

The socio-spatial integration of knowledge districts into the city: Theoretical clarifications and evidence from Belval, Esch/Alzette

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Abstract

The integration of knowledge-related urban development projects into the city is perceived as a major planning objective and as an opportunity for regional growth. However, critics claim that these knowledge districts mostly result in isolated, elitist neighbourhoods and thus fail their initial objectives. In this paper, the author argues that this debate is blurred by diverging conceptions of socio-spatial integration, that prevent a correct understanding of the underlying processes. Therefore, it is first suggested to disentangle the multiple perspectives from which the concept of socio-spatial integration can be observed. Second, the focus is put on a structural approach in order to measure the extent to which the social structure of the Belval knowledge district in Esch/Alzette, Luxembourg, differs from the urban environment it is attached to. The aim is to analyse the structural dissimilarities that exist between the knowledge district and other urban neighbourhoods. Results show that the dissimilarities between Belval and the adjacent neighbourhoods are mainly explained by the international, young and professional profile of the attracted population, rather than by their socio-economic status. Thus, the present paper suggests a more nuanced interpretation of the urban integration of knowledge districts and offers an original, indicator-based tool to measure it.

Keywords

Socio-spatial integration, Knowledge district, Structural dissimilarities, Belval

1. Introduction

Since the popularization of knowledge-related urban development projects, there has been growing awareness – both in political discourses and in academia – about what effects they have on the surrounding space, and how they will be integrated into their spatial and social environment. On the one hand, the integration of newly-built areas into the existing city framework is thought to provide tangible benefits for both parts (Yigitcanlar, Baum and Horton, 2007; Den Heijer and Curvelo Magdaniel, 2012). Newly attracted institutions or businesses could rely on knowledge and skills from the local population, while ‘spillover’ or ‘trickle-down’ processes are believed to enable quality of life improvements for all citizens (Woo and Lee, 2016). On the other hand, critical studies on large-scale urban development projects call into question the very possibility of high integration levels between these projects and older, well-established neighbourhoods. This claim is explained by the fundamentally unequal financing patterns they rely on (Tarazona Vento, 2017), the active attraction of higher-income groups of the population (Madureira and Baeten, 2016), as well as the intended differentiation from local or regional architecture through flagship developments. In the context of so-called knowledge districts – planned

clusters of universities, research centres and other specialized institutions – the multiple issues related to socio-spatial integration appear to be particularly relevant because they attract a highly qualified population that might present important social, cultural and economic differences with the local communities.

Up to now, academic contributions lack clear definitions of the multidimensional nature of the socio-spatial integration concept. There is no holistic analytical framework to evaluate the level of integration between a newly-built urban development project and the rest of the city, which makes it difficult to compare research findings from different studies. The current paper aims to address this research gap by discussing the multiple dimensions related to the concept of socio-spatial integration and by offering a quantified evaluation through a dissimilarity index that measures structural dissimilarities between neighbourhoods. The initial postulate this study relies on states that high structural dissimilarities between two areas indicate a low level of socio-spatial integration between these areas. This study focuses on the Belval knowledge district in Esch/Alzette, Luxembourg, and uses an original set of 21 indicators. They describe the situation of the neighbourhoods and their population at various levels and are detailed in section four. By combining these indicators on every pair of adjacent neighbourhoods the existence of structural dissimilarities between the knowledge district and the rest of the city can be tested.

Given the high density of knowledge-related institutions in Belval, I expect to observe significant structural dissimilarities with the other neighbourhoods in Esch/Alzette in terms of employment sectors, income, age and nationalities. I also expect strong dissimilarities in terms of civic engagement of the population due to the mostly temporary and dynamic character of knowledge-related activities, which would hinder the constitution of an identification with the city. These hypotheses are tested by a multivariate analysis, that allows us to present the existing neighbourhood dissimilarities in their totality and to break them down into a set of factors in order to provide more fine-grained interpretations.

In the following section, I am going to discuss the concept of socio-spatial integration and how it is used in the field of urban development. Then, section three details the methodology and section four gives a brief overview of the case study context. Ultimately, the study outcomes and their implications for the scientific literature and urban planning practices are presented and discussed in sections five and six respectively.

2. Socio-spatial integration

2.1. A broad and multidimensional concept that needs a clear definition in urban development

In the public discourse, the concept of integration is mostly used in the case of integration policies that aim to conciliate the social and cultural practices of immigrant communities with the values of the dominant group in a certain area. It thus appears as a general political objective and as a desirable goal to achieve for policymakers. This political conception always involves two or more groups that are subjected to adaptations in order to guarantee the overall stability and to regain a certain homogeneity. It also includes power relations between the implicated groups: integration can be understood as the desire of the dominant group to extend its control over the newly formed group, that needs to invest greater efforts of adaptation.

This understanding tends to blur the initial sociological meaning of integration (Schnapper, 2007; Ruiz-Tagle, 2016), that was first defined by French sociologist Emile Durkheim in the nineteenth century. He described it as ‘a voluntary act between individuals to live together’ (Rhein, 2002) and set the groundings

for various adaptations and operationalizations in different domains. A contemporary dictionary defines integration as the ‘establishment of closer interdependence between [...] members of a society’ (Robert and Rey, 2001). It highlights the setting up and maintenance of mutual links between two or more actors that are increasingly depending on each other through interaction and control (Gregory *et al.*, 2011).

When it comes to the integration of populated territories, or delimited spaces with inherent social structures, I consider the term ‘socio-spatial integration’, that is frequently used in the border studies literature. This research field offers a rich and stimulating theoretical framework, constructed around the European Union policy paradigm of cross-border integration and territorial cohesion (cf. Hardi & Uszkai, 2017; Durand, 2015; Decoville & Durand, 2018; Ruiz-Tagle, 2013). Even if various factors are taken into account in order to measure socio-spatial integration, there is a significant consensus in the academic literature that integration is a complex, multidimensional process (Van Houtum, 2000; Reitel, 2013; Hinfray, 2010; Durand, 2015; Ruiz-Tagle, 2013). De Boe, Grasland and Healy (1999) define socio-spatial integration as ‘a system of links [...] between territories which is the emerging result of concrete social, economic, and cultural relationships’. Integration is thus not only determined by flows between territories, but also by complex elements, such as social or cultural proximity, as well as a ‘willingness to co-operate’ (De Boe, Grasland and Healy, 1999).

I suggest to generalize this multidimensional conception of integration, so that it can be applied in different contexts and on different scales. Accordingly, socio-spatial integration refers to a process by which the differences, cleavages, fragmentations between two socio-spatial entities are reduced in order to tend towards the formation of a single new coherent and more homogeneous spatial entity, whose constituent parts are largely interdependent. Integration can be analysed from different and complementary points of view:

- the structural dissimilarities between territories,
- the density of flows between territories,
- the strategic cooperation efforts between stakeholders aiming at a common governance,
- the population’s identification with a unified territory.

I consider two areas as being socially and spatially integrated when their structural dissimilarities are minimized, links between actors from both areas are maximized, and their populations share one common territory through their spatial practices and perceptions. In the following parts of this paper, I aim to analyse socio-spatial integration from the perspective of indicator-based, structural dissimilarities and I also shed some light on the populations’ identification with the city.

2.2. Integrating knowledge districts into the city

In the present case, I focus on the socio-spatial integration of a newly-built knowledge district into its urban environment, which is a frequently discussed political objective (Duarte and Sabaté, 2013). High levels of integration between knowledge districts and other city neighbourhoods are seen as a prerequisite to unlock the expected positive dynamics of increasing visibility, capital attraction and economic growth (Yigitcanlar, Baum and Horton, 2007). Therefore, integration has become a necessary planning objective that enables positive effects in the long term and, in turn, legitimizes the massive financial investments put into a single neighbourhood. This rationale partly relies on the ‘knowledge-based urban development’ strategy supported by the European Union with the Lisbon Agenda in 2000, and followed by the Europe 2020 initiative (Bontje and Musterd, 2009).

Many scholars criticize, however, that the socio-spatial integration of these knowledge districts into their urban environment remains an unfulfilled objective. Most studies rely on the observation of high disparities between the populations’ socio-economic status or income levels. The active attraction of

intellectual upper- and middle-classes to a specific area is accused to result in the formation of an 'urban enclave' or an 'island of wealth' (Swyngedouw, Moulaert and Rodriguez, 2002; Madureira and Baeten, 2016). The Songdo district in Incheon (South Korea) is an extreme example of such a 'spatially disjointed, socially disconnected' area that remains completely isolated from existing urban structures (Van Winden *et al.*, 2010; Rugkhaman and Murray, 2019). The territorial inequalities become particularly strong when these knowledge districts are developed in formerly industrial areas, that have no ties to knowledge-related activities. In turn, this may lead to the marginalization of lower-income population groups and to an enhancement of socio-spatial inequalities (Moulaert, Salin and Werquin, 2001; Ponzini and Rossi, 2010). In this context, the socio-spatial integration into the local framework seems to be impossible for knowledge districts because their main focus relies on the attraction of external actors and partners, and not on the actual needs of local communities.

High social and economic dissimilarities between knowledge districts and their urban environment thus constitute a barrier for the politically expected socio-spatial integration process. However, the presented literature does not provide any empirical findings of significant dissimilarities that are grounded on a solid set of official data at neighbourhood level. In addition, it remains unclear how these dissimilarities can be characterized and by what factors they are caused. The major focus is put on the socio-economic status of the population, but other characteristics, such as the demographic structure, the nationalities, or the civic engagement of the populations, have not yet been addressed in this context.

3. Data and methods

The empirical analysis focuses on the case of the Belval knowledge district in Esch/Alzette and is based on a set of 21 indicators that have been composed by the use of data from various public sources. They are grouped into five categories:

- Sociodemographic indicators:
proportion of the population under 15 years of age (15LESS), between 15 and 39 (15TO39), between 40 and 64 (40TO64), and 65 and above (65PLUS); proportion of single-parent households (SINGLE-PARENT); household size (HOUSEHOLD-SIZE).
- Nationality-based indicators:
proportion of the two most represented nationalities; that is, Luxembourgers (LUX) and Portuguese (POR), as well as the groupings of other citizens from the European Union (EU) and from outside the EU (NOT-EU).
- Socio-economic indicators:
median income (INCOME); proportion of the population receiving the social inclusion income (MIN-SOC-BENEFIT); housing prices per square metre (selling prices of existing flats only) (FLATS-PRICES).
- Employment indicators:
proportion of the active population employed in the public administration sector (ADMIN); the construction sector (CONST); the finance and insurance sector (FINANCE); the professional, scientific and technical activities sector (PROF-SCIEN-TECH); the accommodation, food service, wholesale and retail sectors (ACCOM-FOOD-RETAIL); the human health and social work sector (HEALTH-SOCIAL).
- 'Identification to the city' indicators:
participation rate of foreigners in municipal elections (ELECTIONS); mean length of stay in the same dwelling (LENGTH-STAY).

The diversity of these indicators emphasizes the objective to cover different aspects of the neighbourhoods' characteristics and to avoid analysing integration from a single perspective. The above indicators have been submitted to a varimax-rotated principal component analysis (PCA), that summarized the main information provided by the indicators on a few continuous factors. Then, I used the scores for the different neighbourhoods to compute dissimilarity indices on every factor. To be more precise, for every pair of adjacent neighbourhoods, I calculated the absolute value of the differences between their PCA scores on the most important factors. This method allows us to connect the dissimilarity indices with the neighbourhood borders and to visually represent the dissimilarities on a map (Le Goix, 2005). This will eventually lead to a discussion about the possible existence of significant dissimilarities between Belval and the older neighbourhoods of the city.

4. Presentation of the case study

The Belval regeneration project in Esch/Alzette and Sanem was launched in the beginning of the twenty-first century as one of the most ambitious urban planning initiatives in Luxembourg. Today, the eastern part, located in the municipality of Esch/Alzette (Figure 1), constitutes the main site of the University of Luxembourg. Together with several research centres, specialized companies and a business incubator, it forms what I called the 'Belval knowledge district'.

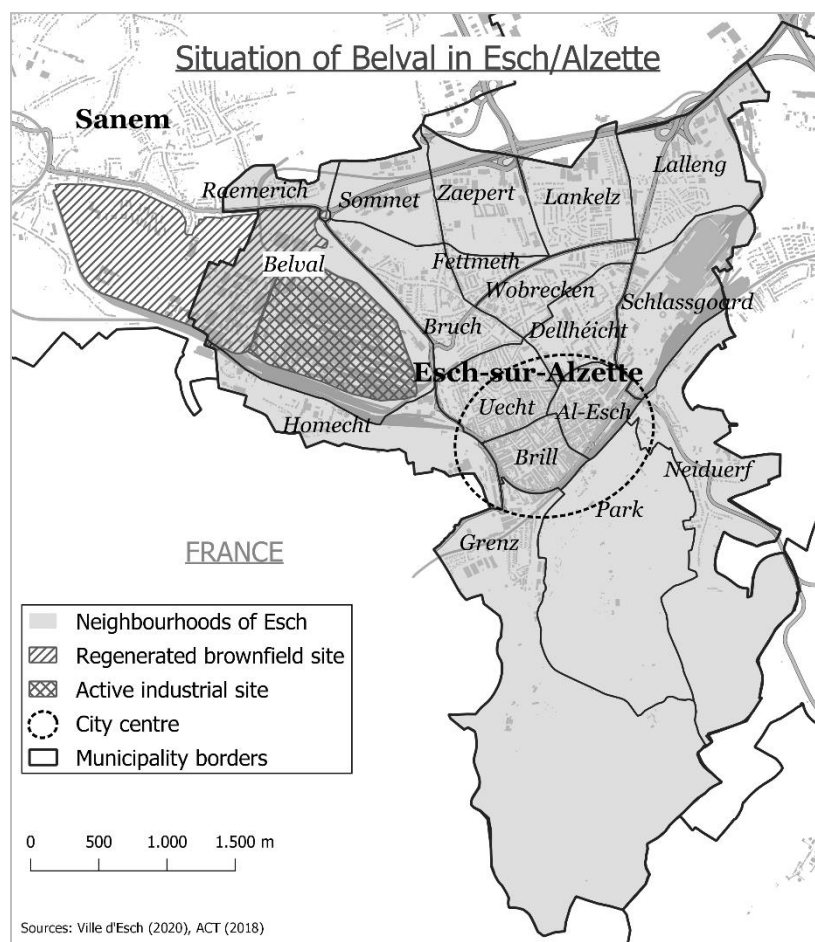


Figure 1 : The situation of the regenerated Belval site into the urban framework of Esch/Alzette.
Author: Joe Birsens, LISER, 2021.

The regeneration efforts in Belval need to be put into the national context of high population growth rates and a relative scarcity of available land for urban development. In order to create a new regional centrality and to boost the socio-economic regeneration of the postindustrial south of Luxembourg, the national government initiated the reinvestment of the Belval area and its reintegration into the urban framework (Knebel and Scuto, 2010; Becker and Hesse, 2013).

First empirical evaluations criticize questionable governance practices and lacking urban and social connections towards the local context (Leick, Hesse and Becker, 2020). The project is seen as an urban development 'island', that does not meet the current challenges of the local communities. With the aim to complete these findings, the present paper presents the first indicator-based evaluation of structural dissimilarities between the knowledge district and its urban environment.

5. A four-factor analysis of structural dissimilarities

Following the PC analysis, I chose to focus on the four major factors, that represent 85.6 per cent of the total variance. They can be characterized as follows:

- Factor 1: socio-economic status
- Factor 2: international and young professionals
- Factor 3: household composition
- Factor 4: employment status

The detail of the correlations between input variables and the four factors is presented in Table 1.

Table 1: Correlation of rotated factors and input variables

Variable	Factor 1	Factor 2	Factor 3	Factor 4
15LESS			0.926*	
15TO39		0.903*		
40TO64		-0.770*		
65PLUS		-0.707*		
LUX	0.653*	-0.667*		
POR	-0.853*			
EU		0.795*	-0.447	
NOT-EU		0.784*	-0.515	
SINGLE-PARENT		0.524		0.458
HOUSEHOLD-SIZE			0.878*	
FLATS-PRICES	0.857*			
INCOME	0.941*			
MIN-SOC-BENEFIT	-0.924*			
CONST	-0.797*			0.458
ACCOM-FOOD-RETAIL	-0.847*			
FINANCE	0.647*			-0.682*
PROF-SCIEN-TECH				-0.856*
ADMIN	0.783*			0.521
HEALTH-SOCIAL				0.788*
LENGTH-STAY		-0.934*		
ELECTION			0.687*	
eigenvalue	6.99	6.32	2.61	2.05
% of total variance	33.27	30.12	12.42	9.76

only significant values for $\alpha = 5\%$ * significant for $\alpha = 1\%$

In a first step, I suggest to examine the dissimilarities between neighbourhoods formed by the combination of the four major factors (Figure 2). It clearly shows very high dissimilarities on the borders of the Belval neighbourhood. However, it appears that they are not the only dissimilarities that are found in the city of Esch/Alzette; the map also shows an important contrast between Al-Esch and Dellhéicht, as well as between Brill and Homecht. Generally speaking, the borders of Belval and those of the city centre – Al Esch and Brill – form significant dissimilarities towards adjacent areas, while the contrasts within the city centre and within the pericentral neighbourhoods in the north are negligible.

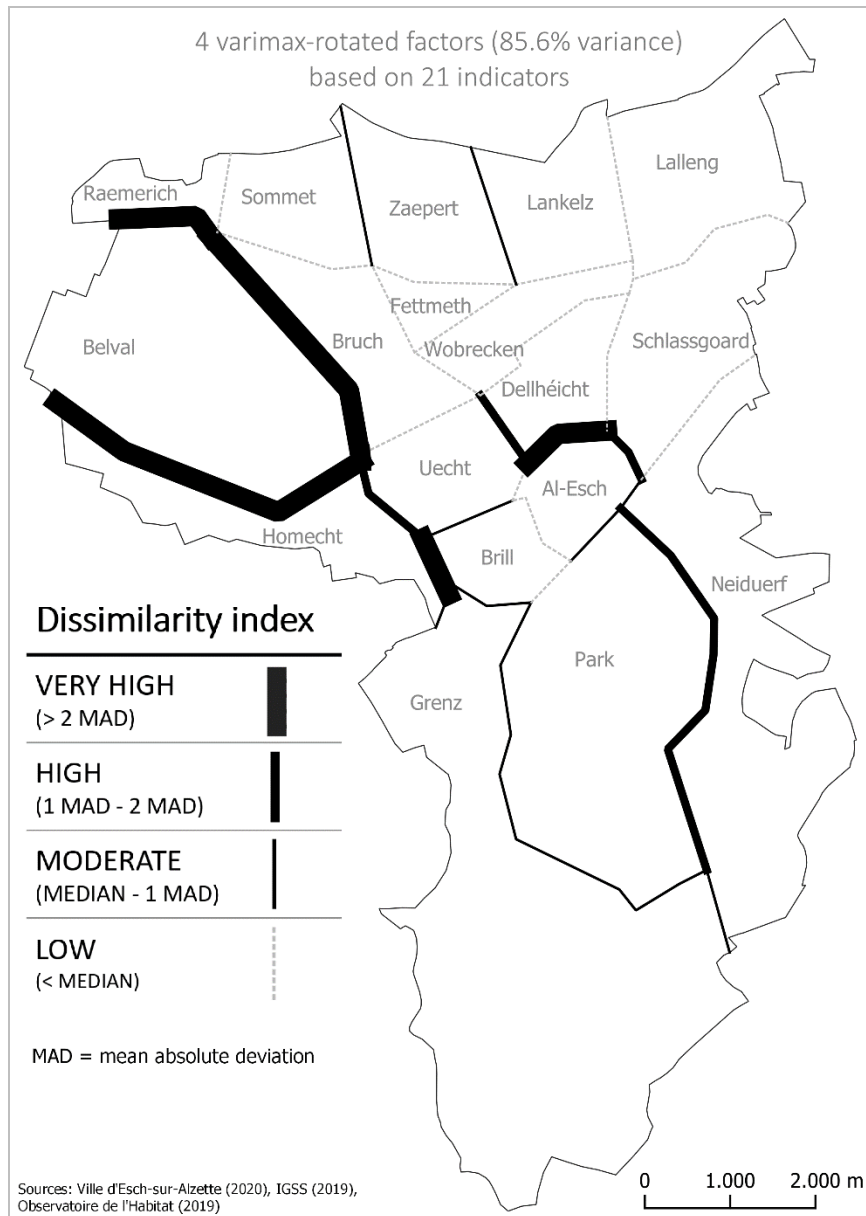


Figure 2 : Dissimilarities between neighbourhoods resulting from the combination of the four principal components. Author: Joe Birsens, LISER, 2021.

In the second part of this dissimilarity-based analysis, I suggest to break up the index and to analyse its constituent factors separately (Figure 3). This allows us to have a detailed overview on the underlying characteristics of the observed dissimilarities between Belval and the other neighbourhoods.

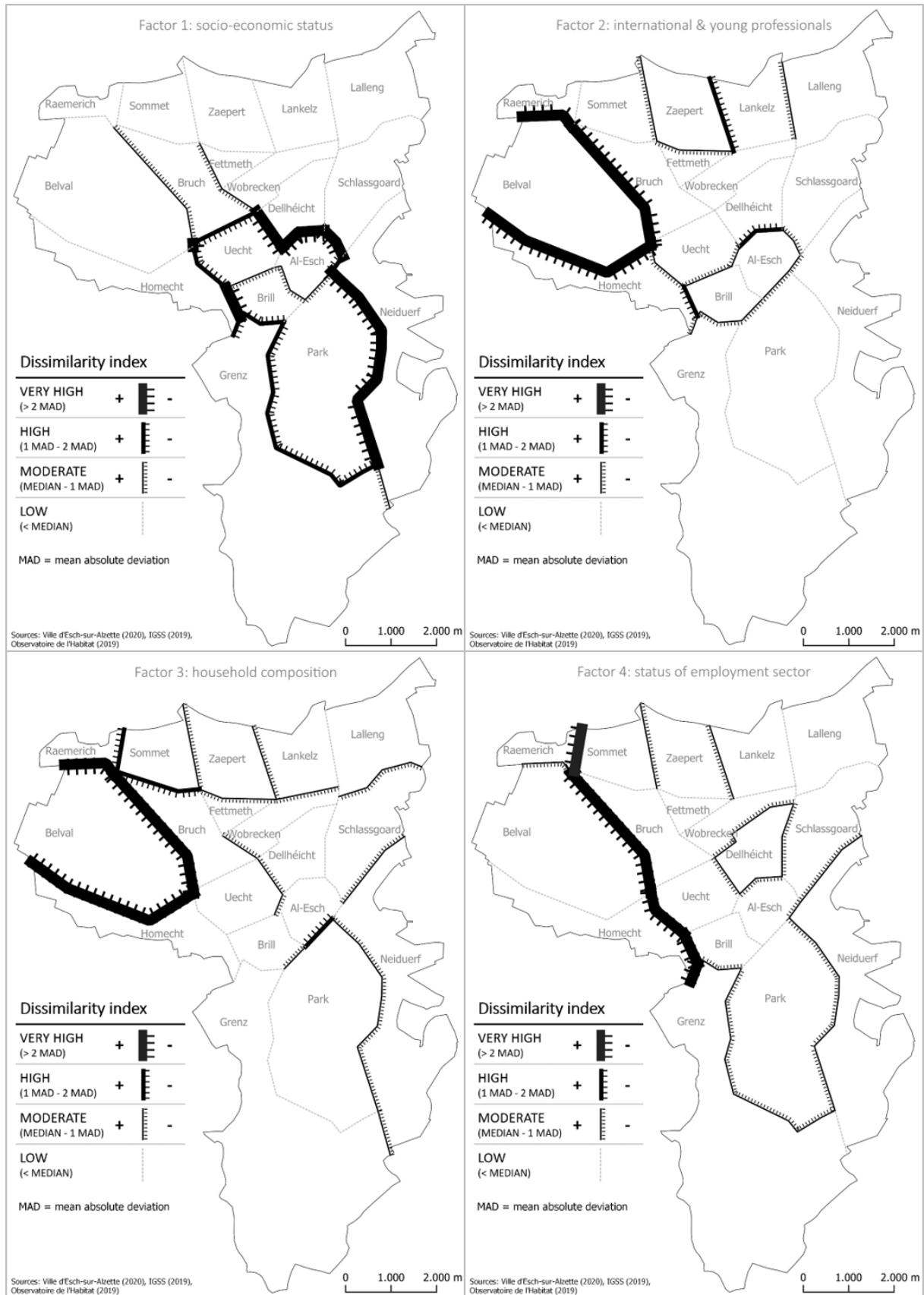


Figure 3 : The detail of the dissimilarity index on the four principal components. Thickness of the border indicates the level of dissimilarities. The 'teeth' are oriented towards areas of lower values for the different factors. Author: Joe Birsens, LISER, 2021.

On three out of the four maps relating to the principal components (Figure 3), the borders of the Belval neighbourhood are well represented. The most important dissimilarities are found on factor 2, which indicates highly significant contrasts in terms of international and young professionals. This underlines the fact that the knowledge district has been built to attract this population group and to foster their professional activities. Non-EU residents, young adults and employees in the specialized, scientific and technical activities sector are strongly overrepresented in Belval compared to the other neighbourhoods. Students and researchers cluster around the knowledge-related facilities and remain nearly absent in the rest of the city. This translates the recent character of the University of Luxembourg in Esch/Alzette and the fact that the post-industrial city did not have any relation to knowledge institutions before.

These significant disparities with all adjacent areas are also visible on factor 3, that is indirectly related to the population of students and young professionals. Factor 3 is mainly explained by the household type and size. In that sense, the Belval neighbourhood has been planned as a neighbourhood with an inner-urban character, including high-rise buildings and a housing stock that is exclusively composed of flats. Student residences are mostly small-sized single-room studios, which explains the low mean household size of 1.5 (compared to a city average of 2.4). On the other hand, in the 'older' neighbourhoods, there are much more families with children and with greater civic engagement – measured by participation rates in local elections. In fact, during the 2017 communal elections, only 10 per cent of the eligible foreigners¹ living in Belval exercised their right to vote. This percentage is more than twice as high in the rest of the city.

The most remarkable finding of the analysis is the absence of significant dissimilarities between Belval and the adjacent neighbourhoods on factor 1, the socio-economic status indicator. Here, the borders around the central neighbourhoods Al-Esch, Brill, Uecht and Park are overrepresented and thus indicate the existence of a socio-economic discontinuity between city centre and pericentral neighbourhoods. Contrary to my expectation and to previous findings, the Belval district does not stand out from the other neighbourhoods due to a significantly different socio-economic structure.

6. Refining the debate around the urban integration of knowledge districts

These findings contribute to the discussion about the socio-spatial integration of newly-built neighbourhoods into the city by adding some empirical nuances. As presented in section two, previous studies criticized urban regeneration projects for forming exclusive spaces for high-income elites of the population and thus contributing to socio-spatial fragmentation.

In general terms, the findings tend to confirm this statement. The development of the new Belval neighbourhood created a socio-spatial discontinuity in the urban framework of Esch/Alzette. It presents highly significant dissimilarities with the adjacent areas due to the very specific composition of its population. It does not seem to fit into the socio-spatial structure of Esch/Alzette, which can be interpreted as a low level of socio-spatial integration into the city, based on the presented data.

However, this paper calls for a distinction between the different constituent components of the observed dissimilarities. Most surprisingly, on the level of socio-economic status, Belval does not present any significant dissimilarities with its neighbouring areas. In fact, the highly visible contrast between a working-class city centre and wealthier pericentral areas are not related to the redevelopment of Belval, but have existed before. They result from a socio-spatial differentiation process initiated by the formation of an important middle class of mostly Luxembourgers and naturalized or well-rooted

¹ Only citizens that have been living for at least five years in Luxembourg can participate in communal elections.

foreigners that left the densely populated city centre in the mid-nineteenth century. Today, the newly-built knowledge district, with its population of students, academics and other professionals, does not greatly differ in terms of socio-economic wealth from other pericentral neighbourhoods of Esch/Alzette. For example, the population living in traditional high-status neighbourhoods, such as Dellhéicht or Wobrecken, present a higher average median income than people living in Belval.

The dissimilarities between the knowledge district and the other neighbourhoods result from the attraction of a young, international and professional population to Belval. This new social group in Esch/Alzette has supposedly a different lifestyle than more traditional population groups in other neighbourhoods. They mostly live in small households and stay only for a limited period at one place. They are underrepresented in local elections, either because they have not lived in Luxembourg long enough or because they choose not to vote. These elements question the identification of the Belval population with their city of residence and their feeling of being a citizen of Esch/Alzette. For the local and national decision-makers, this situation reveals enormous challenges that go far beyond the often mentioned socio-economic inequalities between population groups. In order to socially and spatially integrate the Belval neighbourhood and its population into the city – and also into the entire region – we should take into account the entire profile of these populations, their cultural background, their lifestyle, interests and values.

With regard to the existing scientific literature, I thus suggest to not automatically refer to ‘islands of wealth’ when discussing the development of knowledge districts. They may form ‘islands’ or ‘fragments’ when we take into account the professional profile, the age groups, the ethnic and cultural backgrounds, as well as the local civic engagement, but the Belval case shows that this is not always true in terms of socio-economic status or ‘wealth’.

6. Concluding remarks

The analysis of structural dissimilarities presents a novel tool to evaluate socio-spatial integration in the context of knowledge districts, or other types of urban development projects. It does not only focus on a single indicator, but takes into account a broad set of neighbourhood characteristics in order to analyse the situation in a more complete way. This method allows us to give more nuanced interpretations of the integration of newly-built districts into their urban environment.

Following these findings on the case of Belval in Esch/Alzette, I conclude that it is a simplistic and reductive view to interpret the level of socio-spatial integration of these districts into the city with a single indicator. It appears that the development of a knowledge district forms significant structural dissimilarities towards other neighbourhoods in terms of the demographic, cultural and professional profile of the population. In addition, disparities of household structure and civic engagement of the population are also observed. However, and against my expectations, dissimilarities of socio-economic status did not appear as a significant factor between the newly-built and the other neighbourhoods.

In section two, I presented socio-spatial integration as a multi-dimensional concept that can be approached by various perspectives. The present study thus constitutes one piece in the analytical framework of socio-spatial integration research and does not address every single dimension of the concept. The density of flows of people between two territories, the construction of cooperation networks between actors, as well as the people’s sense of belonging to a common territory also play an important role in the analysis of integration. In terms of the socio-spatial structure, we can conclude that integration between the knowledge district and its urban environment is at a rather low level. However, further studies taking into account other approaches need to be carried out in order to complete the analytical framework of socio-spatial integration.

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