

Smarter city, less just destination? Mobilities and social gaps in Barcelona

Mobilities and
social gaps in
Barcelona

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Received 3 March 2022
Revised 23 August 2022
21 November 2022
Accepted 29 November 2022

Abstract

Purpose – The purpose of this paper is to introduce a critical framework to analyse how “smart” plays out in tourism places. Moving from a recognition of the strategies, expected impacts and imageries of Smart City, the authors engage with the mobilities literature to identify pitfalls in the quest of “smartening up” cities for hypermobile populations.

Design/methodology/approach – The study adopted a set of geoanalytical techniques to establish the potential relationship between the territorial upgrade of mobility and the socio-economic change processes the city of Barcelona is experiencing.

Findings – The paper suggests the effect of “smart” in cities could indeed be one of economic recovery; however, one triggering fundamental transformation of the social fabric of the city, whose most evident facet is the creation of globalised functional enclaves that may be forcefields of exclusion for the most vulnerable populations.

Originality/value – This paper contributes to a new stream of critical research on “smart” with a strong focus on the power of mobilities and mobility systems, whose digital enhancement plays out as a leveraging agent of new place connections and negotiations for short-term populations, but at the same time, may exclude disadvantaged subjects in their capacity to access and afford the system network.

Keywords Smart cities, Tourism mobilities, Agency, Mobility injustice, Socio-demographic change

Paper type Research paper

1. Introduction

This paper aims to deconstruct how “smart” plays out in tourism places. We first introduce an analytic framework grounded in the mobilities literature, nuancing smart cities as a sociotechnical regime. Then, we present some empirical insights of the potential divergence between smart city ambitions and actually realised place and population restructuring processes in Barcelona, Spain, a very successful destination and a celebrated case of smart urbanism, which, nevertheless, suggests that the wicked problem of social inequalities and geographies of disadvantage could be reproduced through such gains.

A main concern of this paper is indeed that the widespread gains achieved by the introduction of information and communications technology (ICT) as “enabling” technologies for navigating the tourist city, which evoke an ideal of emancipation and



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Funding: Funding from the EU's programme HORIZON 2020 under the Grant Agreement no. 870753, and the Spanish Ministry of Science and Innovation (contract number PID2020-112525RB-I00).

Journal of Place Management and
Development
Vol. 16 No. 2, 2023
pp. 291-308
Emerald Publishing Limited
1753-8335
DOI [10.1108/JPM-03-2022-0020](https://doi.org/10.1108/JPM-03-2022-0020)

democratisation of travel, may have unsettled the position of specific collectives in the contest for resources at destinations, and in particular of vulnerable citizens. Urban destinations may be becoming “smarter”, but it is still to a large extent to be proved how this represents an overall improvement for resident communities (Barr *et al.*, 2021). To contrast this hypothesis, we examine how the “smartening up” of a global tourist destination like Barcelona could be indeed associated with processes of social change. Thus, we analyse the geographical deployment of smart mobility initiatives against data that reveal socio-spatial processes of exclusion, such as the distribution of income, the socio-demographic transformation of neighbourhood and the affordability of access to ICT and mobility services and infrastructure. These factors could provide a non-exhaustive insight into the social reconfiguration of neighbourhoods that showcase a high profile in terms of mobile dwelling, but where the breach between “sedentary” residents and their hypermobile counterparts whose lifestyle and practices such systems support is getting wider.

The structure of the paper is as follows. Section 2 frames our research approach in the literature on mobility inequality and contextualises on our case study, the city of Barcelona. Section 3 presents our methodology and research design, based on geostatistical techniques with a focus on demographic and spatial data. Section 4 presents our analysis of socio-spatial trends *vis-à-vis* with the geography of implementation of smart mobility services in recent years. This section includes the results of the geospatial analysis and the time evolution of indicators, and a preliminary discussion of our findings. In Section 5, we conclude and argue for a new research and policy agenda on urban resilience that takes the agency of technology seriously.

2. Unequal geographies of mobility: methodological challenges and selection of case study

As evoked by foundational notions of the Smart City, the digital enhancements of mobility systems and services – frequently part and parcel of Smart City initiatives – should allow citizens and other city users to move faster, cleaner and in a more organised way, thus, enhancing the social and economic climate of cities while at the same time reducing the environmental footprint of the multiple flows of people, vehicle and goods that are ingrained to contemporary forms of economic development. The abrupt disruption and sanctioning of circulation in pandemic times (at least as far as the movements of people to and at places is concerned) has, if anything, underscored the value of smart mobility systems to make societies and local economic systems more resilient and adaptable to sudden changes (Gretzel *et al.*, 2020; Sharifi *et al.*, 2021). Many cities bought into this imagery and launched in ambitious development programs, often partnering with large technological companies and getting involved in collaboration networks and international initiatives that support such endeavours. However, the degree of success in the construction of the Smart City, reflected by international rankings and a lot of self-promotion, tends not to involve a comprehensive evaluation of the gains achieved by local communities (Ivars-Baidal *et al.*, 2021).

Thus, authors like Vanolo (2014), Söderström *et al.* (2014) or Kitchin (2015) have variously invited to scrutinise critically and deconstruct the rhetoric of the Smart City, bringing out its agencies and the mechanisms (discursive as well as operational) through which such development programs fathom new sociotechnical regimes. A progressive or “real” Smart City, as advocated by Hollands (2008), should arguably avoid corporate entrenchments and technological lock-ins and stand instead on the promotion of a more democratic vision of welfare for all, tackling, for instance, the social biases that make the uptake of new technologies largely uneven across society.

From this point of view, following the literature that ascribes to the mobility turn (Urry, 2007; Sheller and Urry, 2004; Hannam *et al.*, 2006; Cresswell, 2010), *smart mobility systems*

should be conceived as a device of empowerment with fundamental implications for the constant struggle through which people, goods and capital on the move negotiate places in which they moor and produce space. In other words, smart places, constituted relationally through differently empowered mobile agents, may reproduce and possibly amplify social inequalities.

A critical approach to the examination of the planning and consumption of technology linked directly and indirectly to human movement does not merely address novel forms of travel and transportation but questions fundamentally movement capacities and their social stratifications (Manderscheid, 2009), and relatedly, as suggested by authors such as Ohnmacht *et al.* (2009) or Soja (2013), access to capital in all its aspects. In other words, if social relations, capital or resources nuance specific spatialities, then access to – or appropriation of – such capital rests on mobilities, which, in turn, require the disposition of certain resources, such as economic capital, and the necessary knowledge, capacities and skills (Cass *et al.*, 2005).

These processes have been mostly investigated in the literature under the category of “studies on transport poverty”, tackling the social in/exclusion effects deriving from the affordability of transport costs (Currie and Delbosc, 2010; Gleeson and Randolph, 2002; Lucas *et al.*, 2016). Much of this research focuses on comparing measures of transport disadvantage with measures of deprivation or exclusion, contrasting the context of inner cities and urban peripheries (Church *et al.*, 2000; Delbosc and Currie, 2011). At the same time, this field of research is advancing together with research on innovation in mobility, examining the ways in which transport poverty is reproduced within the emergence of “smart” and interconnected mobility services (Goodman and Cheshire, 2014; Tyndall, 2017; Groth, 2019). In this regard, digital enhancements in systems of promotion, communication, prescription, regulation and management of tourism have generally been a fundamental dimension of “smart city” programs and are expected to become more intensive and widely diffused in the post-COVID scenario towards a rapid recovery of tourism mobility systems. ICT can also be conceived in itself as network capital: digital technologies transport (knowledge, capital), connect, enable and anchor other (physical) mobilities, they order social spaces (for instance, through age, skills or connectivity divides) and they travel themselves – as product, political project or system. Hence, framing our understanding of a Smart City through a mobilities approach goes some way towards problematising the agency of ICT in relation to social exclusion.

Focusing only on the realm of smart tourist places or smart destinations (henceforth: SD), involving the management of tourists, tourism mobilities and supply systems, Table 1 presents an outline of different domains of SD, specific projects and initiatives in the top five Spanish Smart Cities (Achaerandio *et al.*, 2011) that could be related to them, the agents involved and the expected outcomes from their adoption, also highlighting the adverse effects these could have on social inclusion. It should be noted that some of these initiatives are not necessarily implemented as part of broader Smart City strategies or fall outside of the initiative of local administrations; nevertheless, city or regional governments may provide an “enabling environment”, for instance, adapting regulation frameworks and legal barriers or providing the necessary digital infrastructure. This table clarifies that Smart City programs, especially in contexts in which the user populations are bent on visitors, and the tourism industry has a key agenda-setting role in the actual implementation of the SD, could have unsettling effects on local communities.

As for the case study context of this specific paper, Barcelona offers a convenient focus for our analysis. Firstly, as one of the most important global destinations, it may well be one of the first on which the nexus between tourism development and social inclusion, especially

Table 1.
Domains and
initiatives of smart
destinations involved
agents and expected
effects

Domains of “Smart Destination”	Agents	Systems (Example)	Effects on visitors’ experience and satisfaction	Potential effects for citizens inclusion/destination cohesion	
				Positive	Negative
Smart mobility	Public and PP transit providers’ Transport companies, Parking managers	Flexible routing of public transport according to user demand	Facilitated use of public transport for visitors	Diminished use of public cars by visitors, reduced queues, better internal accessibility	Increased visitor pressure on public transport system in core “tourist areas”
		Road and access pricing schemes for non-resident vehicles	De-crowding of access roads, easiest circulation	Controlled traffic, revenue to be reinvested in infrastructure and service improvement	Non-tourist commuters affected, especially workers to central tourist facilities
		Public bike rental systems	Availability of cheap bikes to visitors, better mobility experience	Increased use of non-contaminating transport	Heavy tourist occupation of bike lanes and infrastructure used by workers
		Parking space locator services	Easier and faster parking	More ordered traffic, revenue from parking use	Increased substitution of private resident parking with visitor parking
Tourist information and management systems	DMOs, attraction managers, planning authorities	User-activated personalised recommendations	Increased accessibility of visitor attractions, more time-efficient and tailored visits	More dispersed visitor pressure, promotion of a wider set of attractions	Increased visitor pressure in residential neighbourhoods, everyday spaces
		Immersive experiences at heritage sites	Increased comprehensibility of heritage, events, etc.	Better capacity of promotion of intangibles, more time/money spent at sites	Capacity of representation out of the hands of citizens
		Crowd control and re-direction systems	Diminished risks from overcrowding, increased safety against robbery or terrorist attacks	Reduced risks, abatement of incidents and related costs, more efficient surveillance	Privacy infringements to vulnerable collectives

(continued)

Domains of “Smart Destination”	Agents	Systems (Example)	Effects on visitors’ experience and satisfaction	Potential effects for citizens inclusion/destination cohesion	
				Positive	Negative
Sharing platforms	Corporate p2p platforms, private providers	“Collaborative” transport (Uber, etc.)	Increased accessibility and security of private transport, cheaper taxis	Increased capacity of the taxi system	More and unregulated cabs on the streets, aggravation of precarious labour
		Hospitality platforms (Airbnb, etc.)	Increased stock of accommodation, better adaptation to demand, better services to families	Flexible expansion of accommodation stock, promotion of “community identity”, revenue to citizens at risk of exclusion	Airbnb’s effects on labour and real estate market
		Free tours and visitor experiences	Opportunities for personalised visits	Promotion and valorisation of personal knowledge	Casualisation of labour, de-professionalisation of guides
Note: PP: Public-private Source: Own elaboration					

Table 1.

in larger cities, has become a matter of controversy, especially after the 2008 financial crisis (Russo and Scarnato, 2018). Secondly, Barcelona is one of the Spanish destinations that, for at least two decades, has counted on specific national policy frameworks articulated at regional and local levels to foster innovation and “smartness” in tourism.

The Catalan city is one of the most important tourist destinations in Europe and a celebrated case of urban regeneration and reimagining. Since 2012, this regeneration has included the implementation of a Strategic Plan to turn Barcelona into the first Smart City in Spain, both in terms of the implementation of initiatives within the fundamental axes, *smart economy*, *smart people*, *smart governance*, *smart mobility*, *smart environment*, *smart living* and in terms of technological innovation in the tourism sector, making of Barcelona a celebrated success story in Smart City development (European Commission, 2014). This initiative required the municipal government to promote the development of technological systems that would enhance the sector’s competitiveness, enabling an adaptation to the new global demand, not only in terms of infrastructure (“smarter” accommodation and attractions) but also to support new modes of physical and cognitive navigation of the city. These services, thus, result fundamental for all urban dwellers who are “on the move” in the city, serving as connectors between global flows and local anchorings and accommodating the practices of mobile collectives such as tourists, temporary dwellers, “mobile” cosmopolitan residents (Russo and Quaglieri Domínguez, 2012). The objective of the analysis is to examine the extent to which such services promote urban cohesion in Barcelona or are rather ingrained in the reproduction of social inequality.

Barcelona is an exemplary test case to look at a tourist destination in which “tourismification” brings into the picture a shift in its social ecology (López-Gay *et al.*, 2019; Sequera and Nofre, 2018), driven by the inflation of housing rents (García-López *et al.*, 2020), changes in the use of public space (Cocola Gant and Palou Rubio, 2015; Brandajs and Russo, 2019) and fundamental alterations of the activity rhythms (Rouleau, 2017; Nofre *et al.*, 2018). All this conjures to challenge the comfort and the affordability of incumbent populations, triggering resentment and exclusion, but also changing fundamentally the socio-economic environment of the city, producing socio-spatial polarisation. The case of Barcelona also presents a Smart City in construction, with a strong focus on the digital enhancement of mobility systems (Achaerandio *et al.*, 2011), a leveraging agent of those that we can define “hypermobilities”, but at the same time, a potential factor of exclusion for disadvantaged subjects in their capacity to access and afford the system network.

3. Methodology and data sources

Our critical mapping of “Smart Barcelona” is carried out using a geographic information system (GIS) representation of the offer of new mobility systems, retrieved from the Smart City Strategic Plan 2014 (Ajuntament de Barcelona, 2014) and matching it with socio-economic and demographic data at neighbourhood scale from the Open Data Barcelona platform (Ajuntament de Barcelona, 2020), a service developed by the Barcelona City Council, which, since 2011, provides information generated or stored by public bodies, allowing access and reuse for the benefit of interested persons or entities.

Our research approach is represented in Figure 1. The analysis uses data on a set of attributes that describe the geography of smart mobility system supply through a point-based analysis. Smart mobility is not a unique system but a complex set of projects, most frequently cited in the Smart City literature (Benevolo *et al.*, 2016), including e-parking, e-ticketing, mobility signalisation, demand-responsive transport, car and bike sharing or e-cars charging stations, sustained by the development of comprehensive ICT

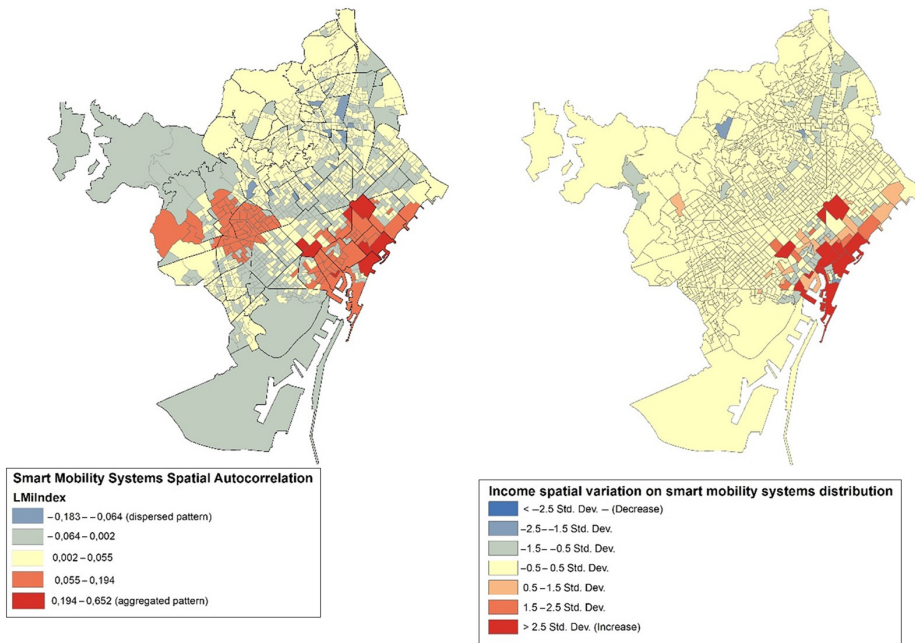


Figure 1.
Analytic framework
of the Barcelona case
study

infrastructure. In Barcelona, we have focused especially on the bike-sharing and car-sharing system, charging stations for electric cars and smart parking spaces (services tracked and monitored by the Municipality and up-to-date data). Thus, our data set includes geolocalised information on the main mobility services all over the city as a first step towards an assessment of the effects of spatial distribution in measures for access inequality. The relationship between the spatial components of smart mobility transition and the main socio-demographic variables used to evaluate the usership of smart mobility systems is part of our concern for the ways in which spatial arrangements operate as constitutive dimensions of social inclusion and urban cohesion.

The socio-demographic data considered to explore the process of social change linked to the smart mobility transition include a set of variables, which include migration rates and demographic change, allowing nuancing the dynamics of populations as dwellers characterised by uneven mobility capital. Following the literature, demographic change and inter-neighbourhood migration characterise processes of socio-spatial change such as gentrification and general population restructuring (Smith, 2002). In our conceptual approach, mobile populations, whose dwelling and life practices tend to align with the opportunities provided by the smart mobility infrastructure, are empowered in such processes of neighbourhood change and highly enmeshed in the general tourist transformation of the city. Hence, a tourism pressure indicator is also used to reflect the concerns related to spatial and transport injustice, whereas tourists and other short-term, physically able and digitally competent populations gain access and control of urban assets over the less mobile and more place-dependent (Lopez Gay *et al.*, 2020). In addition, data on digital skills retrieved from the digital divide enquiry conducted in Barcelona (Mobile World Capital, 2016) are used to measure the potential level of ICT access related to smart mobility

services. With this data, we implemented different geoanalytical techniques bringing out the multiple relations between the two groups of data summarised above (smart mobility systems data based on geolocalised points of supply of mobility services and social indicators). Two types of geostatistical techniques are addressed in the maps in [Figure 2](#): the first aims at establishing the urban distribution patterns of the main smart mobility systems, and the other at characterising the relationship between this geography ICT-powered mobility services and the changing social geography of the city.

4. Results and insights

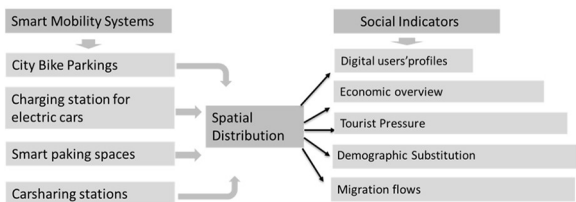
4.1 Static analysis: the geography of smart mobility access and rent distribution

To establish how smart mobility systems participate in the process of urban change, we ran a Moran’s autocorrelation analysis ([Figure 2 left](#)), which identifies spatial concentrations of high and low values of the supply of services (based on absolute numbers of georeferenced service points such as the “bicing” city bike system, charging stations for electric cars, smart parking spaces and car sharing stations). The second step involved a regression analysis in which the values of this first technique are integrated as the independent variable, and the individual income evolution between 2015 and 2018 represents the dependent variable. We further used geographical weighted regression analysis to examine the spatial configuration of the mobility systems currently operating in the city (Moran’s Index) as the predictor variable of the economic performance of the urban areas to account for spatial dependence between both variables.

The map derived from the results of the regression analysis ([Figure 2-right](#)) suggests a generally positive relationship between a high concentration of mobility services and economic growth. This relationship is especially relevant to those urban areas that have been particularly involved in the strengthening and upgrading of initiatives linked to new mobility. The association of the variables reveals that incremental income values also support the distribution of smart mobility services, which have undergone a strong implementation in the south-east sector of the city (Poblenou, Diagonal Mar and the seafront of Poblenou), as well as expected, in the whole central sector of the city ([Figure 2 left](#)) where there is an articulated network of interrelated and interdependent hubs, including their main mobility gateways (train stations of Plaça Catalunya, Passeig de Gràcia, Sants).

However, an analysis of the spatial distribution of the values of the two variables reveals that the association between poor development of mobility services and income is ambiguous. While in the five neighbourhoods in the extreme north-east, corresponding to the districts of Nou Barris, Ciutat Meridiana, Torre Baró and La Trinitat Nova, mostly

Figure 2.
(left) Smart mobility spatial autocorrelation; (right) spatial regression model based on smart mobility spatial autocorrelation and individual income change 2015–2018



low-income working-class residential areas, the spatialisation of the regression coefficients reveals that some of the areas featuring a poor development of mobility services do not show negative values of their income variables, in other high-income neighbourhoods in the north-west section (Pedralbes, Les Corts, Sant Gervasi), the results do not reveal a significant association between the high incidence of the distribution of smart mobility services and the rise of income, as we have observed in the wider area from the most central to the south-eastern part of the city.

Thus, to explain the increase in income in some of the neighbourhoods in which the positive relationship with the distribution of smart mobility services variable seems to be stronger, it is necessary to explore other variables related to the nature of economies as well as the technological capability related to mobility. In the following two maps of Figure 3, the supply intensity of smart mobility services is analysed against the capability of the population to receive and use them in terms of technological skills (Figure 3 left) on the one hand and to the level of tourist pressure (Figure 3 right) on the other. The map representing the digital profile of users across neighbourhoods is based on data from the report “The digital gap in the city of Barcelona” (*Mobile Word Capital Barcelona, 2016*), extrapolating the spatial distribution of *high digital user profiles* (users who own up to three devices and in the last month have carried out more than six online operations). The results indicate, once again, that the south-east sector stands out for its high percentage of advanced users, evidencing the emplacement of the new innovation district of the city, which has been unfolding over the last 20 years. The other areas with a high percentage of advanced users are located outside the Old City (the Eixample and other high-rent neighbourhoods of the

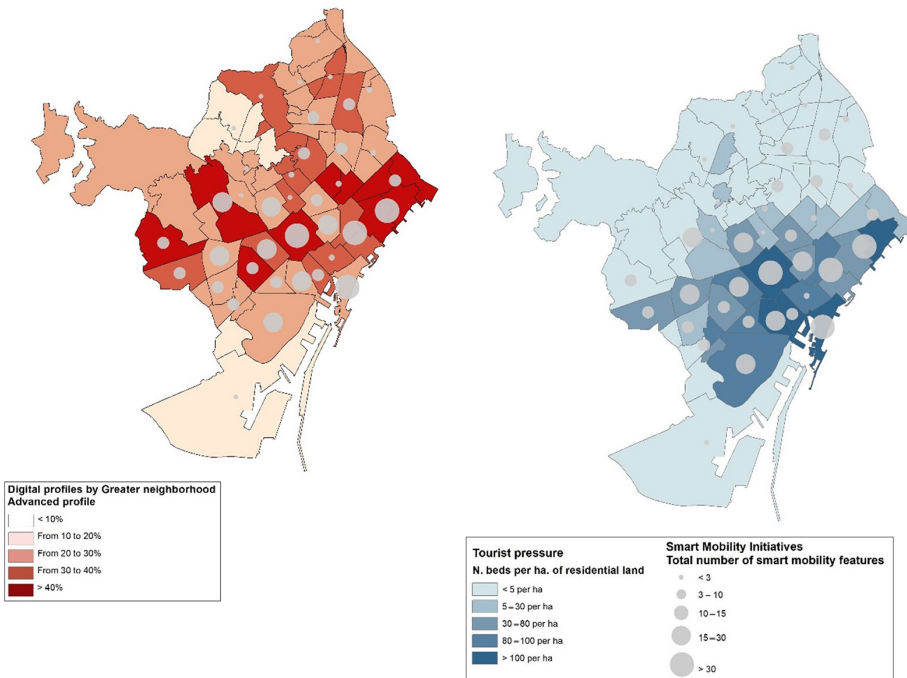


Figure 3.
(left) Acceso to
smart mobility
services on citizens
digital profiles
distribution by
greater
neighbourhood;
(right) availability of
smart mobility
services on N. Beds
on residential
land 2018

city, such as Pedralbes and Sant Gervasi). In the city centre, the high availability of digital mobility services does not seem to fully correspond to the ability to access them from the point of view of digital skills (Barceloneta, Raval), although it should be mentioned that the data refer exclusively to the resident population, which does not reflect the entire population dwelling in the area. In general, the capacity to absorb initiatives involving the use of technologies seems to be quite high throughout the entire municipal territory.

With regard to tourist pressure (Figure 3 right), the intensity of tourist supply, measured as a percentage of tourist dwellings over the total of dwellings (INE, 2020), tends to be unevenly distributed throughout the territory, with high concentration scores in the districts of Ciutat Vella, Eixample and Sant Martí, mirroring the location of key attractions and tourist sites in the city but also the intensity of supply of smart mobility systems.

4.2 Dynamic analysis: smartisation of the city and socio-economic change processes

In the tables below, we include a number of indicators similar to those provided in the previous section but also presenting their evolution (whenever available) over the reference period 2015–2018 (the timeframe of deployment of the ITS system and the other smart mobility programmes), and their spatial distribution in Barcelona's 10 administrative districts. We also include a “zoom” on the three neighbourhoods (a disaggregation of districts, delimiting historical areas of the city), which register the highest intensity of supply of newly implanted “smart mobility” services: *Poblenou*, *Sant’Antoni* and *La Vila de Gràcia*.

The three focus neighbourhoods are experiencing similar socio-economic and demographic processes. Located to the north, east and west of the historical city centre, they are not considered tourist hotspots, possibly due to a lower concentration of key tourist icons and attraction sites. Nonetheless, to varying degrees, they concentrate on a relevant activity with a moderate-to-high presence of hotels and other accommodation types (as shown in the map to the right in Figure 3). Indeed, a high level of tourist pressure, above the average at a municipal level (47.8 bed-places per hectare of residential land), was registered both at the neighbourhood level (2015 data: Poblenou 57.3; Sant Antoni 101.1; Vila de Gràcia 85.5) and at the district level, as shown by the data updated to 2018 (respectively, Sant Martí 77.4; Sant Antoni 149.6; and Gràcia 47.5). It should be noted that the figures for Poblenou differ from the others due to its larger extension in terms of residential land and the high concentration of knowledge economy services in this area. Thanks to location, close to the centre but nonetheless eschewing the most intense tourist pressure, in recent years these three neighbourhoods resulted quite attractive to those foreign populations that we defined as “mobile dwellers”, characterised by greater acquisitive power and a higher degree of flexibility in residential and professional routines.

As can be seen in Tables 2 and 3, these three areas have experienced substantial population change; however, the patterns are quite different. The internal migratory balance is the result of subtracting the number of new inhabitants who have arrived from other neighbourhoods of Barcelona and those who have left for other areas in the same city. In the period 2015–2018, Poblenou has lost the greater share of residents due to internal migration, with a sustained negative balance (–1.5% in 2015 to 4.5% in 2018), demonstrating its low capacity to retain its population. Similarly, at the district scale (Sant Martí), we observe a similar trend (–5.6% on average over the three-four reference years). *Sant Antoni*, although it was experiencing a negative balance in 2015, by 2018, it recovered a positive balance (11.4%) of internal migration. A more stable situation is also visible in the district of Gràcia,

Neighbourhood/district	Distribution of smart mobility services (perc. over city total)	Tourist pressure		Foreign population	
		Tourist bed-places per residential land (n./ha) 2015	Tourist bed-places per residential land (n./ha) 2018	Perc. population with foreign OECD nationality (average 2015–2018)	Perc. population with foreign non-OECD nationality (average 2015–2018)
<i>Poble Nou</i>	3.67	57.32	<i>n.a.</i>	3.31	1.61
<i>Sant Antoni</i>	2.93	101.14	<i>n.a.</i>	3.72	2.52
<i>Vila de Gràcia</i>	4.40	85.53	<i>n.a.</i>	4.88	1.87
Ciutat Vella	13.49	190.58	207.03	6.26	5.56
Eixample	21.41	119.58	149.64	4.20	2.66
Sants-Montjuïc	9.24	47.18	57.39	3.32	3.00
Les Corts	8.50	42.32	46.62	3.75	2.09
Sarrià-Sant Gervasi	8.65	14.52	16.85	3.39	1.21
Gràcia	6.01	35.75	47.47	3.87	1.73
Horta-Guinardó	4.99	6.96	8.72	2.57	1.95
Nou Barris	4.11	1.75	1.84	2.14	2.78
Sant Andreu	6.16	3.42	3.91	2.10	1.88
Sant Martí	17.45	61.21	77.42	2.84	2.24
TOTAL BARCELONA	100.00	47.76	57.06	3.39	2.56

Source: Own elaboration of data from Ajuntament de Barcelona, 2019

Table 2.
Tourist pressure
trends and foreign
population at district
and neighbourhood
level in Barcelona
2015–2018

Table 3.
Demographic and
socio-economic
trends at district and
neighbourhood level
in Barcelona,
2015–2018

Neighbourhood/district	Distribution of Smart Mobility Services (perc. over city total)	Demographic change			Socio-economic trends		
		Pop. Change 2015–2018 (%)	Inter-neighbourhood Migration Rate (% on res. pop.) 2015	Inter-neighbourhood Migration Rate (% on res. pop.) 2018	Inter-neighbourhood Migration Rate (% on res. pop.) average 2015–2018	Unemployment rate (change of perc. rate 2015–2018)	% Change household rent 2015–2018
<i>Poble Nou</i>	3.67	1.2	-1.50	-4.45	-2.97	-1.25	4.30
<i>Sant Antoni</i>	2.93	0.1	-0.76	11.39	5.32	-1.28	5.60
<i>Vila de Gràcia</i>	4.40	-0.8	-0.65	0.14	-0.26	-1.20	-1.90
<i>Ciutat Vella</i>	13.49	0.6	12.58	16.24	3.66	-1.66	9.20
<i>Eixample</i>	21.41	0.5	6.80	13.66	6.86	-1.22	5.15
<i>Sants-Montjuïc</i>	9.24	0.3	-2.27	-5.65	-3.39	-1.61	12.35
<i>Les Corts</i>	8.50	0.3	2.42	-2.80	-5.22	-1.19	-2.85
<i>Sarrià-Sant Gervasi</i>	8.65	1.6	-8.72	-0.66	8.06	-0.75	-2.09
<i>Gràcia</i>	6.01	0.5	2.85	4.34	1.49	-1.27	0.10
<i>Horta-Guinardó</i>	4.99	1.8	-12.48	-12.85	-0.37	-1.57	0.13
<i>Nou Barris</i>	4.11	2.0	-6.43	-9.85	-3.42	-2.03	-2.14
<i>Sant Andreu</i>	6.16	1.2	-3.18	-12.10	-8.92	-1.77	0.27
<i>Sant Martí</i>	17.45	1.0	-0.65	-6.30	-5.65	-1.59	9.31
TOTAL BARCELONA	100.00	1.0				-1.47	100

Source: Own elaboration of data from Ajuntament de Barcelona, 2019

with a slight decrease in this rate but signs of a recover in the last period. It should be noted that in overall terms, this last neighbourhood is losing population, which is to say its internal migratory balance is positive, but the area's population is declining due to residents who leave the city. In contrast, the neighbourhoods of Poble Nou and Sant Antoni are experiencing population growth, which means that the abandonment of residents is more than compensated by immigration from other parts of Catalonia, Spain, Europe and the rest of the world. Indeed, the share of residents that are foreigners from organization for economic cooperation and development (OECD) countries increases slightly over the reference period in the Poble Nou neighbourhood and above the city average, which is negative at -1.2% , while in Vila de Gràcia and Sant Antoni, the foreign population from OECD countries, though remaining higher than that from the non-OECD country, experiences a decline in the reference period, whereas the share of residents that are foreigners from non-OECD countries registers a net growth.

This complex picture of socio-demographic change relates to a certain extent to another set of socio-economic indicators, including the change in household rent and the average unemployment rate of the neighbourhood in the reference period. In the wider context of recovery from the economic crisis that characterised the first part of the decade, in two of our focus neighbourhoods these indicators reveal a drop of the unemployment rate (both in Poble Nou and Sant Antoni, from 5.2% in 2015 to 3.9% in 2018) and an increase in family income (of 4.3 percentage points over the Barcelona total in 2015–2018 in Poble Nou, and of 5.6 in Sant Antoni). Deeper scrutiny, however, rather than indicating an improvement in general salary and employment situations, reveals that these areas are in fact subject to a high rate of population replacement through incoming migratory flows with greater purchasing and educational power, joining the more specialised sectors of the labour market.

4.3 Discussion: Barcelona as exclusionary smart destination?

An understanding of the complexity of (urban) inequalities must take into explicit account the development of the opportunities permitted today by movement, not only in terms of better access to urban assets but also in terms of access to the digital networks that represent connective capital, allowing greater (but uneven) societal engagement with the global economy and the global mobility flows. Indeed, taken together, the three districts to which the selected neighbourhoods belong account for almost 45% of all the new smart mobility services activated in the municipal territory, marking an important advantage for these areas in their capacity to participate in the process of technological and digital transformation, with everything this entails on a social, economic and demographic level.

According to our fine-scale analysis, the processes of “smartening up” of mobility are linked to the reproduction and acceleration of processes, already underway, of gentrification and “touristification” in its broadest sense; thus, not only in terms of activation of specific points of interest for visitors but of attraction of temporary populations that require a plug-in to local networks and access to global networks. In fact, the development of mobility innovations framed in the strategic axes from the north-east to the south-west of Barcelona has been associated with the conversion of these urban areas into global arenas and apt livelihoods for a cosmopolitan and diverse population of mobile dwellers, promoting a socio-spatial stratification by which “hypermobilized” places rich in technological supply are opposed to others poor in global connections and unattractive for the global denizens.

Within our case study, however, different nuances peep up among the trends we examined. While the neighbourhoods of Sant Antoni and Vila de Gràcia demonstrate a certain contrast in terms of socio-economic trends and patterns of attractiveness for different “mobile” populations, the neighbourhood of Poblenou is the area that best reflects the situation we have tried to describe in this paper. This case is indeed key to understanding how the strategies of urban transformation so far linked to both real estate operations and tourist development are now also linked to smart city initiatives services and specifically to mobility services. The analysis of socio-economic trends in Poblenou features a high degree of association between digital and human geographies, confirming the hypothesis that advanced mobility systems in the context of a tourist city could be a factor of reproduction of socio-spatial breeches, encapsulated by processes of population substitution and related socio-demographic regeneration, instead of one of mitigation and empowerment of “slow” residents. Indeed, the activation of new mobility systems reinforces the topical capital of those places that are prepared to receive and use these systems, areas capable of cushioning the effects in the short and long term and which would otherwise suffer outcomes such as forced demographic change, the expulsion of lower-wage and long-term residents and in general the widening of the social gap.

5. Final reflections

The objective of this paper was to excavate the social effects of the deployment of “smart city” strategies in the context of tourist cities. After framing this concern in the mobilities literature, to get a better and more contextualised understanding of the potential relationship between smarter and more or less cohesive tourist cities, we focused then on the city of Barcelona, and three neighbourhoods therein that are at the same time areas of intense development of smart mobility projects and have undergone substantial (though not homogeneous) processes of socio-demographic transformation in the last few years, with generally adverse effects on incumbent resident populations.

These trends should be understood as ingrained to wider processes of socio-spatial restructuring of urban areas, and the case of Barcelona makes a strong case for that. This largely tourism-dependent economy has experienced an abrupt deceleration of their economic and physical growth with the financial crisis of the second half of the 2000s, and in their slow recovery, since approximately 2014, the continuous pull of tourism has been key; yet, the hyper-casualised and marginalised condition of tourism workers after the anti-crisis reforms undertaken in 2012 and the long tail of middle-class impoverishment produced by the financial slump were already a sign that increased social polarisation was going to be an outcome of such recovery.

In this context, smart city strategies, a further booster to recover city attractiveness for companies and the hypermobile top layer of the global job market, could be understood as part and parcel of the neoliberal approach to urban restructuring. Although the Smart City imagery evokes empowered and connected citizens, producing, consuming and moving around more efficiently and with lower environmental footprints, the epistemological toolbox of the mobilities turn invites us to examine more closely which citizenship we are talking about – that of long-term residents or that of global mobilities, including tourists, which a more extended supply of smart services inevitably bolster in their capacity to dwell in and navigate the city.

Thus, the effect of “smart” in cities could indeed be one of economic recovery; however, one triggering – or achieved through – fundamental transformations of the social fabric of the city, whose most evident facet is the creation of sophisticated functional enclaves which are forcefields of exclusion for the most vulnerable populations. This is not different from

what has been noted by many urban analysts in the course of the last 30 years (Brown and Zukin, 1985; Soja, 2000; Swyngedouw *et al.*, 2002); yet, again resorting to authors who laid the foundations of a mobilities approach in urban studies (Amin and Thrift, 2002), Smart City projects have inevitable made the city more “porous” to the intervention of global mobile populations and signs and enhanced the negotiation capacity of mobile dwellers over sedentary sectors of the community. In the emerging context of “overtourism”, the increasing penetration of enabled tourism in the quotidian of cities could be expected to lead to the intensification and acceleration of social exclusion.

As suggested by the critical smart city literature (Hollands, 2008), it is a matter for further scrutiny whether and to what degree SD are deaf to social imperatives and rather skewed towards corporate interests – ranging from those of technology developers looking for big municipal contracts to real estate and financial conglomerates increasingly tuning into the mobilisation of urban assets for global consumers (Cocola Gant and Gago, 2019).

This piece of research has obvious limitations: it cannot demonstrate that there is a direct link between specific smart projects or, more broadly, between smart city agendas and social restructuring, nor it focuses on the longer-term horizon when the effects of smart upgrading, especially in the field of mobility could be expected to transform more structurally the functional morphology of the city, for instance in terms of residential choices *vis-à-vis* work routines. Our selection of projects and focus areas in the case of Barcelona is arbitrary and exploratory, and we did not deal with the extensive complexity of the social impacts of “smartened up” tourism and induced reconfigurations of the social ecologies in the city. Nevertheless, this is arguably a provocative starting point to analyse critically the current transformations of cities that are “mobilised” by technology and the key role played by tourist mobilities in this process. We expect that a future research agenda tackling smart places in construction will be aware of large-scale technology developments as an enabling device. Policy-wise, we look forward to an urban and tourism development agenda that relates to this challenge constructively, for instance, laying the foundations for a new paradigm of resilient smart places where digital innovations are genuinely reducing the pressure on resident populations, and especially, the most vulnerable sectors therein.

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Further reading

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