institution that ensures religious, social, and cultural continuity (Kalra, 2019) while establishing its presence in both time and space (Dassetto, 2009). It has evolved into a multifunctional community center (Conti, 2016), hosting a variety of events, including educational programs, language courses, Koranic studies, and social activities. It is supported by an ecosystem including components such as bookshops, cafés, ethnic Islamic shops, and services that help Muslims strengthen their cultural and religious identity (El Boujjoufi et al., 2023). The Muslim presence in Western Europe stems from historical relationships of domination by European countries through their colonies in Africa and Asia (Cesari, 2005). Most Western European Muslims come from the Maghreb (Morocco, Algeria, and Tunisia) and Turkey (Liebert et al., 2020). Around 25.8 million Muslims reside in the main European countries, as estimated by the Pew Research Center (2011), representing over 5% of the total population, making Islam the largest religious minority in the region (Jikeli, 2023). Countries such as France, Spain, Belgium, and Italy have been preferred destinations for migrants from Africa, while England has welcomed migrants from India, Pakistan, and Bangladesh.

Located at the crossroads of religious, social, and political spheres, mosques reshape the boundaries between private and public spheres while affecting the dynamics of centrality, mobility, and local organization (Alawadi et al., 2023; Conti, 2016). They provide a symbolic and functional anchor for Muslim communities, while in some contexts becoming hubs of economic, cultural, and associative attractiveness (Dassetto, 2013; El Boujjoufi et al., 2023). In this context, understanding the spatial logic underlying the location of mosques is not only a national issue, but also part of broader

European debates on integration, religious visibility, and urban planning for places of worship. It also allows us to question issues of spatial justice, the accessibility of mosques, and the recognition of minorities in urban planning policies, particularly in Belgium (Dassetto, 2013; Torrekens, 2007), while also contributing to broader reflections conducted in other European contexts (Cesari, 2005; Chiodelli, 2015; Gale, 2005). Thus, placing the Belgian case in a broader perspective contributes to international discussions on the location, regulation, and urban recognition of mosques in Western societies, reinforcing the comparative and theoretical scope of this study.

Despite a growing literature on the spatiality of Muslim religious infrastructure in Europe, no national-scale statistical and geospatial analysis of mosque distribution in Belgium has yet been undertaken. The present article addresses this gap. Using socioeconomic, demographic, and territorial data, it employs a binary logistic regression model to identify the associated elements with the presence of mosques. The objective is twofold. On the one hand, it aims to identify the main variables related to their location in Belgian statistical sectors. On the other hand, it seeks to identify underserved areas, i.e., sectors where the probability of a mosque being established is high, but where there are currently none.

This research makes several major contributions. It provides the first georeferenced database of mosques in Belgium and offers an analysis of their geographical distribution. By identifying the socioeconomic and territorial elements correlated with their location, the study highlights the dynamics of the local anchoring of Islamic places of worship and underscores significant spatial disparities. It thus contributes to a better understanding of the logic underlying the location of mosques and fuels reflection on more equitable urban planning. Building on these contributions, the study is guided by three main research questions: (1) How are mosques spatially distributed, and what patterns or clusters can be observed? (2) What are the key socioeconomic, demographic, and territorial variables associated with the presence of mosques in Belgium? (3) Which areas can be considered underserved?

## **2. Literature review**

After the Second World War, Belgium faced the challenge of massive reconstruction, necessitating a large workforce. This situation led to significant immigration, primarily by blue-collar workers. The first waves of Muslim immigration occurred in the 1960s and 1970s (Djelloul & Maréchal, 2018), with many workers arriving from countries such as Turkey and Morocco. These migrants addressed immediate economic needs and introduced considerable cultural and religious diversity into Belgian society. The dynamics of immigration to Belgium have undergone substantial changes over the

decades. The first migrants, who arrived in the 1960s, were mainly single men employed mainly in the mining and steel industries (Kesteloot, 1987). The Muslim population was mainly concentrated in urban areas, with few Muslims living in rural areas. The Brussels-Capital Region is where this community is most represented (Dassetto, 2013), followed by historical industrial areas such as Charleroi, La Louvière, Liège, and Mons (Sägesser, 2020). People of Moroccan origin make up the largest Muslim group in Belgium, followed by those of Turkish origin (Husson, 2020). In Flanders, citizens of Turkish origin are more present than in Wallonia, notably due to the strong presence of Turkish workers in Antwerp and the former mining regions of Limburg. In addition, other Belgian Muslims have diverse origins, mainly tracing their roots back to other Maghreb countries, in addition to Albania, Sub-Saharan Africa, the Near and Middle East, and Pakistan (ElBattui & Kanmaz, 2004).

Belgium does not allow a religious census of its population, which makes it difficult to obtain accurate statistics on the distribution of religious groups. However, according to Jan Hertogen (2016), the Muslim population in Belgium was estimated to be 781,887, or around 7% of the total population. This estimate excludes irregular migrants and the 2015 migration wave. The regional breakdown is as follows: 4.9%, 23.6%, and 5.1% of the population of Wallonia, Brussels, and Flanders are Muslim. Hertogen drew on data available from 1945 to the time of the study, including on inhabitants with an immigrant background, births, deaths, and new migrants. These figures were then adjusted using data from the Pew Research Center to avoid overestimates linked to immigrants from Western Europe. This analysis did not consider Belgian Muslims whose ancestors were not directly descended from immigrants, potentially leading to a slight underestimation of the total. Some experts, such as Torrekens (2024), consider these figures exaggerated. Over time, Muslim immigration to Belgium has become a crucial part of the socio-cultural and economic landscape. Muslim communities have established social and religious structures to meet their needs, contributing to the country's cultural mosaic. The creation of mosques in Belgium reflects the complex interplay between immigration dynamics, integration, and cultural diversity. As places of worship and community life, mosques symbolize the Muslim presence. These buildings represent areas of social life where Muslim communities can convene, practice their faith, and pass on their cultural and religious heritage to future generations.

This demographic growth was accompanied by a gradual structuring of religious infrastructure. Between 1960 and 1980, the first Muslim places of worship in Belgium were established in buildings repurposed from their original use (warehouses, garages, former shops, or cinemas), often located on the outskirts of urban centers or in industrial areas (Dassetto, 2013; Tamimi Arab, 2013). These places, modest in appearance but carefully maintained, provided the faithful with spaces for retreat,

solidarity, and religious transmission. Over time, some were enlarged or relocated to more suitable buildings, contributing to the territorial anchoring of permanently settled Muslim communities.

The increase in the number of mosques in Belgium is the result of several key factors. Firstly, the demographic growth of the Muslim population is driven by births, family reunions, immigration for work or study, and the arrival of asylum seekers. This surge has increased the demand for new Islamic places of worship (Manço & Kanmaz, 2005). Secondly, high attendance at existing mosques often results in overcrowding, exceeding the capacity of these buildings (Gagnon & Germain, 2002). In addition, the cultural and linguistic diversity among the faithful, with specific needs from Arabic-speaking, Amazigh-speaking, and Turkish-speaking Moroccan communities, has prompted the establishment of separate mosques for each group (Dassetto, 1996). Lastly, internal tensions within communities, often tied to management issues or regional rivalries, have also contributed to the emergence of new mosques to prevent conflict and maintain cohesion (Dassetto, 2009; Westfall, 2025). Although these buildings appeared modest from the outside, they were carefully kept on the inside to reflect the image of the religion. The expansion and improvement of these places of worship followed the process of acquiring modest premises. Renovation and expansion efforts were undertaken to transform the image of Islam practiced in underground garages and cellars. Some mosque administrators have had to purchase adjacent buildings and houses to accommodate the growing number of worshippers or relocate to new locations. As a result, these places of worship have become symbolic urban landmarks, offering an anchor to Muslim communities, fostering social cohesion, and transmitting cultural and religious heritage to future generations. This concentration of activities reinforces the centrality of the mosque in its immediate urban environment through educational, social, and economic activities. Today, most mosques in Belgium are organized as non-profit organizations, generally with a high attendance rate for both Friday prayers and religious celebrations. These organizations are now involved in a wide range of activities: religious education, social support, community services, and sometimes even economic or cultural projects (El Boujjoufi et al., 2023; Gale, 2024).

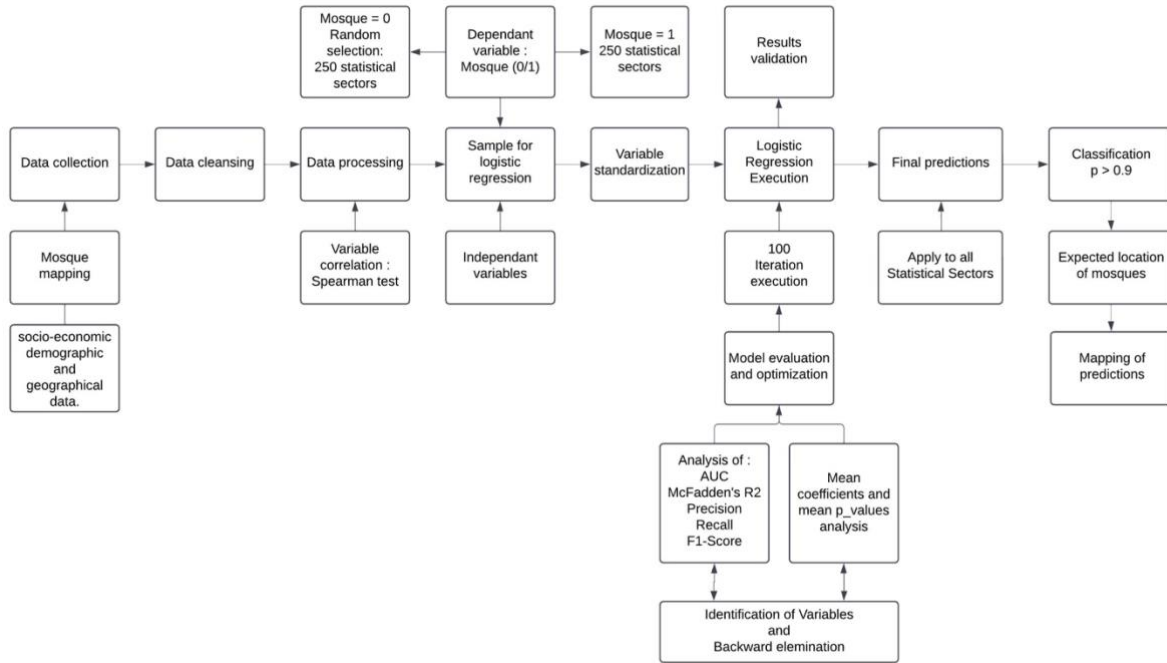
Indeed, far from serving only a religious purpose, mosques in Belgium and Europe generally play a vital role in structuring community life, strengthening local social ties, and managing Muslim visibility in the public sphere (Allievi, 2009; Göle, 2011; Torrekens, 2007, 2024). Their integration into the urban fabric sometimes provokes controversy, particularly because of their architectural visibility. Recent studies, such as that by Valli et al. (2025) in Switzerland, show that the physical presence of identifiable elements (minarets, visible facades) is correlated with increased support for far-right parties and anti-immigration rhetoric. Allievi (2009, 2016) points out that conflicts surrounding mosque projects must be understood not only in terms of Islamophobia, but also through broader

fears related to immigration, urban planning, and the appropriation of public space. Architectural symbolism fuels these tensions, which are often stoked by political or media discourse. Chiodelli's (2015) study of Italian cities, particularly Milan, shows that the Muslim presence is also transforming the urban morphology of cities through places of worship and the ecosystem surrounding them. He highlights a tendency for mosques to be located on the outskirts or in marginalized neighborhoods, often linked to zoning policies, and identifies increased tensions when projects target city centers. This Muslim spatiality, still largely marked by dynamics of relegation, could see diversification and greater institutionalization in the coming years, in the absence of coherent national policies on the place of religions in urban space (Chiodelli & Moroni, 2025).

To our knowledge, there is currently no systematic statistical and spatial analysis of the distribution of Belgian mosques at the national level. This study addresses this gap through an in-depth national analysis. The main objective of this research is to explore and analyze the socioeconomic, demographic, and geographical aspects associated with the presence of mosques. This paper focuses on identifying spatial patterns and correlations based on cross-sectional data. The second objective is to assess the disparities in mosque presence, both locally (at the level of statistical sectors and municipalities) and more broadly (across provinces and regions). This approach aims to highlight territorial dynamics and shortcomings related to mosque accessibility, ultimately contributing to the scientific discourse and perspectives surrounding regional planning.

### **3. Data and Methods**

This study aims to explore the socioeconomic, demographic, and geographical conditions that tend to co-occur with mosque presence across Belgian statistical sectors. The methodology is based on a structured approach consisting of several interdependent stages, as illustrated in Fig. 1. These stages include the collection and analysis of quantitative data, the application of advanced statistical methods, and the validation of results through comparative analyses.



**Fig. 1.** A diagram illustrating the methodology used for logistic regression and the identification of the affected mosques' locations.

### 3.1. Dependent variable: mosques in Belgium

The methodological approach adopted relies on the use of a combination of geographic sources and tools to map mosques in Belgium accurately. Cadastral data from the Belgian Land Registry Administration (cadaster) in 2019 served as the primary basis for locating mosques in Belgium at the parcel level. This cadaster (2019) does not list all mosques present on Belgian territory, so this information was supplemented with data published by the Executive of Muslims of Belgium (EMB) on their website, consulted on April 4, 2020 (EMB, 2020), which lists the mosques officially recognized by the EMB. A cross-referencing and validation process was carried out at the level of all communes, allowing us to locate existing and closed (or relocated) mosques. The data were verified and adjusted for optimal accuracy by manually scanning each commune's maps and resources available on Google Maps and OpenStreetMap. This process enabled us to produce a complete and reliable map of the mosques in Belgium, spread across the country's 589 communes and three regions. Data collection and updating continued on an ongoing basis until October 2024 to ensure the highest possible reliability and representativeness of Islamic places of worship at the time of analysis. This update made it possible to correct or refine certain locations and to better take into account any closures or relocations. The mosques that were active at the end of the survey thus form the basis of our

modeling. The database containing the precise locations of the mosques will be made openly accessible in El Boujjoufi & Teller (2026).

### 3.2. Explanatory variables

We chose to work at the scale of statistical sectors (the smallest scale of statistical analysis available in Belgium), incorporating explanatory variables (Table 1). The socioeconomic data used came from the Belgian Statistical Office for 2019 (Statbel, 2019). Additional spatial data, including the locations of educational, cultural, industrial, and commercial facilities, along with geographical information, were extracted from the Belgian Land Registry Administration's 2019 cadastral data (Cadaster, 2019).

**Table 1:** List of selected explanatory variables

Variable	Name	Unit	Sources	Min	Max	Mean Value	Standard deviation
X1	Population density	Inhabitants/km <sup>2</sup>	BSI	0	45649,1	1642,4	3189,4
X2	Active	Inhabitants	BSI	0	2930	224	263,3
X3	Inactive	Inhabitants	BSI	0	13283	865	928,9
X4	No diploma	Inhabitants	BSI	0	405	13	21,17
X5	Graduates	Inhabitants	BSI	0	2077	104	138,9
X6	Students	Inhabitants	BSI	0	665	42	51,52
X7	Foreign population	Inhabitants	SI	0	3208	64	172,1
X8	Muslim population	Inhabitants	SI	0	2294	18	82,4
X9	Mosques agglomeration	Inhabitants	CD	0	21	0,2095	1,12
X10	Income	€/year	BSI	0	80538	24291,7	10792,1
X11	Proximity to church	Meter <sup>-1</sup>	CD	0,0756	0,9962	0,6015	0,1787
X12	Proximity to industry	Meter <sup>-1</sup>	CD	0,0344	0,9946	0,3350	0,1991
X13	Proximity to city center	Meter <sup>-1</sup>	CD	0,0464	0,9940	0,2874	0,1703
X14	Proximity to a shop	Meter <sup>-1</sup>	CD	0,0493	0,9941	0,5050	0,1933
X15	Proximity to cultural building	Meter <sup>-1</sup>	CD	0,0514	0,9929	0,5167	0,1986
X16	Proximity to educational building	Meter <sup>-1</sup>	CD	0,0639	0,9979	0,5399	0,2077
X17	Proximity to shopping center	Meter <sup>-1</sup>	CD	0,0313	0,9902	0,2766	0,1842
X18	Proximity to coal mine	Meter <sup>-1</sup>	CD	0,0070	0,9824	0,0655	0,1026
X19	Proximity to Horeca	Meter <sup>-1</sup>	CD	0,0700	0,9940	0,4675	0,1989
X20	Proximity to train station	Meter <sup>-1</sup>	CD	0,0183	0,9620	0,2246	0,1646

BSI, Belgian Statistical Office; SI, Self-calculation based on Belgian Statistical Office; CD, Self-calculation based on built-up Cadastral data.

*Population density (X1)* was considered to determine whether mosques are more likely to be located in densely populated areas (Dassetto, 1996). Education level was also included to analyze the possible correlation between education level, with the variables *no diploma (X4)*, *graduates (X5)*, and *students (X6)*, and the presence of mosques. Educational level indicates a community's human capital and influences the organization and institutional recognition of mosques (Cesari, 2005). Students, in particular, can be a powerful driving force behind the creation of mosques close to universities and colleges.

Regarding the labor market, several indicators were taken into account: the number of employed people is considered through the *active* variable (*X2*), while the number of unemployed people, pensioners, and other non-working individuals has been grouped into a variable called *inactive (X3)*. Median household *income (X10)* is also included, as it reflects the socioeconomic levels of the residents. These variables allow an exploration of whether particular labor market characteristics influence the presence of mosques. An active population might support the funding of mosques, while an inactive population might reflect a greater need for spaces for socialization and mutual support.

Geographical accessibility was captured by *proximity to the city center* and *proximity to industry* to examine whether Belgian mosques are located in areas close to urban centers or on the periphery and in marginal areas (Schinkel, 2009; Schmitt, 2013). *Proximity to cultural buildings (X15)*, such as cultural centers, cinemas, theaters, youth centers, and village halls, was included to assess the effect of cultural infrastructure on mosque location. Indeed, the work of Torrekens (2007) has demonstrated the cultural dynamic developed by the Muslim population around mosques. Similarly, *proximity to educational buildings (X16)* was taken into account to determine whether the proximity of educational establishments influences the location of mosques. The *proximity to a church (X11)* in each area was integrated to analyze the relationship between existing Christian places of worship and mosque locations and determine whether there is religious cohabitation or, on the contrary, spatial segregation logic (Pace, 2014).

Regarding commercial activities, the presence of commercial businesses, including *proximity to a shop*, *proximity to Horeca* (hotels, restaurants, and cafés) (*X19*), and *proximity to a shopping center* (supermarkets and/or shopping *malls*) (*X17*), was considered to test whether mosques are more frequently located in areas with high commercial activity (Göle, 2011; El Boujjoufi et al., 2023).

Data on mines and mining activity in Belgium (mining concessions, Terrils, and mining waste management sites) were derived from Service Public de Wallonie digital geographic data requested in April 2024 (SPW, 2019) and Belgian Land Registry Administration cadastral data from 2019 (Cadaster, 2019). These sources provide a solid basis for analysis, capturing the recent dynamics

influencing the establishment of mosques in Belgium. Historically, some of the first European mosques were built in cities with an abundance of mining workers (Dassetto, 1996). Accordingly, we integrated *proximity to a coal mine (X18)*.

We also attempted to introduce data related to the population's religion for inclusion in the cross-tabulations. It should be noted that in Belgium, the state cannot collect data on religion and ethnic origin. To compensate for this lack of statistical data and still provide an estimation of Muslim communities' locations by statistical sector, we relied on statistical data based on nationality of origin (Statbel, 2019). This database enabled us to filter out the *Foreign population (X7)*, those of foreign origin, and those from countries with Muslim origins or a Muslim majority of over 70% based on figures published by the Pew Research Center in 2011 (Pew Research Center, 2011). This work allowed us to estimate the location of the *Muslim population (X8)* so that we could cross-reference it with the locations of mosques and other variables. Indeed, this variable was included in our model in reference to Dassetto's work (2013), which showed that the dynamics of the establishment of the first mosques in Belgium followed the spatial distribution of Muslim communities.

These cross-referenced data were used to identify countries of origin and, therefore, religion to define or estimate the locations of populations from these countries, compare human and physical settlements, and contextualize the presence of Muslim communities across the country. It should be noted that this is an estimate based on countries of origin. These data must be interpreted with caution, as they do not consider Muslims who have obtained Belgian citizenship, the recent settlement of newcomers, or Muslims with Belgian citizenship who converted to Islam, a consequence of the absence of such information in Belgium.

We also included a *mosque agglomeration* variable (*X9*), defined by the number of mosques within a 500-meter radius of each statistical sector, to capture the effect of spatial proximity. This choice is based on the idea that the influence of mosques transcends sector boundaries, and a distance of 500 meters reflects relevant functional access. This threshold, commonly used to assess the accessibility of urban facilities (Geurs & Van Wee, 2004), prevents the inclusion of mosques that are too distant to affect the area directly. Calculated through spatial analysis, this variable enables us to assess local dynamics and the impact of mosques as community centers.

Variables from (*X2*) to (*X9*) represent absolute numbers of people in each category. These values are expressed as numbers of people in each statistical sector and not as relative rates. For distance-based variables, we use a proximity measure, defined as the inverse of the distance between each sector centroid and the nearest point of interest, expressed in meters<sup>-1</sup>. This transformation

facilitates a better interpretation of the impact of immediate proximity, while keeping the resulting values within a standardized range between 0 and 1 and making them comparable across variables. Proximity variables (X11–X20) therefore represent 1/distance to the nearest church, cultural building, train station, or other relevant amenity. Higher values indicate shorter distances. For example, a value of 1.0 corresponds to a distance of one meter. Values close to 1.0 reflect a very high level of proximity between the centroid of the statistical sector and the point of interest. They indicate that it is in the immediate vicinity.

It is important to acknowledge that other significant factors highlighted in the literature—such as cultural and linguistic diversity within Muslim communities and internal tensions—could not be included in the statistical analysis due to the lack of standardized or spatialized data at the level of statistical sectors. These dimensions would require different methodological approaches, such as interviews or ethnographic research. As such, while they are recognized as important explanatory elements in the development of mosque projects (Dassetto, 2013; Fadil, 2019), their absence in our model stems from data availability constraints rather than conceptual oversight. We nevertheless discuss their implications in the Results and Discussion section and propose avenues for future mixed-methods research to capture these dynamics more fully.

Nevertheless, we sought to capture some of the underlying sociocultural dynamics through the use of proxy variables. In this regard, the mosque agglomeration variable (X9) serves as an indirect indicator of several intertwined factors. It may reflect a concentrated demand for mosques, a saturation of existing facilities, or even the emergence of localized social or spatial tensions. These dimensions have been identified in previous studies as key drivers in the development of new mosque projects. Although X9 cannot fully account for the complexity of the sociopolitical and cultural processes involved, it offers a measurable approximation that is consistent with the spatial resolution and methodological framework of our analysis.

### *3.3. Binary Logistic Regression Model*

We used a logistic regression (logit) model to investigate the relationship between mosques and various explanatory variables. This statistical approach is commonly used to model urban phenomena with a binary dependent variable (Y), typically taking values of 0 or 1. In this context, a mosque is represented as 1 (presence) or 0 (absence). The logistic function can be estimated using the following equation:

$$P(Y = 1 | X) = \frac{e^{(\beta_0 + \sum \beta_i X_i)}}{1 + e^{(\beta_0 + \sum \beta_i X_i)}}$$

Logistic regression models are prevalent in urban and spatial analysis studies (Hu & Lo, 2007; Puente-Sotomayor et al., 2021) as they use quantitative predictors to predict categorical variables' outcomes. A logit model can include geophysical and socioeconomic variables. Its capacity to include a wide range of relevant characteristics allows for a better understanding of the associations and patterns underlying the phenomenon under investigation. In the logit model, a logistic function is used to model the relationship between a binary dependent variable and a set of independent (explanatory) variables. In our case, the dependent variable reflects the presence or absence of one or several mosques in the statistical sector. The explanatory variables encompass population density, median income, level of education, pensioner rates, employment rates, unemployment rates, the number of inhabitants of Muslim origin, the number of inhabitants of foreign origin, and proximity to city centers, as well as cultural and educational facilities, commercial and industrial activities, churches, and mining activity areas.

The binary logistic regression model allows for the evaluation of overall performance and the statistical contribution of explanatory variables. All variables were first normalized to make heterogeneous units (metres, numbers, etc.) comparable. To mitigate the potential effects of spatial autocorrelation and the high asymmetry between sectors with and without mosques, we adopted an approach based on balanced random subsamples, ensuring more robust statistical inferences. For each iteration, logistic regression began with the complete set of explanatory variables. A backward elimination procedure was then applied independently: at each stage, the variable with the highest p-value above the threshold ( $p > 0.05$ , score test) was removed, and the model was readjusted. This process continued until all remaining variables were statistically significant. As the selection was reset at each iteration and applied to different subsamples, the variables retained could vary from one iteration to another. The model's goodness of fit was assessed using two approaches. First, the Receiver Operating Characteristic (ROC) curve, a widely validated method for evaluating predictive models, was used to compare estimated probabilities with actual observations. An ROC value of 0.5 indicates a model is making decisions at random, while a value close to 1 suggests strong discriminatory ability (Hu & Lo, 2007).

The second approach focuses on accuracy, measured as the proportion of correctly classified predictions. To address the significant imbalance between areas with and without mosques, we implemented a repeated sampling procedure coupled with logistic regression. Each iteration was based on a new balanced random sample, with an equal number of areas. Due to these sampling variations, the statistical structure of the data differed slightly from one iteration to another, which meant that certain variables were retained in some series but not in others. Table 3 reflects this

dynamic: it lists all the variables selected at least once and specifies in which iterations they remain after backward elimination, making it possible to distinguish stable predictors from those dependent on a particular sample. This procedure was repeated 1, 10, and 100 times to assess the stability of the coefficients and the robustness of the model's predictive performance. For each variable, the final coefficient presented in Table 3 corresponds to the average of the coefficients obtained during the iterations in which the variable was retained after backward elimination. The final p-values were calculated using the same principle, by averaging the p-values from the iterations in which the variable appeared in the model. This averaging strategy produces stable and robust estimates that are less sensitive to variations in a single subsample. With 100 iterations, repeating the entire process yields virtually identical coefficients and p-values, indicating that the model converges and that the estimates obtained are highly reliable. This convergence confirms that the model is no longer sensitive to the variability introduced by random sampling and that the procedure has reached a sufficient level of stability to guarantee the robustness of the results.

The logistic regression model predicts the probability of a mosque being present in a given area based on explanatory variables. It quantifies how these variables are statistically associated with mosque presence and assigns a probability score to each sector. These probabilities are then spatially represented in a susceptibility map, illustrating areas with a higher likelihood of containing a mosque. This predictive mapping approach is valuable for urban planning and spatial analysis, as it helps identify potential disparities in mosque distribution. To identify underserved areas, we focused on sectors where the model predicts a high probability of mosque presence ( $\geq 0.9$ ) but where no mosque currently exists. These sectors are labeled as "deficit sectors". The use of a high threshold (0.9) instead of the standard 0.5 is intentional: it ensures that only sectors with the strongest statistical justification for mosque presence are selected, minimizing the risk of false positives.

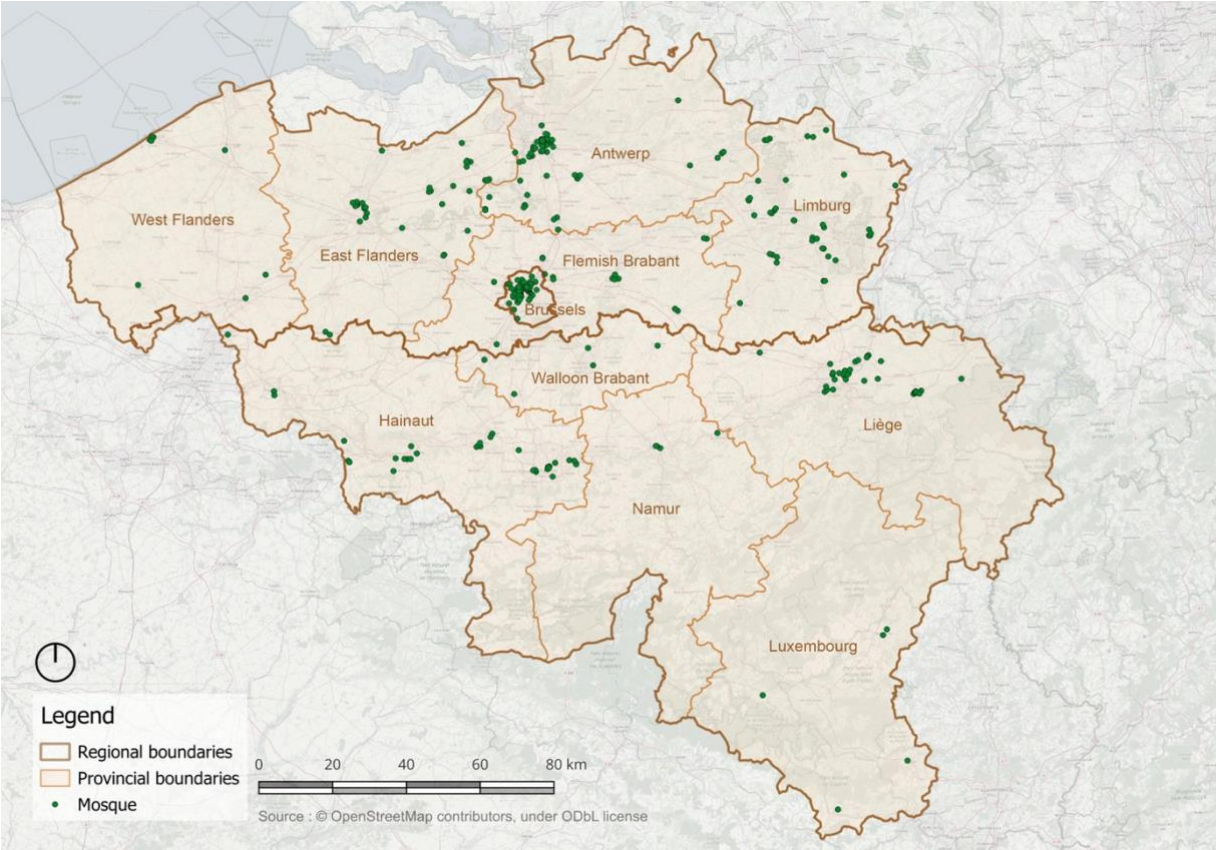
We applied an additional geospatial filter to enhance the results. This filter consists of a 500-meter buffer around existing mosques, allowing us to locate sectors outside of these radii and potentially underserved in terms of access to Islamic places of worship. Mosques serve vital cultural, religious, and social functions as essential community facilities. The selection of this distance is underpinned by theoretical foundations related to the accessibility of community services. Geurs and van Wee (2004) recommend using 500 meters as the standard for evaluating accessibility to urban services, emphasizing that it is a reasonable walking distance. This methodology ensures quick and easy access, minimizing barriers for local residents. Additionally, Talen (2003) emphasizes the significance of facilitating pedestrian access to key facilities, such as places of worship, to foster consistent and active community involvement. Sectors with no mosque, with a predicted probability  $\geq 0.9$ , and located outside this buffer were considered as priority underserved zones, where spatial and

community coverage is likely insufficient. This strategy provides meaningful predictions that cater to the needs of communities and highlights areas where access to Islamic worship spaces is lacking, and community needs could be more effectively addressed. By cross-referencing the model's predictions with geospatial criteria, this method presents a clear perspective on locations where establishing a new mosque could enhance community coverage needs.

#### 4. Results and Discussion

##### 4.1. Cartography and distribution of mosques in Belgium

This identification strategy, along with the census of mosques in Belgium, enabled us to quantify and map the country's 345 mosques (Fig. 2), with a median of 1 mosque for every 51.294 inhabitants, or approximately one mosque for every 959 Muslims. The ratio varies considerably by province, from a minimum of 948 inhabitants per mosque (Hainaut Province) to a maximum of 123.511 inhabitants per mosque (Namur Province). Table 2 shows this distribution in detail by province, providing a transparent, structured overview of the number of mosques across the country.



**Fig. 2.** Geographical distribution of Mosques in Belgium.

The geographical distribution of mosques in Belgium is characterized by a strong presence in the Flemish region, which is home to over 50% of Belgian mosques, with 173 mosques. This number is not evenly distributed across the region's five provinces. The Province of Antwerp alone boasts 70 mosques, or around 20% of all mosques in Belgium, making it the province with the most mosques, followed by the Province of Limburg, with 45 mosques, corresponding to around 13% of the country's mosques. In the Walloon region, 87 mosques are spread across the various provinces and cities, representing 26% of the total number. The Province of Liège is home to the majority, with 39 mosques, or around 12% of the total.

The 80 mosques in the Brussels-Capital Region, representing around 24% of the total number of mosques in Belgium, are particularly concentrated in a few communes, such as Molenbeek-Saint-Jean, with 21 mosques; Schaerbeek, with 18 mosques; Brussels-City, with 13; and Anderlecht, with 10.

**Table 2:** The distribution of mosques by Province in Belgium

Province	Number of mosques by province	Population (2019)	Mosque per inhabitant	Estimated Muslim population	Mosque per Muslim population
Antwerp	72	1 855 486	25 771	67 906	943
Limburg	41	87 3425	18 988	17 850	435
East Flanders	34	1 513 556	44 516	33 766	993
Flemish Brabant	18	1 145 371	88 105	19 562	1 087
West Flanders	13	1 194 950	91 919	13 526	1 040
Liège	38	1 105 733	28 352	35 878	944
Hainaut	34	1 342 456	3 948	30 074	885
Walloon Brabant	6	403 420	67 237	5 094	849
Luxembourg	5	284 442	56 888	2 380	476
Namur	4	494 042	123 511	4 940	1 235
Brussels Capital	80	1 200 322	15 004	132 780	1 660
<b>Total</b>	<b>345</b>	<b>11 413 203</b>		<b>363 756</b>	
Minimum value			3 948		435
Maximum value			123 511		1 660
Mean value			51 294		959

#### 4.2. Understanding the location of mosques through correlated variables

The approach we employed led to the elimination of some non-significant variables, including income, active, graduates, students, foreign population, proximity to the city center, proximity to industry, proximity to Horeca, proximity to a church, and proximity to a train station.

The overall performance of the final model was strong, as evidenced by the fit indicators calculated over 100 iterations, reflecting the averages of the obtained results. The AUC (Area Under the Curve) of 0.96 indicates the excellent discriminative ability of the model with respect to distinguishing between sectors with and without mosques. The average McFadden  $R^2$  is 0.61, suggesting a good overall fit of the model to the observed data and an adequate explanation of the underlying relationships. The average sensitivity is 0.92, while the average specificity is 0.91, confirming the model's accuracy in classifying sectors containing a mosque. The mean values for accuracy (0.91) and kappa (0.83) indicate substantial agreement between the actual observations and predictions, reinforcing the model's reliability. Finally, the prediction averages show that the model correctly identified 251 true positives, 23 false positives, 252 true negatives, and 22 false negatives, with an average Precision of 0.91% for areas predicted to contain mosques.

**Table 3:** Results of the final logistic regression models.

Number of iterations	1 iteration			10 iterations			100 iterations		
	Coefficients	P_values		Coefficients	P_values		Coefficients	P_values	
(Intercept)	-2,0747	4,11E-36	***	-2,0811	9,57E-32	***	-2,0795	8,98E-31	***
Muslim population	2,7629	1,63E-20	***	1,8973	2,23E-07	***	1,8015	3,61E-08	***
Mosques Agglomeration	0,874	1,54E-13	***	1,0288	2,55E-03	**	1,2618	5,63E-04	***
Proximity to education building	0,4881	3,71E-03	**	0,6456	7,04E-04	***	0,6597	2,23E-03	**
Proximity to shopping center	0,5227	4,81E-06	***	0,498	4,45E-04	***	0,4608	3,67E-03	**
Density	-0,671	4,71E-06	***	-0,445	1,31E-02	*	-0,5038	1,89E-02	*
Proximity to cultural building	0,2881	8,68E-02	.	0,3659	7,84E-02	.	0,2952	1,87E-01	.
Inactive	-0,0087	9,42E-01	.	0,2747	2,53E-01	.	0,2822	1,59E-01	.
Proximity to shop	-0,2918	9,48E-02	.	-0,3359	1,49E-01	.	-0,2956	1,92E-01	.
Proximity to coal mine	0,0202	7,78E-01	.	0,1223	3,51E-01	.	0,1182	2,56E-01	.
No dipoma	0,2203	1,89E-02	*	0,0399	3,84E-01	.	-0,0045	3,81E-01	.
Precision		0,8989			0,9089			0,9148	
Recall		0,9088			0,9146			0,9206	
Kappa		0,8066			0,8226			0,8345	
AUC		0,9603			0,9591			0,9613	
F1		0,9038			0,9117			0,9176	
Accuracy		0,9033			0,9113			0,9173	
Sensitivity		0,9088			0,9146			0,9206	
Specificity		0,8978			0,9080			0,9139	

R2	0,6195	0,6102	0,6155
----	--------	--------	--------

Significance: \*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ , · $p < 0.1$ ,  $p \geq 0.1$

The results of the final model (Table 3) indicate that there is a highly significant positive relationship between the *Muslim population* variable (Coefficient = 1.8015,  $p$ -value  $< 0.001$ ) and the presence of a mosque, suggesting that the presence of a Muslim population is strongly associated with the presence of mosques in Belgium. Indeed, mosques are strongly associated with areas characterized by a high concentration of Muslims, a finding consistent with the work conducted by Dassetto (2013), who demonstrated that the dynamics of establishing the first mosques in Belgium often followed the spatial distribution of Muslim communities to meet community needs. This causal link between the presence of mosques and the settlement of Muslim populations may not be unidirectional. While the earliest mosques were set up in areas already occupied by Muslims, some mosques may also attract a Muslim population, encouraging families to settle near these new centers of worship.

A second variable, just as significant as the previous one, is the mosques' agglomeration effect (coefficient = 1.2618,  $p$ -value  $< 0.001$ ), which measures the number of mosques within a 500-meter radius of each statistical sector. This result indicates that mosques tend to be located close to one another, suggesting a pattern of spatial clustering. While the model captures this effect, it does not identify the underlying mechanisms. Several hypotheses, grounded in existing literature, can help interpret this result. Mosque clustering may reflect overcrowding and capacity limitations in existing facilities, especially in areas with a high concentration of Muslim population, prompting the need for nearby alternatives (Gagnon & Germain, 2002; Manço & Kanmaz, 2005). It may also result from ethnic, linguistic, or theological distinctions within Muslim communities, which often lead to the establishment of separate mosques for Moroccan, Turkish, or Sub-Saharan groups, each with specific practices and institutional preferences. Identity and organizational dynamics observed in the establishment of mosques in Belgium confirm that Islam does not constitute a homogeneous bloc there. As Dassetto (2013) and Torrekens (2024) point out, places of worship are often structured by divisions within Muslim communities themselves, whether cultural, linguistic, or institutional. For example, there are distinctions between mosques founded by Arabs or Amazighs within the Moroccan community, or between Turkish mosques affiliated with the Diyanet and those that claim independence. These differences reflect varied relationships with religion, but also specific political or identity-based affiliations. Furthermore, generational trajectories play an important role in this diversity: mosques established in a more restrictive political context, often perceived as conservative, sometimes struggle to meet the expectations of new generations. Conversely, newer mosques, established in a more open sociopolitical environment, adopt more diverse religious and

organizational models, which fuels increased fragmentation and spatial dispersion of places of worship (Westfall, 2025). Finally, these patterns of differentiation can be reinforced by institutional mechanisms, particularly those related to the inertia of administrative procedures. The presence of a mosque in a sector may signal that planning approval has already been granted, reducing institutional resistance and simplifying procedures for subsequent projects. This creates a more favorable regulatory environment and encourages new founders to settle nearby (Gale, 2005; Wu et al., 2023). Although not captured directly in the model, such institutional dynamics likely reinforce observed clustering patterns. These interpretations, while grounded in literature, go beyond what cross-sectional data can establish. We therefore present them as contextual hypotheses requiring further investigation through longitudinal and qualitative methods to better understand the political, cultural, and institutional drivers of mosque distribution.

Other correlated elements were also identified as having meaningful associations with mosque location. For example, *proximity to educational buildings* (Coefficient = 0.6597,  $p < 0.01$ ) and *proximity to shopping centers*, including commercial malls and department stores (Coefficient = 0.4608,  $p < 0.01$ ), have positive impacts. In contrast, a significant negative correlation was observed with *population density*, as indicated by the coefficient of -0.5038 ( $p < 0.05$ ). These results show that mosques are close to schools and shopping centers while also being situated in areas of relatively low residential density. This trend could be interpreted as individuals responsible for mosques opting for more accessible yet less congested locations instead of erecting them in densely populated urban areas. Also, the high cost of land and real estate in central areas could explain the preference for situating mosques on the periphery. Indeed, the negative correlation between density and mosque location suggests a preference for less densely populated urban areas, where mosques can cater to community needs while benefiting from better accessibility. These findings underscore the importance of accessibility in the creation of places of worship (Alawadi et al., 2023). The proximity to schools and shopping centers may indicate a strategic choice of location in peri-urban areas, where residential neighborhoods coexist with educational and commercial services. Although these areas are less densely populated, they provide optimal accessibility and visibility while being sufficiently removed from the crowded urban centers. At the same time, the proximity of shopping centers indicates a presence in functional and developing regions, where a blend of residential, commercial, and community services is available. This highlights a phenomenon in which mosques, rather than being concentrated in very dense neighborhoods, are contributing to the creation of new urban centralities that integrate social, educational, and commercial aspects and functions.

In the final model, based on 100 iterations, several variables were found to be insignificant. These include proximity to local stores, proximity to Horeca zones, proximity to cultural buildings, proximity

to coal mines, and proximity to railway stations. Additionally, the presence of an inactive population and the presence of a population with no educational qualifications were also found to have no significant effects on the final model. These results suggest that, although these variables may have a contextual influence in some cases—as revealed by the results of the model with a single iteration—they do not exert a direct, determining influence. This indicates that their impact diminishes when integrated into a broader context model.

Another significant finding is the exclusion of the income variable from the first phase of backward elimination due to its lack of significance. This result suggests that the establishment of mosques is not limited to poor neighborhoods but extends to various socioeconomic contexts, and challenges the analyses of Schinkel (2009) and Schmitt (2013), according to which mosques are located in industrial and marginal areas, thereby contributing to the spatial and social marginalization of Muslims.

The repositioning of mosques in more central residential zones reflects the socio-spatial evolution of Muslim communities, marked by greater integration into the urban fabric. This shift towards more accessible and socially mixed locations reflects a broader trend observable in Western Europe: the gradual “domestication” of Islam and the normalization of mosques in urban public spaces (Göle, 2016; Cesari, 2005; Beekers & Tamimi Arab, 2016). Indeed, beyond their spiritual role, mosques are becoming points of attraction that influence urban space organization, particularly through their ability to attract other places of worship. This phenomenon of spatial clustering is one of the original contributions of this study. The results show that the presence of a mosque significantly increases the likelihood of other places of worship being established, suggesting that mosques are not simply isolated religious infrastructures, but structuring hubs around which urban centrality and community dynamics are reconfigured. By strengthening religious and social interconnections, they promote the concentration of infrastructure in strategic locations, contributing to the formation of new urban centralities characterized by more intense associative, economic, and cultural activities. This concentration of religious establishments plays a central role in shaping new forms of urban centrality, fostering spaces where Muslim communities, through these centers of worship, actively engage in a city's economic and social dynamics. This observation confirms the findings of the study by El Boujjoufi et al. (2023), which show that mosques do not function as isolated entities but as hubs around which a genuine community ecosystem develops.

Although these results show a certain spatial normalization of mosques and their increasing integration into residential contexts, they should not be interpreted as an absence of tension. At the European level, several studies show that this apparent presence can be accompanied by new forms of vigilance, negotiation, or resistance (Allievi, 2016; Allen, 2020). The visibility of mosques in mixed

and central areas continues to spark debate about the compatibility of Muslim presence with dominant urban norms (Göle, 2016; Schnabel, 2023). An original contribution of this study lies in the identification of a phenomenon of agglomeration, where the presence of one mosque seems to encourage the establishment of others nearby, thus reinforcing their centrality and their structuring role in the urban space. This process, observed in several neighborhoods, suggests that mosques do not simply integrate into the urban fabric but actively participate in the reconfiguration of new religious, social, and territorial centers. These dynamics, which are still poorly documented, deserve to be explored comparatively in other contexts to assess their significance within contemporary European cities.

#### 4.3. Locations of areas of scarcity

We calculated the mosque location prediction to determine the statistical sectors where a mosque is likely to be situated. Before analyzing the results, we validated the model's precision. We compared the prediction results with the areas that already feature mosques (Mosque=1). This allowed us to confirm the predictive quality, achieving an accuracy rate of 91.7%, which demonstrates the model's reliability in identifying areas where a mosque is located. We focused on statistical areas where the probability predicted by the model exceeded 0.9.

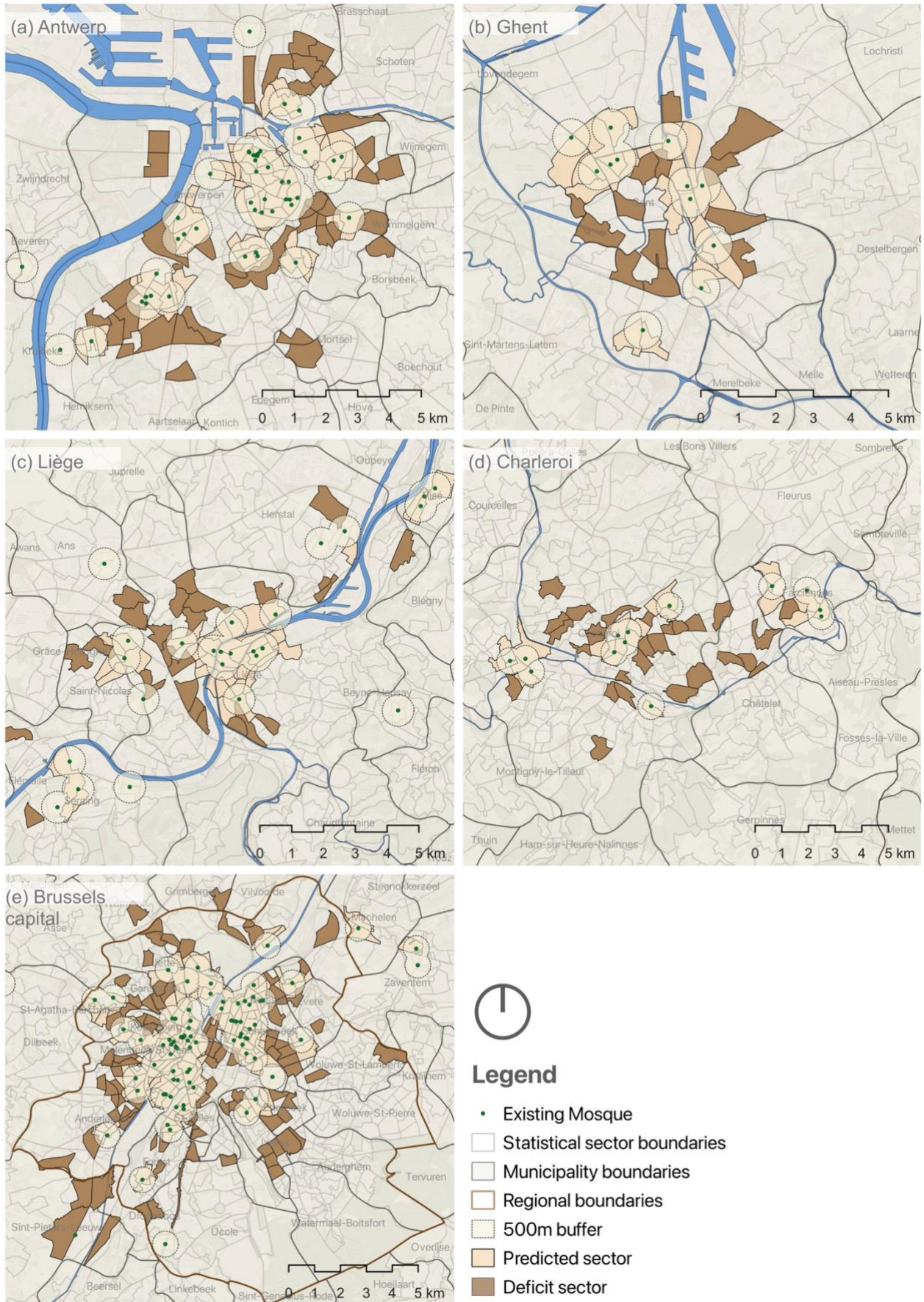
**Table 4:** Mosque deficit by province.

Province	Population (2019)	Estimated Muslim population	Predicted sectors by the model	Existing mosques	Mosque deficit sectors by the model	Mosque deficit sectors outside 500m buffer
Antwerp	1855486	67906	144	72	105	51
Limburg	873425	17850	35	41	19	12
East Flanders	1513556	33766	77	34	55	28
Flemish Brabant	1145371	19562	30	18	23	14
West Flanders	1194950	13526	12	13	11	7
Liège	1105733	35878	79	38	59	30
Hainaut	1342456	30074	61	34	46	33
Walloon Brabant	403420	5094	1	6	1	-
Luxembourg	284442	2380	1	5	1	-
Namur	494042	4940	5	4	3	2
Brussels Capital	1200322	132780	239	80	185	85
<b>Total</b>	<b>11413203</b>	<b>363756</b>	<b>684</b>	<b>345</b>	<b>508</b>	<b>262</b>

The predictive analysis revealed disparities in the locations of mosques across the provinces of Belgium (Table 4). A minimum of 262 statistical sectors, spread over 80 communes, were identified as lacking a mosque. Most of these areas are in the Brussels-Capital Region, with 85 sectors identified as needing a mosque. In Flanders, Antwerp (51 sectors) and East Flanders (28 sectors) have significant needs as well, followed by Flemish Brabant (14 sectors), Limburg (12 sectors), and West Flanders (7 sectors). In Wallonia, the provinces of Liège (30 sectors) and Hainaut (32 sectors) also face this issue, while Namur has only two deficit sectors.

The results also revealed communes with no mosques, despite a high probability of establishment predicted by the model. In Wallonia, these include Châtelet and Dison. In Flanders, the municipalities of Borsbeek, Mortsel, Lanaken, Kuurne, Grimbergen, and Wemmel are among those requiring such infrastructure. Municipalities such as Etterbeek, Auderghem, and Woluwe-Saint-Lambert in the Brussels-Capital region also appear to be in high demand.

In the following section, we aim to analyze the major Belgian communes identified as underserved.



**Fig. 3.** Map of statistical sectors with mosque deficits: (a) Antwerp, (b) Ghent, (c) Liège, (d) Charleroi,

and (e) Brussels-Capital.

The locations of mosques in major Belgian cities vary considerably from one city to another, influenced by their urban morphologies, history, and demographic dynamics. Despite differences in number and density, a common trend emerged: a concentration of existing mosques in urban centers and a notable deficit on the periphery, often in areas developed during industrialization in the late 19th and early 20th centuries.

Antwerp, the Belgian city with the most mosques (49), presents a well-distributed network, particularly in central districts and strategic locations, ensuring good accessibility for Muslim populations. Gaps persist, notably in 35 statistical sectors located in the northern, northeastern, southern, and southwestern peripheries. These areas, urbanized primarily in the first half of the 20th century, exhibit moderate to high residential density but do not have enough Islamic places of worship (Fig. 3a).

In Ghent, the 12 existing mosques are mainly concentrated near the city center and in residential neighborhoods. Nonetheless, 13 statistical sectors remain without a mosque. Several of these areas, urbanized between the late 19th and early 20th centuries, exhibit a deficiency in places of worship. Industrial districts in the north, developed around the port, and residential expansions to the east and southeast, characterized by varying densities, show a clear need for additional mosques. Additionally, central districts that developed alongside railway and university expansions in the late 19th century, as well as newer, less densely populated southeastern areas, remain distant from existing mosques (Fig. 3b).

Liège, with 12 mosques, exhibits a concentration around the city center, particularly along the left and right banks of the Meuse River. A minimum of 16 statistical sectors have been identified as requiring mosques due to their distance from existing places of worship. These areas, located on the outskirts of the historic urban core and urbanized mainly in the late 19th and early 20th centuries, have moderate to high residential densities. Densely populated neighborhoods in the north, northwest, and west, shaped by 19th-century industrialization, as well as residential zones along the Meuse River to the east, show a marked need for additional mosques. The right bank, which underwent urbanization later in the 20th century, also remains underserved (Fig. 3c).

The nine mosques in Charleroi are primarily located in the northern and downtown districts near the Sambre River, serving a significant portion of the Muslim community. At least 23 statistical sectors, situated on the periphery of the town center to the north, east, south, and southeast, lack places of

worship. These areas, characterized by moderate to high urban density, emerged from industrialization and urban expansion in the late 19th and early 20th centuries. The urban fabric in these districts predominantly consists of working-class housing and small apartment buildings, highlighting a need for improved mosque accessibility (Fig. 3d).

The Brussels-Capital region exhibits an uneven distribution of mosques, with over 75% of them concentrated in four municipalities: Molenbeek-Saint-Jean, Schaerbeek, Bruxelles-City, and Anderlecht. In contrast, several communes, including Auderghem, Etterbeek, and Woluwe-Saint-Lambert, have no mosques despite predictive models indicating a need. The analysis highlights significant geographical disparities, particularly in central Brussels, where high-density neighborhoods urbanized in the 19th century remain underserved. Peripheral areas to the north and south, near the Canal and at the intersection of residential and industrial zones developed in the late 19th and early 20th centuries, also exhibit a need for mosques. Similarly, densely populated districts urbanized throughout the 20th century, particularly in the east and west of the region, lack sufficient places of worship. Lastly, the outskirts of Brussels, despite having a lower density than central districts, also require mosques due to their growing populations (Fig. 3e).

Beyond the Belgian context, the results of this study are part of a broader European trend concerning the establishment of Muslim places of worship in urban areas. Many studies have demonstrated that the location of mosques is neither random nor solely correlated with the Muslim population, but rather results from complex interactions between urban heritage, institutional regulations, and community strategies for territorial anchoring (Cesari, 2005; Chiodelli & Moroni, 2017; El Boujjoufi et al., 2025; Gale, 2024; Göle, 2016; Maussen, 2009). The concentration observed in some historic city centers and the under-representation in certain peripheries, particularly industrial ones, reflects a persistent spatial marginalization that has been widely documented in various European contexts (Allievi, 2010; Kuppinger, 2014; Tamimi Arab, 2023). The model's predictions developed in this study reinforce this pattern by identifying areas where the statistical likelihood of mosque presence is high, yet no mosque is currently located. This discrepancy suggests the persistence of institutional, political, or symbolic barriers that may limit the possibility of establishing, maintaining, and accessing these places of worship (Cesari, 2013; Maussen, 2009; Mattes & Rosenberger, 2014). It refers to what Cesari (2005) describes as the “conditional recognition”: a framework in which Islam is legally recognized but spatially constrained, producing subtle forms of control, invisibility, and territorial delegitimization of the Muslim presence.

These results may also be interpreted in light of contemporary urban planning frameworks. The concept of the 15-minute city (Moreno, 2024), now adopted by many European cities, aims to ensure

equitable access to essential facilities within a 15-minute walk or bike ride. Several studies highlight its potential in terms of urban sustainability, ecological transition, and territorial equity (Allam et al., 2022; Khavarian-Garmsir et al., 2023; Papadopoulos et al., 2023), while others point out its primarily normative nature and the fact that it is sometimes difficult to operationalize in complex socio-spatial contexts (Pozoukidou & Chatziyiannaki, 2021; Alawadi et al., 2025). Furthermore, local accessibility varies according to individuals, daily schedules, and mobility practices (Willberg et al., 2023), revealing the limitations of a uniform approach. In the Western context, places of worship are rarely considered a priority in proximity policies (Arias-Molinares & et al., 2025) and, when they are, they may be classified under secondary categories, such as “recreational activities” (Guerreiro et al., 2026). Such an omission is particularly significant in neighborhoods where the Muslim population resides. Recognizing the mosque as a community facility, in the same way that the church has historically been, therefore appears essential. At the European level, this invites urban planners and decision-makers to explicitly integrate places of worship and the socio-demographic composition of neighborhoods into 15-minute city assessments, accessibility measures, and planning strategies. Such an approach would make it possible to move beyond reactive management of mosque creation requests and adopt a more proactive approach for anticipating territorial needs related to religious diversity. The spatial distribution of mosques should thereby be interpreted as a process of producing inclusive, mixed, and sustainable urban environments.

## **5. Conclusions**

This study marks a significant advance in the geographical analysis of mosques in Belgium, filling an important gap caused by the absence of consolidated data on the locations of these places of worship. Through the construction of a database and detailed mapping, this research provides an accurate overview of the distribution of mosques across the country.

The average mosque coverage corresponds to a ratio of one mosque per 51,294 inhabitants or approximately one mosque per 959 Muslims. This average, however, conceals significant disparities between the provinces, ranging from a ratio of one mosque per 3,948 inhabitants in the province of Hainaut to a ratio of one mosque per 123,511 inhabitants in the province of Namur.

The results of this study reveal that variables such as proximity to local shops, Horeca, cultural buildings, coal mines, and train stations, as well as the presence of inactive and unqualified populations, do not have a significant link with the locations of mosques. Although they may play a contextual role, these elements do not influence the overall model directly. Furthermore, the exclusion of the median income variable from the initial elimination phase suggests that the

establishment of mosques goes beyond low-income areas, thus spreading across diverse socioeconomic contexts.

Beyond the presence of a Muslim population, an essential element in explaining the mosque presence, this study highlights the importance of proximity to other mosques as a variable strongly associated with their location. The agglomeration effect of mosques reveals that the presence of a mosque in a region encourages the establishment of a new mosque nearby. This shows that the location of mosques is not solely determined by functional considerations, but also by community, relational, and perhaps strategic dynamics. Proximity to services such as schools and shopping centers also favors the establishment of mosques, and a lower population density also seems to be associated with their establishment, suggesting a preference for less dense and more accessible, generally less expensive, peri-urban areas. These areas, as they become strategic spaces, favor the convergence of religious practices, community activities, and economic dynamics, thus redefining urban centralities, both physical and symbolic.

We also identified statistical sectors with a mosque deficit. A total of 262 sectors in more than 80 communes were identified, mainly situated on the periphery of historic urban centers, often urbanized at the end of the 19<sup>th</sup> century and the beginning of the 20<sup>th</sup> century. These areas, characterized by moderate to high density, are marked by a predominance of residential activity and a more limited commercial fabric, sometimes with an industrial background. Although some mosques located in urban centers may partially serve these peripheries, their function as a local community facility remains insufficient. Consequently, some peripheries still lack mosques, despite relative accessibility. These findings offer planners and decision-makers directly transferable lessons: the usefulness of national geostatistical analyses, the need for proactive planning, the recognition of the spatial distribution of mosques as a vector of emerging centrality, and the value of transparent and non-discriminatory regulatory frameworks.

This study presents an informed analysis of the geographical distribution of mosques in Belgium, as well as variables related to their location and the deficit in mosques. The disparities observed between the model's predictions and the reality on the ground, particularly in the absence of mosques in certain communes, underline the need to examine institutional factors, such as refusals to grant building permits for or create mosques. Nevertheless, the prospects for future research remain rich. This study contributes to shifting the European debate on Muslim visibility away from conflicts surrounding large mosques toward a more nuanced understanding of the mechanisms of spatial distribution and marginalization that currently structure the continent's religious geography.

## **Bibliography**

- Alawadi, K., Anabtawi, R., & Alshehhi, G. (2025). The Minute City: between theory and practicality in suburban landscapes. *Sustainability: Science, Practice and Policy*, 21(1), 2444007.
- Alawadi, K., Alkhaja, N., Alhadhrami, M. A. A., & Mustafa, S. O. (2023). Making religious buildings more accessible. *Journal of Transport and Land Use*, 16(1), 189-214.
- Allam, Z., Bibri, S. E., Chabaud, D., & Moreno, C. (2022). The '15-Minute City' concept can shape a net-zero urban future. *Humanities and Social Sciences Communications*, 9(1), 1-5.
- Allen, C. (2020). *Reconfiguring Islamophobia: A radical rethinking of a contested concept*. Springer Nature.
- Allievi, S. (2009). *Conflicts over mosques in Europe: Policy issues and trends*. Alliance Publishing Trust.
- Allievi, S. (2010). Immigration and cultural pluralism in Italy: Multiculturalism as a missing model. *Italian culture*, 28(2), 85-103.
- Allievi, S. (2014). Immigration, religious diversity and recognition of differences: The Italian way to multiculturalism. *Identities*, 21(6), 724-737.
- Allievi, S. (2016). The symbolic power of mosques in Europe: A case study of urban space and identity. *Journal of European Social Studies*, 8(2), 85–104.
- Arias-Molinares, D., Geurs, K., Grigolon, A., Ulak, B., Duran-Rodas, D., McCormick, B., ... & Esztergár-Kiss, D. (2025). Exploring the 15-Minute City concept for the urban outskirts: a systematic literature review. *European transport research review*, 17(1), 50.
- Beekers, D., & Tamimi Arab, P. (2016). Dreams of an iconic mosque: spatial and temporal entanglements of a converted church in Amsterdam. *Material Religion*, 12(2), 137-164.
- Cadaster (2019). *Belgian cadastral dataset (CAD): parcels and buildings [Database]*. The CAD, made available by the Belgian Land Registry Administration, contains vector data on buildings in 2D. Consulted as part of research by the LEMA Research Center, Uliège, in accordance with established agreements.
- Cesari, J. (2005). Mosque conflicts in European cities: Introduction. *Journal of Ethnic and Migration Studies*, 31(6), 1015-1024.
- Cesari, J. (2013). *Why the west fears Islam: An exploration of Muslims in liberal democracies* (p. 9). New York: Palgrave Macmillan.
- Chiodelli, F. (2015). Religion and the city: A review on Muslim spatiality in Italian cities. *Cities*, 44, 19-28.
- Chiodelli, F., & Moroni, S. (2017). Planning, pluralism and religious diversity: Critically reconsidering the spatial regulation of mosques in Italy starting from a much-debated law in the Lombardy region. *Cities*, 62, 62-70.

- Chiodelli, F., & Moroni, S. (2025). Urban Planning and the Pluralistic City. In *The Legal and Political Geography of Pluralism* (pp. 73-85). Bristol University Press.
- Conti, B. (2016). Islam as a new social actor in Italian cities: Mosque controversies as sites of inclusion and separation. *Religion, State & Society*, 44(3), 238-257.
- Dassetto, F. (1996). *La construction de l'islam européen. Approche socio-anthropologique*.
- Dassetto, F. (2009). *Le devenir de l'islam européen et belge face aux défis citoyens*.
- Dassetto, F. (2013). *L'Iris et le Croissant : Bruxelles et l'Islam au défi de la co-inclusion*. Presses universitaires de Louvain.
- Djelloul, G., & Maréchal, B. (2018). L'islam et les musulmans en Belgique : Quelques repères historiques, Démographiques et organisationnels. *Dossier documentaire du CISMODOC*, 1.
- El Boujjoufi, M., & Teller, J. (2026). Mosques in Belgium. *Mendeley Data*, V1. Doi: 10.17632/whgdzhhw2y.1.
- El Boujjoufi, M., Mustafa, A., & Teller, J. (2023). Does mosque location matter? Mosque and Islamic shops in the European context. *Journal of Islamic Marketing*, 14(2), 465-483.
- El Boujjoufi, M., Torrekens, C., & Teller, J. (2025). Is There Room for New Mosques in Belgian Cities? An Actor–Network Theory Approach. *Land*, 15(1), 70.
- ElBattoui, M., & Kanmaz, M. (2004). *Mosquées, imams et professeurs de religion islamique en Belgique. Etat de la question et enjeux*. Bruxelles.
- EMB. (2020). Muslim Executive Belgium website (<https://www.embnet.be/fr/presentation-de-linstitution>), consulted on 2 April 2020.
- Fadil, N. (2019). The anthropology of Islam in Europe: A double epistemological impasse. *Annual Review of Anthropology*, 48(1), 117–132.
- Gagnon, J. E., & Germain, A. (2002). Espace urbain et religion : Esquisse d'une géographie des lieux de culte minoritaires de la région de Montréal. *Cahiers de géographie du Québec*, 46(128), 143-163.
- Gale, R., & Naylor, S. (2002). Religion, planning and the city: the spatial politics of ethnic minority expression in British cities and towns. *Ethnicities*, 2(3), 387-409.
- Gale, R. (2013). Religious residential segregation and internal migration: The British Muslim case. *Environment and Planning A*, 45(4), 872-891.
- Gale, R. (2005). Representing the city: Mosques and the planning process in Birmingham. *Journal of Ethnic and Migration Studies*, 31(6), 1161-1179.
- Gale, R. (2024). Governing religious space: Exploring the religion and urban planning nexus. In *Handbook of the Geographies of Religion* (pp. 391-414). Cham: Springer Nature Switzerland.

- Geurs, K. T., & Van Wee, B. (2004). Accessibility evaluation of land-use and transport strategies: Review and research directions. *Journal of Transport Geography*, 12(2), 127-140.
- Göle, N. (2011). The public visibility of Islam and European politics of resentment: The minarets-mosques debate. *Philosophy & Social Criticism*, 37(4), 383-392.
- Göle, N. (2016). Introduction: Islamic controversies in the making of European public spheres. In *Islam and public controversy in Europe* (pp. 3-20). Routledge.
- Guerreiro, M. S., Dinis, M. A. P., Sucena, S., Silva, I., Pereira, M., Ferreira, D., & Moreira, R. S. (2026). The 15-Minute City in Porto, Portugal: Accessibility for the elderly. *Cities*, 170, 106655.
- Hertogen, J. (2016). Etude démographique. Université catholique de Louvain.
- Hu, Z., & Lo, C. P. (2007). Modeling urban growth in Atlanta using logistic regression. *Computers, Environment and Urban Systems*, 31(6), 667-688.
- Husson, J.-F. (2020). La reconnaissance de l'Islam en Belgique. Les grandes étapes. *IMAG*, 351.
- Jikeli, G. (2023). How Do Muslims and Jews in Christian Countries See Each Other Today? A Survey Review. *Religions*, 14(3), 412.
- Kalra, V. S. (2019). *From textile mills to taxi ranks: Experiences of migration, labour and social change*. Routledge.
- Kesteloot, C. (1987). The residential location of immigrant workers in Belgian cities: An ethnic or socio-economic phenomenon? *Erdkundliches Wissen*, 84.
- Khavarian-Garmsir, A. R., Sharifi, A., & Sadeghi, A. (2023). The 15-minute city: Urban planning and design efforts toward creating sustainable neighborhoods. *Cities*, 132, 104101.
- Khoojinian, M. (2019). Du travailleur au clandestin. La politique de l'emploi et l'immigration de travail dans la Belgique de la fin des Trente Glorieuses (1965-1974). *Revue belge de Philologie et d'Histoire*, 97(2), 521-575.
- Kuppinger, P. (2014). Mosques and minarets: Conflict, participation, and visibility in German cities. *Anthropological Quarterly*, 87(3), 793-818.
- Liebert, S., Siddiqui, M. H., & Goerzig, C. (2020). Integration of Muslim Immigrants in Europe and North America: A Transatlantic Comparison. *Journal of Muslim Minority Affairs*, 40(2), 196-216.
- Manço, U., & Kanmaz, M. (2005). From conflict to co-operation between Muslims and local authorities in a Brussels borough: Schaerbeek. *Journal of Ethnic and Migration Studies*, 31(6), 1105-1123.
- Maussen, M. J. M. (2009). *Constructing mosques: The governance of Islam in France and the Netherlands* (Doctoral dissertation, Amsterdam School for Social Science Research).

- Mattes, A., & Rosenberger, S. (2014). Islam and Muslims in Austria. In *After Integration: Islam, Conviviality and Contentious Politics in Europe* (pp. 129-152). Wiesbaden: Springer Fachmedien Wiesbaden.
- Moreno, C. (2024). *The 15-Minute city: a solution to saving our time and our planet*. John Wiley & Sons.
- Pace, E. (2014). Increasing religious diversity in a society monopolized by Catholicism. In *Religious pluralism: Framing religious diversity in the contemporary world* (pp. 93-114). Cham: Springer International Publishing.
- Papadopoulos, E., Sdoukopoulos, A., & Politis, I. (2023). Measuring compliance with the 15-minute city concept: State-of-the-art, major components and further requirements. *Sustainable Cities and Society*, 99, 104875.
- Pew Research Center (2011). Muslim Population by Country.  
<https://www.pewresearch.org/religion/2011/01/27/table-muslim-population-by-country>
- Pozoukidou, G., & Chatziyiannaki, Z. (2021). 15-Minute City: Decomposing the new urban planning utopia. *Sustainability*, 13(2), 928.
- Puente-Sotomayor, F., Mustafa, A., & Teller, J. (2021). Landslide susceptibility mapping of urban areas: Logistic regression and sensitivity analysis applied to quito, ecuador. *Geoenvironmental Disasters*, 8(1), 19.
- Sägesser, C. (2020). L'organisation et le financement public du culte islamique. Belgique et perspectives européennes. *Courrier hebdomadaire du CRISP*, 24592460(14), 5-72.
- Schmitt, T. (2013). Mosque Debates as a Space-Related, Intercultural, and Religious Conflict. *Chloe: Beihefte Zum Daphnis*, 46(1).
- Schnabel, E. (2023). *Contested Faith: Resistance to New Mosques in Chicago Suburbs and Berlin* (Doctoral dissertation, University of Illinois at Chicago).
- SPW. (2019). Digital geographic and biological data from the Walloon Public Service. Mining concessions, Mining waste management sites and Terrils.
- Statbel. (2019). General Statistics Directorate - Belgium. Statistical data by statistical sector.
- Tamimi Arab, P. (2013). Mosques in the Netherlands: Transforming the meaning of marginal spaces. *Journal of Muslim Minority Affairs*, 33(4), 477-494.
- Tamimi Arab, P. (2021). Islamic heritage versus orthodoxy: Figural painting, musical instruments and wine bowls at the Dutch National Museum of World Cultures. *Journal of Material Culture*, 26(2), 178–200.
- Talen, E. (2003). Neighborhoods as Service Providers: A Methodology for Evaluating Pedestrian Access. *Environment and Planning B: Planning and Design*, 30(2), 181-200.

- Torrekens, C. (2007). Concentration des populations musulmanes et structuration de l'associatif musulman à Bruxelles. *Brussels Studies. The e-journal for academic research on Brussels*.
- Torrekens, C. (2024). Muslims in Belgium: From Immigrant Guestworkers to a Polymorphic and Contested Minority. In R. Ceylan & M. Mücke (Éds.), *Muslims in Europe* (p. 23-38). Springer Fachmedien Wiesbaden.
- Valli, C., Gravelle, T. B., Nai, A., Medeiros, M., Murri, C., & Eugster, B. (2025). The Mosque Next Door: How the Visibility of Mosques Influences Support for the Far-Right and Anti-Immigration Policies. *Political Behavior*, 1-24.
- Westfall, A. (2025). The political power of Muslim social capital in Europe and North America. *Politics, Groups, and Identities*, 1-25.
- Willberg, E., Fink, C., & Toivonen, T. (2023). The 15-minute city for all? Measuring individual and temporal variations in walking accessibility. *Journal of Transport Geography*, 106, 103521.
- Wu, S., Zhong, Y., Bao, S., Wang, W., & Nie, T. (2023). The Evolution of the Spatial Distribution Pattern of Mosques in the Kashgar Region from 1955 to 2004. *Religions*, 14(2), 216.