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Socio spatial characterization of Large Housing Estates in the Metropolitan Area of Barcelona

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Abstract. Fifty years after the construction of Large Housing Estates in the periphery of the Barcelona urban continuum, public administrations face the need to redesign policies and tools aimed at improving living conditions in each of these specific areas. The need to improve the current living conditions of the housing stock according to habitability exigencies, maintenance and repair of building pathology, the improvement of energy efficiency and the research of a better social integration of their population, are some of the issues that call for being addressed when aiming to improve Large Housing Estates. The current research provides a socio spatial characterization of 20 study cases according to the evaluation of both socio demographic, socio economic and spatial indicators and their evolution along 5 time periods since their construction. Even if all study cases originally had many common characteristics, their very different evolution in time calls for a specific analysis of the current state of each area. Moreover, the characterization of the different evolution of the studied indicators on each specific case is a very useful tool to identify and describe past and ongoing complex social and urban processes. The applied methodology provides a detection of risk parameters, allowing to identify the most vulnerable cases in comparison with the analysed cases as well as the city average indicators. The transversal capacity of considering simultaneously social aspects as well as urban, architectonic and technological aspects, provides an integral view on the current state of Large Housing Estates in the Metropolitan Area of Barcelona. A result consisting of relevant information in order to design effective integral tools that refer to the particular social and physical contemporary conditions and ongoing processes on each site.

1. Introduction

Interventions of architectural, urban, technical improvement of Large Housing Estates in the Metropolitan Area of Barcelona has been object of debate over the past years [1], [2]. Nowadays, this particular sites provide both challenge and opportunity to develop sustainable processes in social and technical terms [3].

The current research is based on the hypothesis that sociological aspects need to be analysed simultaneously with urban, architectonic and technological aspects in order to obtain significant results that can provide tools in order to advance on the design of solutions and mechanisms to improve the past and ongoing degradation of Large Housing Estates.



2. Objectives

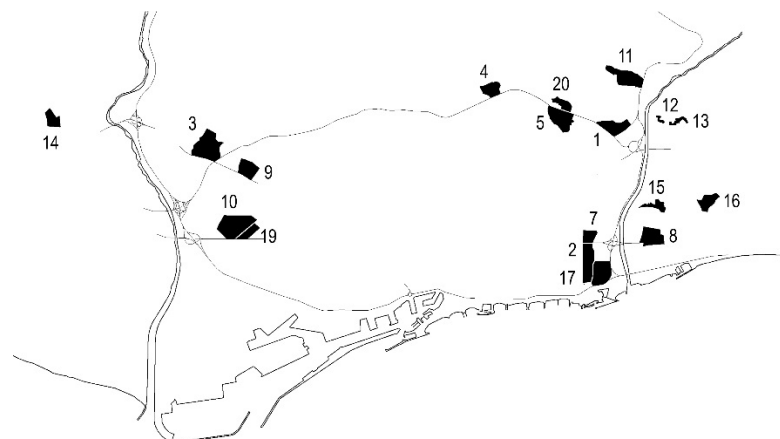
The transversal capacity of a research that focuses both in the social and technological fields and that considers the multi scalar condition of the object study, is based on the accomplishment of the following objectives:

- Production of a knowledge basis that can provide objective criteria for the decision making processes and the design of intervention policies on existing Large Housing Estates.
- Elaboration of an analytic methodology that can be applied to all Large Housing Estates in the Metropolitan Area of Barcelona and possible also in the rest of the Catalan territory that counts with similar geographic and climatic conditions (coast areas).
- Actualisation and evaluation of a sample of 20 Large Housing Estates according to both social and technical issues and in contrast with their evolution since the time of construction.

3. Methodology

The present research establishes a territorial and chronological delimitation of the object of study, in order to preselect a first sample of study cases. The analysed cases are located within the administrative limits of the Metropolitan Area of Barcelona and are described on census unit level. Besides, the selected cases were built between the year of approval of a mass housing construction plan in 1954 and the year of approval of the first Spanish obligatory norm regarding thermal insulation (NTE CT-79) in 1979.

According to the previous knowledge and expertise [4], 20 study cases were selected with the aim to include different municipalities and to cover a wide territorial distribution (Figure 1), as well as to include distinct relevant construction periods. Contextual and urban indicators expressed in Table 1 are the base for the geographic and social delimitation of the cases and for their further characterisation.



- | | |
|--|--|
| 1. Trinitat (Barcelona, 1954 - 1958) | 11. Ciutat Meridiana (Barcelona, 1965) |
| 2. Sud - Oest del Besòs (Barcelona, 1959-1967) | 12. Les Oliveres (Santa Coloma de Gramenet, 1966) |
| 3. Sant Ildefons (Cornellà de Llobregat, 1959-1974) | 13. Can Franquesa (Santa Coloma de Gramenet, 1966) |
| 4. Montbau (Barcelona, 1959-1971) | 14. Camps Blancs (Sant Boi de Llobregat, 1967-1968) |
| 5. La Guineueta (Barcelona, 1962-1964) | 15. Lloreda (Badalona, 1967-1977) |
| 6. Espronceda (Sabadell, 1962-1964) | 16. La Salut (Badalona, 1968-1969) |
| 7. La Pau (Barcelona, 1963-1974) | 17. La Mina (Sant Adrià de Besòs, 1969-1971) |
| 8. Sant Roc (Badalona 1963-1965) | 18. Can Badia (Ciutat Badia, 1971-1972) |
| 9. Can Serra (L'Hospitalet de Llobregat, 1964-1972) | 19. El Gornal (L'Hospitalet de Llobregat, 1972-1976) |
| 10. Bellvitge (L'Hospitalet de Llobregat, 1964-1976) | 20. Canyelles (Barcelona, 1973-1974) |

Figure 1. Sample of 20 study cases in the Metropolitan Area of Barcelona

Table 1. Contextual urban indicators.

I.O. Contextual indicators (physical environment and population)	I.O.1 Geographical delimitation	Census units
	I.O.2 Resident population	Total resident population in the housing estate
	I.O.3 Territorial situation and urban location	Map of the location in the Metropolitan Area of Barcelona
		Plan of the housing estat
	I.O.3 Morphology and building typologies (main types)	Number of floors
		Number of dwellings / staircase
		Interior dwelling surface
		Scheme of urban morphology of the most representative typology (plan - section) 1:500
		Plan of the main typology 1:200

The applied methodology on the 20 study cases is based on the following phases:

- Elaboration of a database of indicators based on three research axes: socio demographic, socio economic and socio spatial.
- Compilation of data for five analysed time periods based on the Census and Municipal Registers:
- Description of the different evolution of the studied indicators and radiography of the current state of each study case.
- Comparative study of the 20 study cases in contrast with the average values of the studied indicators in each municipality.
- Detection of limit values according to the comparative study, in order to remark extreme situations and detect the most singular cases.
- Elaboration of a socio spatial vulnerability index according to the analysed indicators that provide evidence of social or technical deterioration risk and thus, higher need for improvement.

The database provided in the present research is elaborated through an extensive work with bibliographic [5-8] and digital data sources [9-11].

4. Results and discussion

In order to characterize and evaluate the study cases according to their evolution, current state and vulnerability it is fundamental to consider simultaneously the socio demographic, socio economic, and socio spatial dimensions that affect housing estates' social and technical improvement or regression processes. The results derived from the application of the previously exposed methodology to analysed sample are presented in this section according to this order.

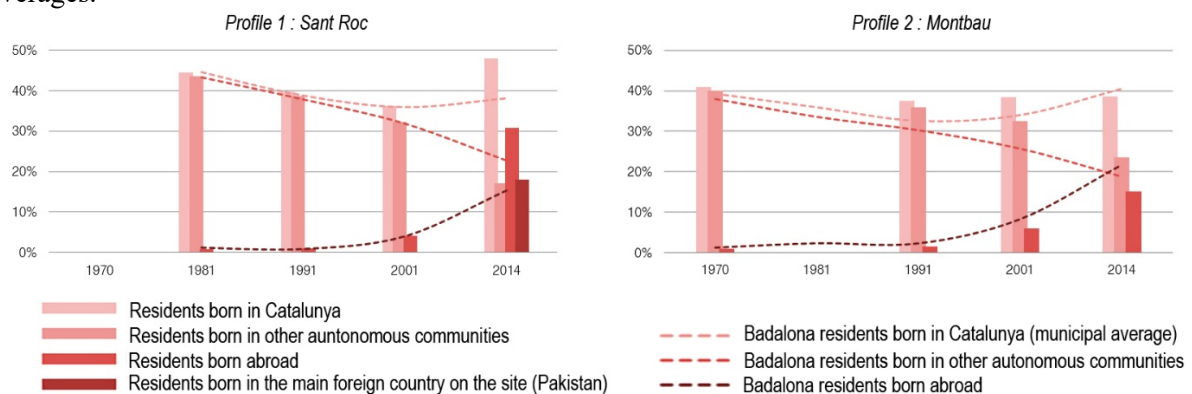
4.1. Socio demographic and socio economic characterization

Socio demographic and socio economic characterization describe the evolution and current state of several indicators that refer to resident population as well as the management of existing residential stock. The analysed indicators are listed in Table 2.

Table 2. Socio demographic and socio economic indicators

I.1 Sociodemographic indicators	I.1.1 Immigration and origin	Born in other autonomous communities
		Born abroad
		Born in a specific foreign country (representative nationality among all)
	I.1.2 Age groups	Children (0-4 years)
		Young population (5-24 years)
		Population of 25-34 years
		Population of 35-44 years
		Population of 45-64 years
		Elderly population (over 65 years)
		Population of very advanced age (over 75)
I.2 Socioeconomic indicators	I.2.1 Professional situation of the population	Inactive population
		Student population
		Active population
		Occupied population
		Professional workers sector
		Unemployed population
	I.2.2 Dwelling occupation types	Primary dwelling - occupied
		Secondary dwellings
		Empty dwellings
	I.2.3 Tenure regime	Owned and paid dwelling
		Owned and paying homes (mortgages)
		Property dwelling owned by inheritance
		Property dwelling owned by donation

The observation of the evolution of indicators results in different neighbourhood. In the specific case of the Immigration and origin indicators (Figure 2), the present study establishes two profiles. In the first one, neighbourhoods like Sant Roc have welcomed a greater flux of immigration in contrast with the municipality and increasingly over the studied periods. In opposition, other cases such as Montbau have barely experienced the arrival of immigrant population, a proportion below municipal averages.

**Figure 2.** Two neighbourhood profiles according to immigration processes

Regarding socio economic indicators, through observation, for example, of Dwelling tenure between 1991 and 2011 (Figure 3) we distinguish two profiles. In cases like Canyelles the proportion of Owned and paid dwelling increases over time. In contrast, in cases like Les Oliveres this proportion decreases very significantly in turn of an increase in owned and paying dwelling (mortgages). Housing estates that belong to the second group have experienced resident population substitution processes, and in some cases the high proportion of owned and paying dwellings is an indicator of high economic risk taking into account the drastic effects on neighbourhoods after the economic crisis in 2007.

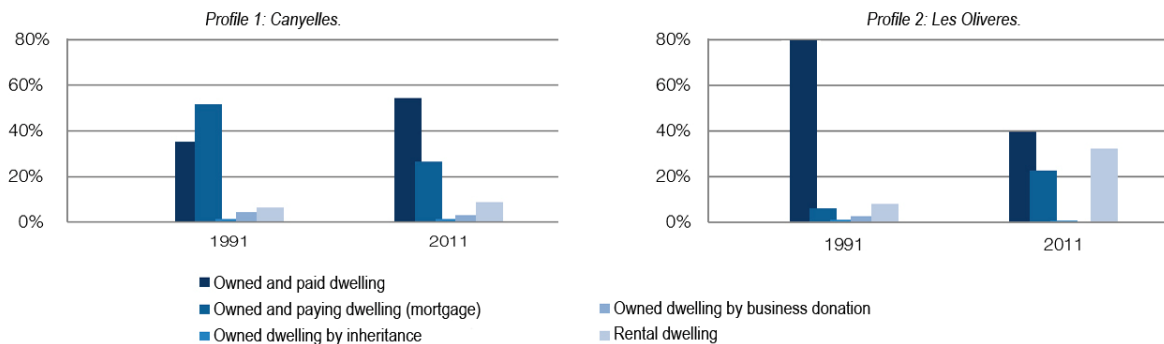


Figure 3. Two neighbourhood profiles according to the evolution of dwelling tenure

4.2. Socio spatial characterization

Socio spatial characterization describes the evolution and current state of several indicators that refer to the spatial conditions of the building stock in contrast with its occupation and population density. Analysed indicators are listed in Table 3.

Table 3. Socio spatial indicators.

I.3 Sociospatial indicators	I.3.1 Family patterns Kind of family/ dwelling	Single-core family
		Single-core family and other related people
		Family with two or three cores
		Family with other unrelated people
		Two or more families
	I.3.1 Family patterns Number of people/ dwelling	Two people
		Three people
		Four people
		Five people
		Six or more people
	I.3.2 Density of occupation	Number of people/ dwelling
		Number of people/ access
	I.3.3 Living area per person	m ² / occupant
		m ² / number of children

Socio spatial indicators provide a measure of the adequacy of living conditions according to the nowadays very different types of occupancy. While the interior dwelling surfaces are in general very homogeneous among each housing estate and even among the whole, the family patterns and the number of people per dwelling differs significantly from the time of conception of housing estates. The analysis of existing dwelling typologies (Figure 4) and study of the most representative in each estate (Figure 5) provides data that can be crossed with density, number of occupants and family patterns.

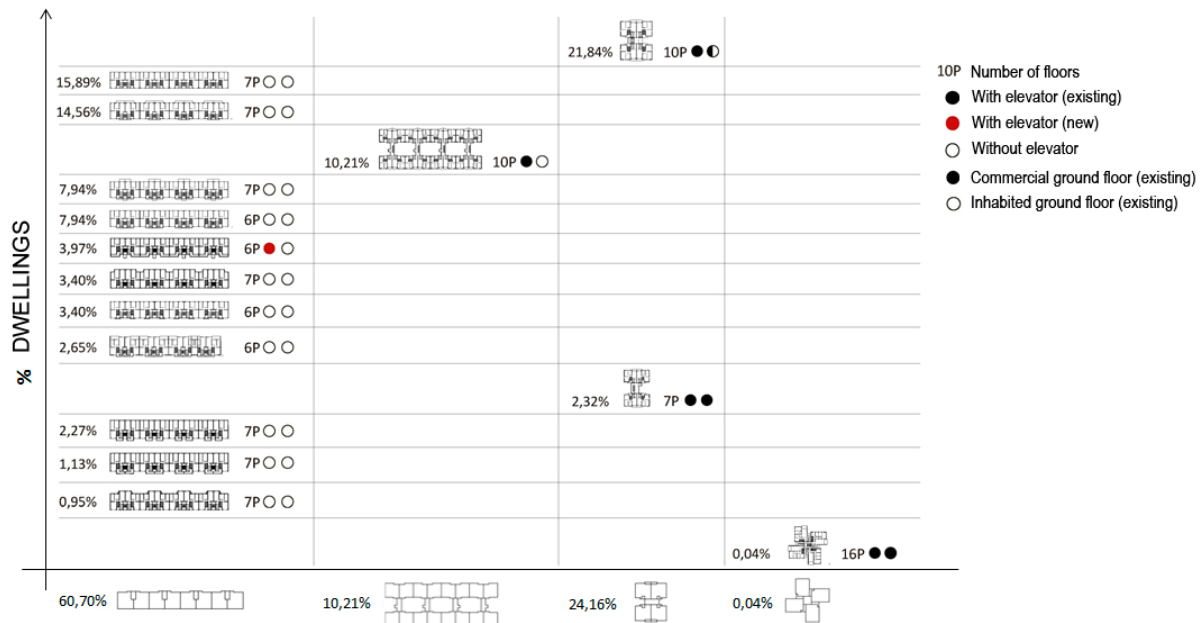


Figure 4. Spatial characterization according to the most representative building types



Figure 5. Dwelling surfaces and typologies of the most representative building types

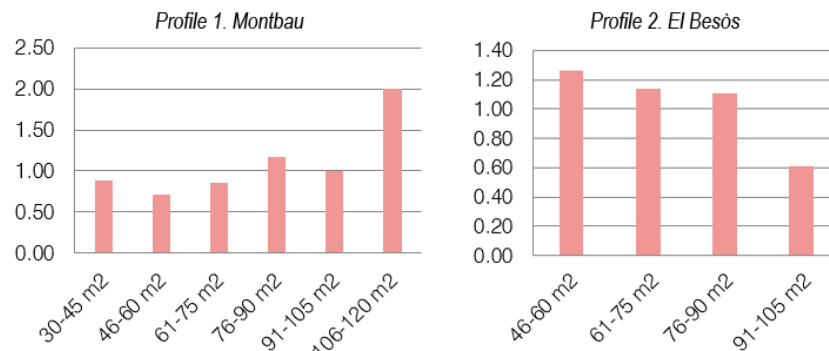


Figure 6. Profiles of occupation according to surface and number of occupants

As expressed in Figure 6, also different neighbourhood profiles are provided by the socio spatial characterization. In Profile 1, the number of occupants increases coherently with the dwelling surfaces, while in Profile 2, more occupants live in dwellings of smaller surface. In cases included in Profile 2 population with less resources live in small dwellings where the existence of situations of over occupancy of dwellings is common.

4.3. Comparative study

Results from the comparative study between the current state of 20 study cases in contrast with municipal average values provide valuable information regarding the existence of extreme values and quite significant differences among the profiles of each study case.

Figure 7 and Figure 8 exemplify the existence of extreme cases in two of the analysed parameters nowadays, as well as the very significant differences among the twenty study cases. The variation of values in comparison to the average of the twenty housing estates and the municipal average is important.

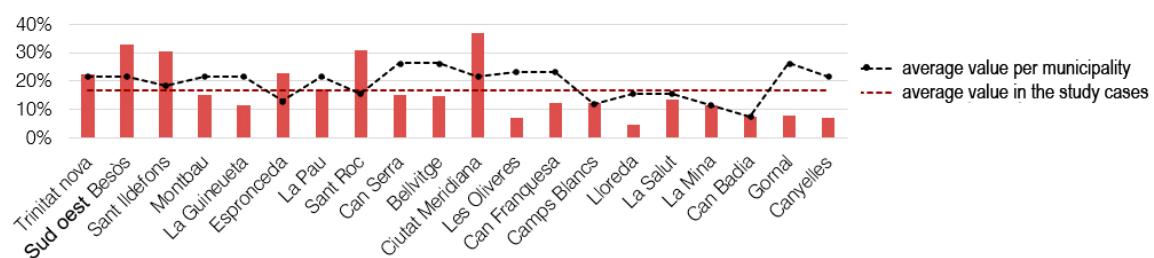


Figure 7. Comparative study regarding the percentage of immigrant residents

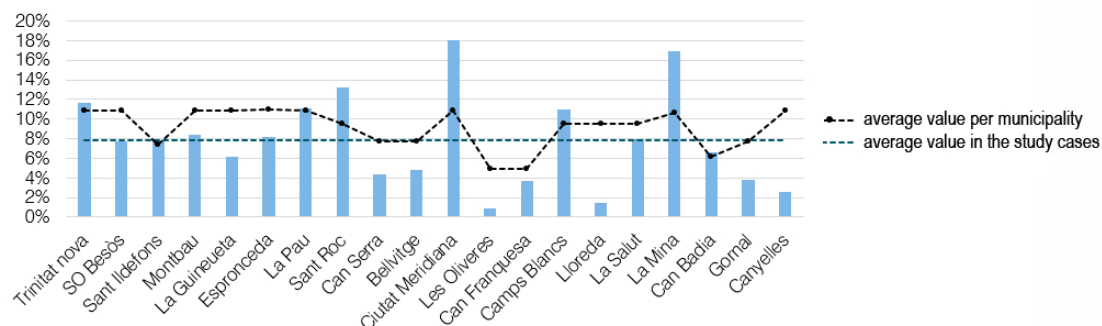


Figure 8. Comparative study regarding the percentage of empty dwellings

4.4. Evaluation of vulnerability

Results obtained from the characterization of cases according to the three research axes as well as the comparative study provide tools in order to evaluate objectively the current index of socio spatial vulnerability of the 20 study cases.

The final result of the study is shaped in a multivariable matrix that is structured according to the sum of determinant indicators pondered according to the intensity in which values differ from municipal and large housing estate's averages. A systematization of the analysis of each indicator that provides a measure of vulnerability for each of the study cases (Figure 9).

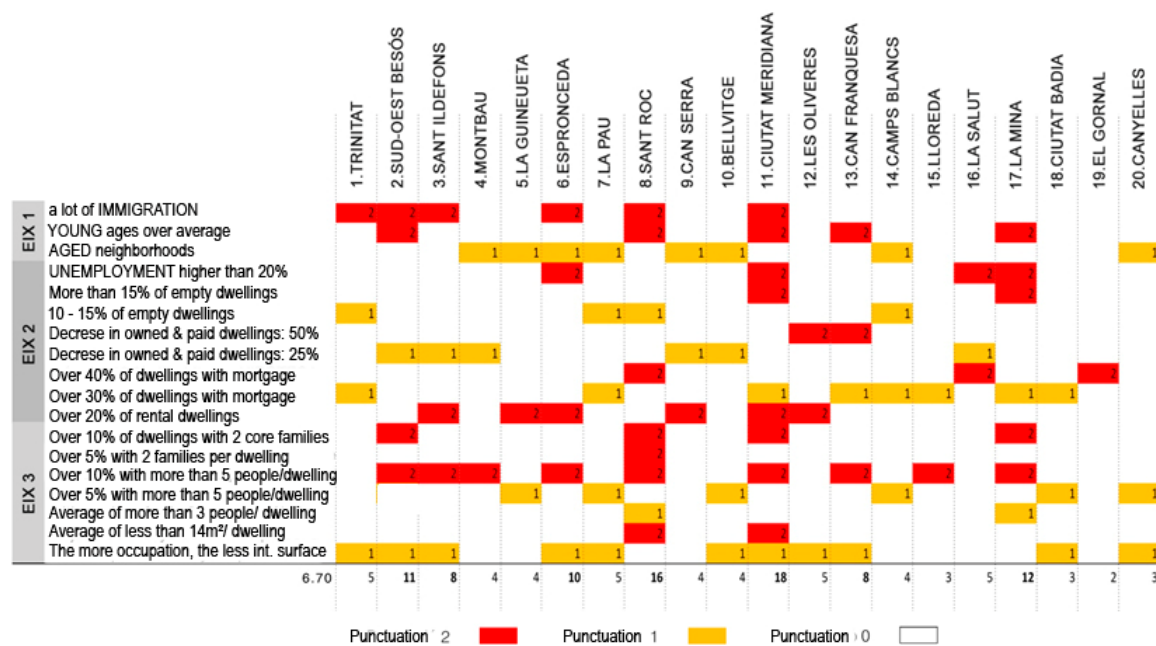


Figure 9. Multivariable matrix and measure of vulnerability

The average value is established in 6,70, being 18 the maximum value defining an extreme vulnerability in the location of Ciutat Meridiana. In contrast, el Gornal housing estate obtains the minimum value of 2. The variability between those two extreme cases is significant.

Listed in a descending order regarding vulnerability values, the studied that overpass the vulnerability average of 6,70 are: Ciutat Meridiana (18), Sant Roc (16), La Mina (12), Sud-oest del Besòs (11), Espronceda (10), Sant Ildefons (8) and Can Franquesa (8). The high punctuation of the first two, almost three times the average, contrasts with the following two cases that closely duplicate it and the final three that are slightly punctuated above.

While only seven cases are punctuated over the average, almost the double of cases obtain a punctuation under the average, some of them being significantly lower. It is the case of El Gornal (2), Canyelles (3), Ciutat Badia (3), Lloreda (3), Camps Blancs (4), Bellvitge (4), Can Serra (4), La Guineueta (4), and Montbau (4). The last four cases are also punctuated above average but less significantly: Trinitat (5), La Pau (5), Les Oliveres (5), and La Salut (5).

The results from the present approach to the measure of vulnerability are mapped and highlighted with a colour code in Figure 10.



Figure 10. Map of vulnerability in Large Housing Estates of the Metropolitan Area of Barcelona

5. Conclusions

A first characterization of the evolution and current state of a representative sample of housing estates in the Metropolitan Area of Barcelona, based on the systematization of multivariable data from different time periods and on different research axes provides a wider understanding of the different evolution, phases and processes that have shaped the current state of this twenty originally very similar urban areas.

The very distinct neighbourhood profiles obtained from the socio demographic, socio economic and socio spatial characterization can provide further research with useful tools in order to frame the characteristics of other large housing estates in Catalonia. The observation of different evolution profiles among multivariable indicators provides a useful tool to identify and prevent degradation risks both in social and urban terms. Also, the elaboration of a methodology proposal for the comparison and establishment of limit and average values provides helpful flexible tools in order to foster further evaluation and actualisation of the analysed indicators according to possible changing future processes.

The mapping of results into a cartography including the twenty case studies provides a visual useful tool in order to identify areas of higher risk. The very different current condition of each neighbourhood has its translation on the territory, where very distinct measures of socio spatial vulnerability coexist in geographically close locations. Nevertheless, it is possible to affirm that most vulnerable cases, including the three most severe situations, are located along the river Besòs axes, in a broader area where urban vulnerability is a matter of preoccupation [12], [13].

A methodology for the measurement of socio spatial vulnerability based on a multivariable analysis that focuses both on social and urban aspects provides a first approach to evaluate the situation of large housing estates in the Metropolitan Area of Barcelona, independently from other urban tissues and in within the framework of those urban neighbourhoods that were originally conceived similarly regarding both urban and social issues.

In general terms, large housing estates have evolved in a very different manner and consequently their current situation and measure of vulnerability is very variable among cases. While some neighbourhoods present extreme values regarding some risk indicators, others turn out to be positively ranked quite under the municipal average.

Finally, it is clearly observed that the originally homogeneous morphological urban, architectural and social condition of large housing estates in the Metropolitan Area of Barcelona does no longer determine their characterisation. The difference of profiles and vulnerability measures among the twenty studied cases illustrates their distinction from urban homogeneous pieces. Hence, the current

problematic of some large housing estates has stronger links with the immediately neighbouring residential tissue and its urban location in relation with global city processes.

Acknowledgments

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