Miguel P. Amado
Editor


# Practices, Challenges and Benefits

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URBAN DEVELOPMENT AND INFRASTRUCTURE

# URBAN PLANNING

# PRACTICES, CHALLENGES AND BENEFITS

# URBAN DEVELOPMENT AND INFRASTRUCTURE

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MIGUEL P. AMADO
EDITOR

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# INTRODUCTION

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The future for our urban planning actions is dependent on the results of us doing something today. In particular, archiving urban areas that are sustainable is a challenge in our increase urbanized world.

In 2003, 48% of the world's population lived in urban areas. The predictions are that by 2030, more than 60% of the population will be urban[1]. This reality promotes the challenge as to how urban planning practices can be achieved.

The aim of this book is to present the reader with practices, challenges and benefits of the changing patterns in urban planning. The sustainability has been placed on the world agenda, and urban planners and countries need to take it into consideration. In the same context, due to the emergence of migrations in reaching the basic needs, a reformed urban planning methodology arises, which unequivocally addresses a group of emerging urban challenges relating to climate change, poverty, informality and re-housing in a rapid urbanization phenomena. All of these issues show the necessity of specific operational processes and the evaluation of planning actions.

The need is to implement measures that focus on population needs and environmental problems, and to merge the potential of urban planning in response to the phenomenon of informal settlements. The opportunity of the inclusion of public participation in the operational process ensures the commitment to arising concrete outcomes and enhancing the potential of urban planning. Also, the process should include clear indications in a restricted number to avoid losing potential of the action, but a large team of consultants should be used, if possible, to enhance quality and efficiency through insights and goals.

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[1] United Nations (Department of Economic and Social Affairs/Population Division), 2004 *World Urbanization Prospects: The 2003 Revision,* New York: United Nations.

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*Chapter 1*

# PLACE PROMOTION, SPATIAL PURIFICATION AND THE SPECTRE OF ADDICTION/TREATMENT: METHADONE MAINTENANCE TREATMENT AND THE GENTRIFICATION BATTLEGROUND

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## ABSTRACT

The 2006 relocation of a methadone maintenance treatment (MMT) clinic into a gentrifying neighbourhood in downtown Toronto, Canada provoked a fierce campaign of opposition.

Drawing from interviews with community opponents, this chapter examines the interrelationship between discourses of place promotion and spatial purification, demonstrating how 'urban village' and 'creative class' strategies actively produce socio-spatial stigmatization in the case of addiction treatment.

Analysis reveals a series of socio-spatial processes, including re-claiming, re-branding and re-developing.

Tracing the interplay between gentrification and stigma, this chapter concludes that place promotion and spatial purification are interdependent phenomena that effectively work towards re-positioning the gentrification 'war zone'.

Mobilizing the discursive force of the 'war on drugs' in tandem with (intra-)urban boosterism, the analytical force of this chapter therefore lies at the intersection between urban planning policy and drug/treatment policy, where revanchist urbanism and the redevelopment frontier intermingle to form a space of seemingly irreconcilable conflict surrounding the contested space of addiction treatment.

**Keywords:** Gentrification, urban redevelopment, socio-spatial stigmatization, addiction treatment, methadone, urban boosterism, NIMBY, community opposition

## INTRODUCTION

> "Junk is often found adjacent to ambiguous or transitional districts … A point where dubious business enterprise touches Skid Row." (Burroughs 1977: 111)

Recent research has demonstrated how gentrification and urban redevelopment can serve to promote and exacerbate socio-spatial stigmatization directed at marginalized, socially vulnerably urban populations, a problematic that is rendered particularly acute in the case of what has been termed the 'contested space of addiction treatment' (Colon and Marston 1999; Smith, 2010, 2011a; Strike et al. 2004; Takahashi 1997).

In spite of extensive scholarship concerning conservative community opposition and the 'Not-In-My-Back-Yard' or NIMBY phenomenon in relation to homeless shelters (Henig 1994; Takahashi 1997; Lyon-Callo 2001) and HIV/AIDS service facilities (Takahashi 1997; Colon and Marston 1999), drug/service users[1] or addiction/treatment subjects and service sites have been largely neglected or overlooked in these debates (Smith 2010, 2011a). Here, the collapse of 'addiction' into 'treatment' suggests a relationship of mutual-constitution and interdependence, each invoking the other.

In this context, the intentional rendering of addiction/treatment points to the popular conflation between harm reduction and addiction treatment (i.e. 'maintenance'/'substitution') services, circumventing the sense of passivity implied in the post-pathology era of addiction research and treatment paradigms that ironically followed from what Rosenbaum (1995) referred to as the 'demedicalization' of methadone maintenance.

Despite the lack of critical analysis, NIMBYism is growing increasingly prevalent with regard to harm reduction, addiction treatment sites and their users (Des Jarlais et al. 1995; Radcliffe and Stevens 2008; Smith 2010, 2011a; Strike et al. 2004; Tempalski 2007; Treloar and Fraser 2007; Williams and Ouellet 2010).

Correspondingly, in Socio-Cultural Geography and related disciplines, very little attention has been devoted to the correlations between urban boosterism discourse, socio-spatial stigmatization, and the process and lived experience of gentrification (Barnes et al. 2006; Short 1999; Smith 1996).

Drawing from a case study of community conflict surrounding the relocation of a methadone clinic into Corktown, a rapidly gentrifying neighbourhood in downtown Toronto, this chapter explores the interdependent discourses of place promotion and spatial purification in opposition to the perceived socio-spatial 'disorder of drugs' (Short 1999; Sibley, 1995; Smith, 2010; Fraser and Moore, 2008).

In the case of the Corktown methadone clinic, evidence suggests that moral-criminological ideologies surrounding the 'war on drugs' bled into and became inseparable from intra-urban boosterism strategies, effectively serving to resituate Corktown as a gentrification 'war zone' or 'battle ground'.

[1] In place of the capitalist-inscribed designations 'client' or 'consumer' attending the dawn of neoliberal public health policy, Smith (2012) poses *drug/service users* as a term that conveys a "potentially productive, fluid interchangeability".

## Literature Review: Corktown, Urban Boosterism and Rebranding Post-Industrial City Space

> "[W]orker cottages still stand, and the factories and breweries are now condos and lofts bearing the names of what had been in the building before… A decade ago, nobody would have dreamed of owning property in Corktown's industrial wasteland. But over the past six years, real estate has doubled and tripled." (Wintrob 2006, p.2PH)

Situated adjacent to the neighbourhood of Cabbagetown – so named because its impoverished, primarily Irish and Scottish working class residents grew cabbage on their front lawns – Corktown's geographic positioning on the cusp of Toronto's early industrial area served to associate the neighbourhood with immigrants, industry and working class heritage (Caufield 1994). Owing to its largely immigrant, working class demographics, during the post-WWII period the industrial landscape of Corktown became stigmatized as a blighted, poverty-stricken area of east downtown Toronto (Fraser 1972; Purdy 2005). With increasing levels of residential desertion and commercial abandonment throughout the later twentieth century, the area was widely considered a 'wasteland' (Wintrob 2006). During this period, while downtown Toronto witnessed significant capital reinvestment, the peripheral landscape of Corktown was sited for an increasing number of social services, further reinforcing its reputation as a space of poverty and social pathology (Sommers and Blomley 2002). Considered a 'site of least resistance' owing to its low residential density and distance from the core, Corktown became stigmatized as a 'dumping ground' for social service facilities (Takahashi 1997), cementing popular perceptions of the area as a 'service-dependent ghetto' (Dear and Wolsch 1987).

After sustained post-industrial decline and disinvestment, the 1990s witnessed a fundamental series of socio-spatial changes in Corktown. Coinciding with both growing desires among upper-middle class suburbanites to re-settle in the inner city (Caulfield 1989, 1994), and increasing real estate pressures throughout the downtown core, developers turned their focus towards the former industrial 'wasteland' of Corktown. This massive wave of reinvestment beginning in the twenty-first century can be traced to the adaptive reuse of a nearby industrial complex strongly informed by Florida's (2002) 'creative class' theory. Prefiguring community representations of Corktown, promotion for the this development boasted 'European style', 'bursting with galleries, shops, cafes and open-air festivals', offering both 'big city sophistication' and 'small town charms' (Distillery District, 2008). Situated between this trendy 'creative class' hub, and Regent Park, the oldest and to date largest public housing project in Canada – itself currently undergoing a multi-phase 'revitalization' project – Corktown was thus situated in a patchwork landscape of social class clashes and competing commercial interests (Benger 1996; Bowie 1993; Purdy 2005).

Spurring a major socio-demographics shift, the surge of proximate reinvestment catalysed by 'creative class' redevelopments neighbouring to the south, in tandem with the 'revitalization' of the adjacent housing project along its northern border, served to book-end the socio-spatial reinvention of Corktown as a neighbourhood situated between the forces of gentrification and ghettoization, reinvestment and disinvestment, place promotion and spatial purification, 'light' and 'dark' forms of intra-urban boosterism discourse and representation (Sibley 1995; Short 1999; Smith 1996). Positioned on the cusp of Toronto's redevelopment 'frontier' (Smith 1996), Corktown's profound transformation functioned to produce a

heightened state of contestation, leading to increased conflicts regarding local social service sites. In spring 2006, opposition to the relocation of a methadone maintenance treatment (MMT) clinic by the Corktown Residents' and Business Association (CRBA) mobilized significant media attention. Following a series media-fuelled moral panic regarding MMT in Ontario (Donovan and Leeder 2006a, 2006b, 2006c, 2006d, 2006e, 2007; Cohen 1972), the Corktown conflict culminated in a provincial MMT Task Force charged with auditing treatment practices (Ontario Ministry of Health 2006; Hart, 2007)[2].

Closely corresponding to the themes that permeated the 2006 moral panic concerning MMT in Ontario, the Methadone Task Force was mandated to focus on five specific areas of treatment provision, including an explicit examination of 'community engagement. (Hart 2007). Given its emphasis, the formation of the Ontario MMT Task Force simultaneously spurred the revision of a document produced by the Canadian Centre for Addiction and Mental Health (CAMH) (2000, 2009) entitled Methadone Maintenance Treatment: A Community Planning Guide. As the introduction to the revised CAMH (2009: 1-2) Community Planning Guide explained:

> In its 2007 report, the Methadone Maintenance Treatment Practices Task Force recommended that the Ontario government improve access to MMT. The task force identified public resistance as a barrier to sustained access to MMT services, and recommended greater awareness of MMT and more intensive engagement of communities in the development of MMT services … This community planning guide is intended for those communities interested in starting or expanding MMT services. Community involvement is an important part of the planning, development and integration of an MMT program. The information in the guide is based on current research and first-hand experience. You will find practical suggestions on how to build public support and increase acceptance of those struggling with opioid dependence, through raising community awareness and acceptance of MMT services in your community.

Re-branding the image of post-industrial city space has been a persistent theme throughout the late twentieth century (Barnes et al. 2006; Beauregard 1993; Short 1999). With the 'hyper-mobility of capital' brought about by the forces of economic globalization, competition for 'restless', 'footloose' capital has increased the intensity of 'place wars' not only between cities, but also importantly within cities (Barnes et al. 2006; Harvey 1990; Sassen 1998; Short 1999). In contrast to inter-urban boosterism produced by planners, politicians, and private sector partnerships (Smith 2002; Smith and Derkson 2002; Zukin 1995), intra-urban boosterism promotes specific areas according to dominant urban planning themes, constituting a grassroots process, promoted by community coalitions and business

[2] During the course of community interviews, the author learned that, in part due to the role of the community conflict in catalysing its formation by then Ontario Minister of Health, one local Corktown resident and business owner had been appointed to a prominent position within the *Ontario Methadone Task Force*; when contacted, the individual formally consented to participate in an interview concerning community opposition to the arrival of the methadone clinic, but as the work of the *Task Force* was at that time on-going, the individual agreed only to speak from the perspective of Corktown resident / business owner, not as member of the Task Force. At several points throughout this interview, however, the participant requested that the author turn off his recording equipment in order to share a series of critical 'off the record' comments.

improvement associations (BIAs)[3]. As Short (1999: 38) notes, although subject to contestation and (re)production, 'regimes of representation' work to transform space into place. 'Light' forms of urban boosterism, Short (1999: 40) suggests, present positive portrayals of the city to attract investment, promote development, and influence local politics, while 'dark' or 'shadow' narratives often allude to elements that need to be "contained, controlled, or ignored", invoking a 'discourse of decline' (Beauregard 1993). In each distinct manifestation, Short (1999: 42) argues that recurrent anatomical metaphors construct the social body of the city in the terms of health and illness, vitality and disease (Derrida 1993).

Since 2000, the 'creative class' and 'urban village' have characterized two of the most predominant themes in urban planning discourse and practice (Barnes et al. 2006; Florida 2002). Florida's (2002) creative class theory poses intellectuals, artists and knowledge economy workers as an engine of post-industrial urban growth. In order to secure transnational capital and remain competitive in the global economy, Florida's (2002) argument assumes that cities must "aggressively plan for, and compete to attract, members of this new 'creative class'" (Barnes et al. 2006: 337).

The City of Toronto's most explicit attempt to positioning itself as a 'creative city' is evidenced in the 2003 Culture Plan for the Creative City and subsequent Live With Culture campaign, consisting of a series of public marketing efforts highlighting the city's arts and cultural industries.

In their investigation of 'urban village' strategies, Barnes et al. (2006: 336) assert that boosterism and place promotion discourse functions not only to refashion post-industrial space, but also as an attempt to remedy perceived social problems. Here, 'nostalgically re-imagining' urban areas in a 'quasi-rural' light represents a "utopian rhetorical device", where "against the industrial decay of the city, the village is more natural, pure, spiritual […] and community focused", and as a consequence, "sex workers, alcoholics, drug users and working class residents become redundant—abject others to be discarded from the ideal place identity" (Barnes et al. 2006: 345).

Characterized by Smith's (1996) 'revanchist city' concept, the 1980s marked the dawn of increasingly vengeful manifestations of gentrification, involving upper/middle class efforts to 'reclaim' the urban core from immigrants, the working class, and other marginalizaed, socially vulnerable urban populations such as people who are homeless and people who use illicit drugs (Lees, Slater and Wyly 2008; Smith 1996; Slater 2004). Metaphorically "legitimat[ing] a process of conquest", Smith (1996, p, xiii-xv) argues that the post-1960 'gentrification frontier' has been portrayed as "the habitat of disease and disorder, crime and corruption, drugs and danger", representing a landscape to be tamed, conquered and settled. Premised on socio-spatial conquest, revanchist gentrification is therefore implicated in the systematic exclusion of 'undesirable' elements, where forms of urban 'regeneration' posed by public-private partnerships are designed to eliminate the socio-spatial 'disorder of drugs' (Cusick and Kimber 2007; Fischer et al. 2004; Fraser and Moore 2008; Smith 2010; Zukin 1995).

A 'mutually constituting process' that simultaneously projects spatial stigma on to social bodies and social stigma on to specific inner-city sites and spaces, gentrifying redevelopment

[3] Here, see Zukin's (1995) discussion of the role of Business Improvement Districts (BIDs) in the gentrification of New York's Bryant Park.

campaigns thus represent both cause and symptom of socio-spatial stigmatization (Takahashi 1997: 910).

Conversely, driven by concerns regarding 'public dis/order', interventions such as supervised injection sites have been criticized as contributing to inner-city social sanitization, recasting the city itself as site of 'safe/supervised consumption' for tourists and international capital (Fischer et al. 2004; Short 1999; Smith 2010; Smith and Derkson 2002).

## METHODOLOGY

Drawing on six months of participant observation ethnographic fieldwork following the methadone clinic's relocation into Corktown (June - November 2006), this chapter is based on qualitative interviews with local residents and business owners, along with an analysis of other forms of mediated community self-representation produced by the CRBA. In total semi-formal, open-ended, tape-recorded interviews were conducted with 20 local community members (10 male and 10 female), following a traditional snowballing recruitment method. Community interviews were catalysed by an altercation involving individuals from a business across the street from the methadone clinic openly photographing drug/service users (see Smith 2010, 2011a). Following this incident, the author began knocking on the door of residents and business owners in immediate proximity to the clinic, who in turn suggested other potential interview subjects. Owing to the nature of this recruitment strategy, most Corktown community interview participants were strongly opposed to the clinic, with a small faction who expressed more moderate views; for the purpose of this examination, analytical focus was placed on oppositional voices. Community interviews encompassed questions regarding neighbourhood change, the impact of the methadone clinic, and organized strategies of opposition. Among the sample, eight individuals identified as Corktown residents, seven identified as small business owners, and the remaining five both lived and worked in the community; moreover, more than two thirds of the sample was actively involved in the CRBA, which served as the primary engine for mobilizing opposition among the wider community.

With ethics approval from York University (Toronto, Canada), informed consent was collected from all research participants. Pseudonyms were employed in all cases to ensure confidentiality and anonymity, with each participant identified only by their status as resident and/or businessperson. All interviews and fieldwork notes were conducted, transcribed, coded and analyzed by the author. Because the first stage of the larger project from which this research was drawn consisted of fieldwork and interviews with drug/service users at the methadone clinic[4], initial contact with Corktown opponents was characterized by suspicions regarding the author's political alliances and sympathies (Becker 1967). Beyond ethnography, the author attended public meetings of the CRBA, collected national and municipal media coverage of the conflict, and gathered public documentation produced by the CRBA. Key themes emerging from initial analysis of the interview data in turn informed the project's theoretical orientation. Tools that have elsewhere proven useful in analyzing stigma regarding addiction/treatment, this work employs Foucaultian discourse analysis and Derridan

[4] As part of the author's dissertation research, further insights into the wider project can be found in: Smith 2008, 2010, 2011a

deconstruction in tandem with gentrification and urban planning theory (Boothroyd 2000, 2006; Brooke and Stringer 2005; Derrida 1993; Rodner 2005).

## Results: Re-Situating Corktown

Examination of how local opponents attempted to discursively position and situate Corktown yielded significant insight into not only contemporary patterns of gentrification and urban change, but also the relationship between intra-urban boosterism, redevelopment and strategies of oppositional concerning the contested space of addiction treatment (Smith, 2010). Shifting between 'light' and 'dark' regimes of representation, community depictions of Corktown were thus characterized by tensions between place promotion and spatial purification, functioning to position Corktown as both a site of creativity, culture and heritage, and a 'tainted space', threatened by the continual encroachment of drug/service users (Short 1999; Sibley 1995; Sommers and Blomley 2002; Woolford 2001). Consistently citing Corktown's potential for growth and (re-)investment in relation to the CRBA's 'war' against the methadone clinic, here revanchist discourses drew ideological momentum from the 'war on drugs', rearticulating the 'gentrification frontier' as that of a 'war zone' or 'battlefield' (Derrida, 1993; Smith, 1996; Sommers and Blomley 2002; Woolford, 2001). As delineated in the sections that follow, the discursive tensions that served to frame Corktown were posed as a succession of interdependent socio-spatial stages shifting between narratives of re-claiming, re-branding, re-developing, and re-positioning the neighborhood.

## "The Indigents and Criminals Left": Re-Claiming Corktown

Prior to being re-cast as a site of culture and creativity, history and heritage, reclaiming formed a prominent theme in descriptions of Corktown's recent historical development. Portrayed as the result of concerted local efforts to 'clean-up' and 'take back' the area, the ideological force underlying such invocations of reclamation was fundamentally based on exclusion, where strategies of socio-spatial purification were posed as both prerequisite to – and an ongoing, inherent part of – efforts of place promotion (CBRA 2007; Sibley 1995; Short 1999; Smith 1996). Corktown community members "worked tirelessly to reduce crime, promote our business community and reclaim our parks so they [could] be once again a haven for children, families and seniors instead of an outdoor office for drug dealers", read the CRBA Community Impact Statement (2007) presented during a public meeting of the Ontario MMT Task Force convened in Corktown. Emphasizing the perceived impacts of the "large population of transient, marginalized people" deemed responsible for creating "enormous problems for the businesses and residents of this small, historic community", the CRBA Statement (2007) continued:

> We were very successful on M---- Street. S---- Park had a complete makeover – the new landscaping allowed the police to see what was happening […] the indigents and criminals left – children came back to frolic in the playground [and] families returned to have picnics.

Effectively redesigned to displace and ward off the 'indigents and criminals', the park's makeover took on symbolic proportions, implicitly situating public space as an indicator of overall community health (Sibley 1995; Fischer and Poland 1998). After 'cleaning up' the park by 'clearing out the bums', however, the methadone clinic was posed as an urgent impending threat (CRBA 2007); here, references to the reclamation of symbolic public spaces oscillated between past and present tense, affirming suggestions that 'reclaimed' space is seldom stable and often subject to subsequent acts of contestation (Short 1999). The local community "worked long and hard to get the neighbourhood back", remarked one Corktown employee, "so in their minds the methadone clinic is going to encourage all the riff-raff to come back and take over the neighbourhood, making crime go up, and blah, blah, blah …" (Charlotte).

Notions of displacement featured prominently in narratives of reclaiming Corktown, whereby concerted local opposition to proximate social services was posed as the key catalyst for wider demographic transformation. Following the closure of a nearby homeless shelter, "then you started getting the lawyers moving in", one resident remarked, adding that as a direct consequence, "the streetscape improved" owing to "a staying power of people" (Nancy), or in other words, a critical mass or prospective middle class agents of gentrification. Descriptions of this precarious process of transformation were, however, consistently accompanied by discourses that worked to frame the methadone clinic as a perceived looming threat; when the clinic opened, the same woman reported, "one person who used to be on the [CRBA] Board who had a businesses here for 20 years sold everything – he said 'I'm tired of fighting it…'" (Nancy).

## "A Wonderful Little Neck of the Woods": Re-Branding Corktown

Contemporaneous to reclaiming, residents and business owners described Corktown's re-branding, a process heavily reliant on 'creative class' and 'urban village' strategies (Blackwell 2006; Florida 2002; Barnes et al. 2006). Underscoring the area's historical value and formal heritage designation by the city, community opponents portrayed Corktown as one of Toronto's oldest established neighbourhoods, where repeated references posed historic sites and specific buildings as "the best part of the Corktown community" (CRBA 2007), effectively functioning to hyper-accentuate the neighbourhood's 'heritage status' (Ralph, Suzette, Madeline). Extending from such representations, participants recurrently positioned Corktown as a 'small town' or 'urban village'. "It's a wonderful little neighbourhood, like a small town; one of the great things about it is that people know each another", remarked one local resident and business owner, adding: "we're all friendly associates, like a little neck of the woods" (Madeline). Drawing correlations between its 'historical' value and 'small town' feel, other community narratives romantically invoked Corktown's industrial heritage:

> W all had façade grants and worked diligently to improve these buildings. This building was built in 1745—do you know how historical that is in Toronto? When you think that these buildings were once little storefronts, and the guy on the end used to be a barber and next door was a smithy… If you saw photos of old Corktown with its tiny shacks for the Irish working class and saw the puffs of smoke, you'd be shocked (Valery, business owner).

Above and beyond 'urban village' and 'heritage community' depictions, opponents additionally worked to frame Corktown as a place of art, culture and creativity. "The growing artistic community around here is really exciting" one long-time resident reported, going on to describe the neighbouring creative class redevelopment of the former industrial complex as "an artistic hub" (Adam). Directly attributed to adjacent redevelopments, other participants noted the recent arrival of distinctly new types of businesses, intended for a decidedly different demographic: "trendy, cool places have all just come into the neighbourhood in the last two years, most of it in the last year" (Carla, business owner). Referencing his experience living in an established upper class Toronto neighbourhood he perceived to be "98 percent WASP", another resident and business owner explained he was "bored stiff" before moving to Corktown. Citing the ubiquity of Starbucks© as emblematic of the socio-economic and ethnic homogeneity responsible for his boredom, it is therefore perhaps slightly ironic that at the start of the interview he gestured toward the methadone clinic half a block down from the café where the interview was taking lace and flatly stated: "I would've preferred that was a Starbucks©" (Dennis). "People talk to each other, there's a vibrancy here, a real sense of aliveness," he remarked, "because it's such a diverse neighbourhood where there are so many people who are different" (Dennis). Constructing certain factions of the local population as 'out of place' (Cresswell 1996), this sense of 'difference' was, however, selectively embraced: "I just love that!" exclaimed another resident, pointing to a student with dyed hair and facial piercings walking past the same café where the previously cited interview had taken place, "but I don't love the fact that we have homeless people on the other side of the fence" (Malcolm)[5].

## "Maybe we Should Have a Starbucks": Re-Developing Corktown

Allusions to economic reinvestment and 'rejuvenation' were central to Corktown's representational and discursive re-branding as a creative class community. "That's part of the whole gentrification thing going on here" one local resident remarked, detailing a host of nearby projects "that the gentrified community would appreciate" (Adam). "Every time you turn around there's a new development", stated another business owner in reference to increasing arts-oriented amenities, "people are starting to look into this area now and there's a lot of stuff going on to improve the neighbourhood" (Ralph). Concurrently, however, Corktown's transformation was consistently situated as 'under attack' by the methadone clinic and it's service users. Positing the clinic as a looming threat to recent reinvestment, one resident insisted on the importance of not "encourag[ing] another element" after the community "spent so much time getting rid of [a nearby homeless shelter] and breaking up all the crack houses" (Charlotte). In spite of the "radical and tremendous demographic changes"

[5] One side of the Corktown neighbourhood was bordered by two one-way streets that served as on and off ramps for a nearby major highway running north-south along Toronto's Don Valley; between these two streets was a patch of grass that might be seen as an example of *spaces left-over in planning* (SLOIP) or '*orphaned space*', which, as a function of it's ambiguous and effective no-man's-land status, coupled with the relentless stream of traffic on both sides, was often occupied by people who were homeless from the nearby shelter, often including those with severe apparent mental health conditions and substance use issues. This 'orphaned space', which some Corktown businesses and residents looked on to from their back yards, featured prominently in narrative representations of methadone service users and/as 'indigents and criminals' perceived and presumed to be lurking in the community's public and quasi-public spaces.

afoot, in other words, the clinic and its 'clients' were clearly posed as impediments to redevelopment:

> This used to be a very working class neighbourhood. Now you have BMWs and lawyers and professors. The demographic has changed radically. It's become… it was becoming more upscale. We had [an upscale business] move in and we were thrilled; now they're moving. We had a lovely restaurant open, but clientele don't wish to look out the window and see methadone people. We had a lawyer in the process of purchasing a building who has now changed his mind. So, while the demographics were looking up, the clinic has had a huge effect. (Suzette, resident)

Recalling both light and dark urban boosterism strategies, other opponents made imaginative projections concerning the methadone clinic's impact and the developmental trajectory of Corktown (Barnes et al. 2006; Florida 2002; Short 1999). Situating the clinic as 'out of place' in relation to the increasingly gentrified image of Corktown, one business owner stated: "Wouldn't it be better to have a Club Monaco© moving in? Maybe we should have a Starbucks©!" (Madeline). Directly referencing the 'heritage' value of the neighbourhood's built form— "as European and charming as you can get anywhere in the world" — another business owner explained:

> I would like to see galleries, I would like to see more cafes. This area is meant for tourism – it's built for tourism. The building down the street [pointing] was constructed in 1873 and it's absurd to me that the restaurant inside is closing, all because of the [methadone] clinic (Malcolm).

## Discussion: Re-Positioning the Gentrification 'War Zone'

Mobilizing metaphors of bodies and behaviours in and out of place, community opponents driven by the CRBA discursively articulated the redevelopment of Corktown through successive narratives of displacement that extended beyond notions of revanchism, effectively functioning to transform Toronto's gentrification frontier (Cresswell 1996; Smith 1996). While some residents and business owners measured the negative effects of gentrification in terms of the displacement of the very 'creative class' in whose image Corktown was ostensibly being re-created (Andrew), others posed the rate of re-investment and socio-demographic change as a positive force that would eventually serve to displace those deemed 'out of place' (Cresswell, 1996). "I think in two or three years you will see the face of this little village change dramatically", one business owner reported:

> In a couple years the clinic is going to move because it's going to be so uncomfortable. Could you imagine putting a facility like this on L---- Street next to [high-class retailers]? That's what's inevitably going to happen down here. People from the clinic are not going to be able to afford a Starbucks© coffee. Most of those people are dirty and they're not going to be welcome there. It's bad for everybody to have those kinds of people in this kind of neighbourhood, you know? It's just that: they're in the wrong place. (Malcolm)

Situating drug/service users and service sites as 'out of place' in the context of the rapidly transitional neighbourhood, Corktown opponents advanced explicit discourses of socio-spatial purification that worked to privilege the dark or 'shadow' side of urban boosterism representation (Cresswell 1996; Sibley 1995; Short 1999; Smith 2010, 2011a). In collaboration with a nearby downtown residents' association with a similarly conservative core constituency, the CRBA created an interactive website highlighting the area's perceived over-concentration of social services, attempting to suggest the neighbourhood's status as a 'service-dependant ghetto' (Benger 1996; Dear and Wolsch 1987; Sommers and Blomley 2002). Pinpointing correctional centres, rooming houses, public housing projects, homeless shelters, and 'drug use facilities'[6], the website asserted local social services operated "outside their regulatory restrictions", 'ghettoizing' and thereby creating "unnecessary risk for the user population [and] host community" (Garden District Residents' Association, 2007).

Corktown's socio-spatial repositioning was thus contingent on both discursive and electronically-mediated visual forms of neighbourhood self-representation. Intermingling popular cultural signifiers of gentrification (Starbucks©, BMW©s, lawyers) with references to the place of Corktown in relation to established elite, post-gentrified Toronto neighbourhoods, opponents situated heightened community opposition as a direct expression of larger political-economic forces. "As one of the last undeveloped areas in downtown Toronto Corktown is on a really quick upward trajectory," explained one business owner through comparative reference to the geographically bounded nature of New York City, resulting in property values "outpacing the rest of the city" (Dennis). Inventorying the area's 'phenomenal growth'[7], this narrative was invariably seamlessly intermingled with a localized discourse of decline, where the "jarring halt" of (re-)development was attributed solely to the establishment of the methadone clinic and its steady service user traffic. "You can see the number of 'for rent' signs that have come up just recently," commented another business owner: "I have tenants in my building who are threatening to leave because of the methadone clinic; they feel threatened, they don't feel safe in the neighbourhood" (Madeline).

Just as community opposition featured prominently in representations of Corktown's rebranding, conversely the precarious place of the neighbourhood was consistently located in relation to the larger social body politic in the ongoing campaign against the clinic. Here opponents invoked a recurrent succession of 'war' metaphors in reference to the neighbourhood conflict, posing the arrival of the methadone clinic as merely another phase in the community's longstanding and on-going 'battle' against unwanted social service facilities and by direct extension, drug/service users themselves. Mobilizing and effectively extending the combined ideological force of both 'revanchist' urbanism and the 'war on drugs', these narratives demonstrated how contestation surrounding the (contested) space of addiction/treatment effectively triggered the formation of a physical, discursive and ideological gentrification 'war zone' or 'battle ground' (Derrida 1993; Smith 1996; Smith 2010). Depicted as a series of interlinked phases, community representations of the 'war' against the methadone clinic shifted between (1) the mobilization of wider community

[6] Perhaps unsurprisingly, the map's two 'drug use facilities' consisted of the former and present location of the Corktown methadone clinic.

[7] Here, detailing the impact of local redevelopment, *Dennis* described a host of recent projects, including townhouses "starting at just under 600 thousand", the arrival of high-profile restaurants, and retrofitted industrial warehouses gutted by developers "spending millions of dollars in anticipation of a whole new type of clientele, business, and new type of person that's going to live and work in [the] area".

support for and/or involvement in the oppositional campaign, (2) processes of taking sides, identifying 'enemies', and apportioning blame, and (3) the active, direct enactment / deployment of community policing strategies. Shifting from a recourse to urban planning policy, to a critique of MMT practice, to the stigmatization of MMT users, during this period the perceived 'enemy' in the conflict therefore changed from municipal politicians, to clinic staff (and, in/directly, the physical site/space of the clinic), to individual drug/service users (Smith, 2010).

"We will continue to press useless politicians […] to change zoning regulations so that other communities are not raped in this way," remarked a Corktown business owner (Ingrid)[8]. Discussing earlier stages of the 'reclaiming' of Corktown, frustrated opponents situated municipal politicians as the primary enemy. "Every time somebody went to battle, [the city] just opened another [homeless shelter] across the street or a few doors away", reported another resident:

> A lot of my friends fought the battle, got rid of the drug dealers and all that, and then [politicians] go and put something in our neighbourhood that makes them [sic] say 'you know what, I've got better things to do with my life' (Nancy).

Recognizing the futility of political appeals, in a strategic about-face, opponents redirected attention to clinic staff – particularly the MMT pharmacist(s) and/or physician(s) or 'prescriber(s)' understood to variously run, manage and own the facility[9] – who were perceived to have little regard for the surrounding community:

> [The MMT physician] needs to get with the program and think about what he's doing, because I feel he just doesn't care, and unfortunately if this keeps up he's going to have people across the street put up a big sign saying "NO METH CLINIC". Does he want that? The people on B--- St. are furious, and the people on M--- St. are furious. There's such a brouhaha going on right now. (Sandy)

Beyond identifying and actively engaging a plural array of 'enemies', the larger battle over Corktown's community identity additionally revealed evidence of stark socio-economic division. Expressing her cumulative battle fatigue, one self-identified 'lower-class' resident discussed how some of the more affluent community members grew tired of 'fighting the war' and admitted defeat, retreating to established 'old money' enclaves or gentrification strongholds:

> I can't afford to move out of the neighbourhood, which is probably why I'm still here. Like, this is my home and everything, but if I had the money I'd probably move too. Like, we all fight the war, but if [the upper-class residents] can afford to leave, they'll leave. (Brenda)

[8] Under Ontario law, medical services can occupy any commercially-zoned property, with no special designation or regulations concerning addiction treatment service sites.

[9] This clinic can be seen as a quintessential example of what Smith (2011a: 297) referred to as a 'juice bar': "Owing to both the segregation of methadone users and the limited spectrum of treatment services, high-volume, group-practice methadone clinics are often referred to by critics as 'juice bars' in Canada, where methadone is mixed with orange juice and generally administered orally".

Community policing strategies revealed further socio-political and ideological divisions within the Corktown community; here, photographic documentation explicitly targeted at MMT users by an extreme faction of community opponents formed perhaps the primary source of public concern contention. While some locals insisted that "the addicts shouldn't be victimized" (Frank), others advanced the logic that by driving service users away, the clinic itself would be forced to close (Dennis, Edward). Positioning the neighbourhood as 'under attack' by the arrival of the clinic, proponents posed photographic documentation as a rational line of 'defence'. "I've been confronted by all sorts of people," one resident explained:

> We've got graffiti on the wall and hookers on the corner. I'm the one who's being attacked, and if I'm being attacked, I have the God given right, by the laws of this country, to defend myself. It's aggressive, yes, but it's just beginning to get aggressive. (Alan)

Woolford (2001) asserts that invocations of 'war' in the context of social problems perform two primary functions. First, war discourse provides a means of "signalling the justice of a certain cause", drawing simplistic lines between 'us' and 'them', 'good' and 'bad' (Woolford 2001: 44). Second, war functions as a response to situations deemed 'out of our hands' or beyond human control, negating the possibility for change "by placing the event in a realm that is not amenable to human action" (Woolford 2001: 45). Derrida's (1993) commentary concerning the ideological underpinnings of the 'war on drugs' demonstrates how war discourse relates to the broader social body politic. Prohibitionist discourse, Derrida (1993: 7) argues, implicitly suggests the (individual and collective) "protection of a 'natural' normality of the body". Although the 'natural', 'organic' body has long been exposed as a socially constructed utopian dream (Derrida 1993; Goodeve 1999; Haraway 1991; Ronell 1993), prohibitionists pose the 'artificial paradise' of addiction as an infectious threat to the 'ideal' (socio-political/individual) body, asserting that the 'addict' or drug dependant subject exists in a "world of simulacrum and fiction" (Derrida 1993: 4).

Drawing from Woolford (2001) and Derrida's (1993) assertions concerning the individual body and the body politic, the deployment of war metaphors in the Corktown conflict thus originate in the mutual constitution of place promotion and/as spatial purification, composed of intermingling, indistinguishable discourses of utopian promise and transformation, coupled with the distinctly dystopian threat of socio-spatial contagion and transgression induced by the dizzying, disorienting intoxication that accompanies the our narcotic modernity and 'disorder of drugs' (Derrida 1993; Ronell 1993; Smith 2010, 2011b).

## CONCLUSION

### Socio-Spatial Stigmatization, Gentrification and the Contested Space of Addiction/Treatment

Building on emergent literature regarding socio-spatial stigma and addiction treatment (Smith, 2010, 2011a; Fraser 2006; Radcliffe and Stevens, 2008), this chapter explored how urban redevelopment and boosterism-inspired regimes of representation intersect with forms of community opposition in the specific context of MMT.

While stigmatized urban populations such as people who are homeless and people who use drugs are often cited as impediments to urban redevelopment, spatial solutions are increasingly posed as an antidote to social problems such as public drug use (Cusick and Kimber 2007; Davis 1990; Fischer et al. 2004; Mitchell and Staeheli 2006; Smith 1996; Smith 2010, 2011a; Smith and Derkson 2002; Sommers and Blomley 2002). At the same time, however, gentrification also functions to exacerbate socio-spatial stigma through implicit and explicit forms of exclusion and marginalization (Colon and Marston 1999; Mitchell and Staeheli 2006; Smith 2010; Strike et al. 2004; Takahashi 1997). Tracing boosterism strategies employed in the representation of Corktown, interviews with local residents and business owners revealed a series of interdependent socio-spatial processes that shifted between notions of (re-)claiming, (re-)rebranding, and (re-)redevelopment. Here, opponents positioned the methadone clinic as 'out of place' in the transitional landscape of Corktown, where, in its place, the community imaginatively projected a Starbucks©. While some community members may still nurture this dream, it is perhaps relevant (albeit if only ironically) to note that the commercial space formerly occupied by the methadone clinic, situated less than one kilometre outside of Corktown, has since been redeveloped as a Starbucks© franchise.

Marshaling metaphors of displacement, these mutually constituting processes functioned to re-frame and re-positioning Corktown by utilizing the ideological momentum of both late-revanchist urbanism and the U.S.-led 'war on drugs', effectively transforming the redevelopment frontier into a gentrification 'battle ground' or 'war zone' with a shifting succession of physical and ideological battle lines. Playing a "pivotal role in neoliberal urbanism", Smith and Derksen (2002) and Smith (2002: 446) argue that the 1990s witnessed the "generalization of gentrification as global urban strategy," catalyzed by new forms of partnerships between nation-states and global capital.

As conflicts surrounding the contested space of addiction/treatment grow move common and acute, and forms of increasingly aggressive and intensively violent revanchist gentrification evolve and proliferate, it is therefore inevitable that Smith's (1996) redevelopment frontier will be increasingly rendered in the explicit terms of 'war', demarcating literal and metaphorical boundaries between the normative order of late-capitalist urbanism and the inherent socio-spatial transgression and infection encoded in the disorder of drugs[10] (Smith 2010; Fraser and Moore 2008). "In the name of the organic and originary naturalness of the body," Derrida (1993: 7) writes, "we declare and wage the war on drugs, the war against these artificial, pathogenic, and foreign aggressions [where] again we find a desire to reconstitute […] the 'ideal body,' the 'perfect body'". Building on Derrida's remarks, here the dynamic inter/intra-activity between the abject body of the addict and the social body of the city – a body-becoming-city-becoming-body (Fitzgerald and Threadgold 2004; Smith 2011b) – reveals the 'war on terror' as a thinly disguised permutation of the 'war on drugs'[11], providing "the constitutive outside, the outcast whose presence is indispensible"

[10] As one localized example of literal boundary inscription we might point to Victoria, Canada, which has imposed a series of colour-coded bordered zones (i.e. green zone, red zone), each corresponding to its own specific by-law ordinances (and attendant fines and penalties, which vary wildly by zone), enacted in large part to eradicate panhandling and other visible forms of poverty from the public view of tourists in the city's historic downtown core.

[11] Itself directly descendant from the 'cold war'. here, the slight of hand reinvention of the war on drugs into the 'war on terror' deserves significant further critical investigation; for a brief discussion, see Craig (2004).

(Sommers 1998: 289) for the imaginary construction of 'healthy' socio-spatial bodies in the late-capitalist neoliberal phase of 'our narcotic modernity' (Derrida 1993; Ronell 1993; Smith 2011b).

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*Chapter 2*

# URBAN PLANNING FOR COUGAR PRESENCE IN NORTH AMERICA: PRACTICES, CHALLENGES AND BENEFITS

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## ABSTRACT

This chapter examines cougar-human contacts in North America, as an issue of urban ecology, planning and management. Cougar-human interactions are increasing in several North American cities, but the reasons for these occurences are not clear. From the perspective of urban planning, important practices are green space development and variable policies towards invasive animals. Challenges involve gaining more knowledge of urban cougar behaviour and links to human attitudes and quality of life, with possible benefits to both people and cougars through mutually effective conservation and urban social policies. The common themes in the literature concern cougar preferences for utban green spaces and corridors, human fear of cougars and conservation – elimination policy conflicts for large carnivores, mostly bears. There are few studies from the perspective of cougar adaptability in mixed environments and human quality of life.

Based on an analysis of literature, cougar behavior within urban settlements is examined. It is concluded the actual configuration of urban landcover (e.g. green spaces, forest proximity, food sources) is only partially relevant to cougar - human relations, due to the highly adaptable, individualist and unpredictable behavior of the cougar. Effective management of cougar-human relations in urban contexts must incorporate cougar adaptability, transit and territorial needs in built as well as green areas, and also study human attitudes and impacts on human quality of life.

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## INTRODUCTION

Urbanization has emerged as a major contemporary factor for wildlife habitat penetration and consequently is a crucial issue for conservation studies, especially for large carnivores that may have competing needs with humans (Burdett et al., 2010). Human-felid conflicts in land use have been described as among the most important and neglected, conservation issues globally (Inskip and Zimmerman 2009).

Human action is a major predictor of large carnivore existence and extinction; and human population increase, intensified land use, public attitudes, human extirpation of prey species and suitable habitat, and urban sprawl have been major factors for large felid distribution and extinction (Weber and Rabinowitz 1996; Woodroffe 2000; Hayward and Somers 2009; Karanth and Chellam, 2009). These affect large carnivores, because of their mobility, requirement for large tracts of land, wide ranging prey species, low dispersed population densities, negative human attitudes and resultant problems with conservation (Grumbine, 1990; Purvis et al., 2000; Cardillo et al., 2004; Schipper et al., 2008; Campbell and Torres Alvarado 2011). These are in addition to the natural factors of prey abundance and habitat suitability (Karanth and Stith 1999; Carbone and Gittleman 2002; Karanth et al., 2004; Schipper et al., 2008; Karanth and Chellam 2009; Karanth et al., 2010). In fact, human factors may be more important than competition from other animal species or migration (Nowell and Jackson 1996; Jackson and Nowell 2008; Hayward and Somers 2009; Campbell and Torres Alvarado 2011).

Resultant extinctions of large felids include: the North African lion *Panthera leo leo* Linnaeus, 1758 extinct due to the long Roman and other habitation of North Africa (Nowell and Jackson 1996); the Javan tiger *Panthera tigris spondaica* Temminck, 1844, extinct in the 1970s in densely populated Java (Mazák and Groves 2006; Jackson and Nowell 2008); the Bali tiger *Panthera tigris balica* Schwarz, 1912 extinct through hunting (Jackson and Nowell 2008); and the Caspian Tiger *Panthera tigris virgata* Illiger, 1815 extinct through hunting and landuse (Seidensticker et al 1999; Jackson and Nowell 2008). In North America, the jaguar *Panthera onca* Linnaeus, 1758 is largely extinct from the United States, with the possible exception of Arizona (Hatten et al., 2005). Also, the Eastern Cougar *Puma concolor* Linnaeus 1771 was declared extinct in 2011 (U.S. Fish and Wildlife Service 2011).

Relevant ameliorative conservation requires contextual knowledge of both people and animals. For planning for an urban context, it is also necessary to assess the possibility of large carnivore utilization of built, sub-urban and peri-urban land, and the derived public attitudes (Campbell 2012).

It has been hypothesized that ecologically informed management at species and population levels, combined with knowledge of relevant human behaviors and attitudes may preserve carnivore presence, even with human population increase and variable public and government attitudes (Woodroffe 2000; Linnell 2001; Karanth and Chellam 2009; Fonturbel and Simonetti 2011). Crucial topics are variable public attitudes to wildlife and animal variability in behaviour and adaptability. These opinions may be dependent on real or imagined behaviours of animal species, their size and strength, and stakeholder vulnerabilities and the demographics of the human observers (Campbell 2012). For example, human demographic characteristics such as age and gender may contribute to different attitudes toward large carnivores, with women and older people being more concerned about their

personal safety. Also, in some cases, men are more likely to support carnivore hunting (Kellert 1994; Kellert et al., 1996; Bowman et al., 2001, 2004; Decker et al., 2001; Williamson 2002; Morzillo et al., 2007; Lagendijk and Gusset 2008; Campbell 2012).

## COMPARISONS BETWEEN COUGARS AND OTHER LARGE CARNIVORES

In North America, the commonest large felid that has a variably conflicted relationship with people is the cougar *Puma concolor* Linnaeus 1771, also named puma and mountain lion (Campbell and Lancaster 2010; Campbell 2012). The cougar is the second largest cat in the Americas and the fourth largest in the world after the tiger, lion and jaguar, usually slightly larger than the leopard (Campbell and Torres Alvarado 2011). The cougar is more adaptive and has a much wider range than the jaguar, ranging from Alaska and the Yukon in the north, to southern Chile and Argentina, and occupying forest, grassland, semi-urban and even built areas (Lopez-Gonzalez and Gonzalez-Romero 1998; Campbell 2012). Throughout its range, the cougar is sympatric with other larger carnivores (brown and black bears in North America, jaguars in North and South America) (Lopez-Gonzalez and Gonzalez-Romero 1998).

Both the cougar and jaguar are far less likely to attack people than tigers, lions and leopards in the Old World (Campbell and Torres Alvarado 2011). Nevertheless, compared with the jaguar, the cougar is generally considered as less dangerous to people (despite possibily a greater number of attacks from cougars than jaguars) and much more elusive in any context, a possible factor for its survival (Conforti and Azevedo 2003; Campbell and Torres Alvarado 2011). Comparative studies emphasize the larger size, superior strength, public fear, larger sized prey base and livestock predation tendencies of the jaguar (even when cougars are the actual livestock predators) (Farrell et al., 2000; Polisar et al., 2003; Scognamillo et al., 2003; Palmeira et al., 2008; Rosas-Rosas et al., 2008; Campbell and Torres Alvarado 2012; Rosas-Rosas and Bender 2012).

This study will focus on urban northern North America, where the sympatric carnivores are the brown and black bears; the jaguar is extinct here and is omitted from further mention. Urban cougar studies, while similar to urban bear studies in assessing human impacts, also differ in that cougars are elusive almost to the point of invisbility and their adaptability in built contexts is unpredictable and little understood. Unlike bears, cougars are not known for targeting human waste and gardens. Comparisons between these animals in terms of urban planning relate to three main topics: (1) the impacts of cougars on human quality of life; (2) the urban substrates most likely to attract or repel cougars; and (3) changes in cougar adaptation to new landscapes. In line with the title of this chapter concerning *practices*, *challenges* and *benefits*; the *practices* are the common development of urban green spaces, believed to attract cougars, and competing mindsets and practices that seek to conserve or criminalize cougars. The *challenges* concern the increased number of cougars and cougar-human contacts in urban areas, polarised public attitudes to cougars and the lack of understanding of cougar adaptability. The *benefits* concern the possibilities of cougar conservation enhancing human quality of life, and also benefiting the cougar as an aspect of North America's rich natural heritage. The study is based on the general literature; including

two papers I published based on field work in British Columbia (Campbell and Lancaster 2010; Campbell 2012).

## COUGARS IN NORTH AMERICA

Cougar interactions with humans in urban and suburban North America are steadily increasing (Beier 1993; Torres et al., 1996; Weaver et al., 1996; Campbell 2012). Some studies note that cougars avoid settled habitat, despite using such areas for transit (Dickson and Beier 2002, Dickson et al., 2005). Nevertheless, Beier et al., (2010) state that "probably every adult mountain lion in the coterminous United States has seen humans, crossed paved roads, and encountered human settlements", this despite the urban landscape being "impenetrable" to cougars. Certain cities, in particular Denver/Boulder, Missoula, Los Angeles and San Diego have experienced more cougar-human conflicts since the 1970s than other cities with similar cougar populations (Shuey 2008). The reasons for this discrepancy were however not clarified in this study. In the general literature, human encroachment into cougar territory is the principal identified culprit (Spencer et al., 2001, Dickson and Beier 2002; Thornton and Quinn 2009). Shuey (2008) demonstrated that all types of cougars, not only sub-adults and transients are common in exurban, suburban and other residential areas. Keston et al., (2013) argue that where sub-adults use urban landscapes more than adults do, it is largely because the former are attempting to establish a home range near their more prestine territory (see also Beier 1995; Beier et al., 2010; Logan and Sweanor 2001; Maehr et al., 2002; Ruth 1991; Van Dyke et al., 1986).

Kerston et al., (2013) note that cougar presence in urban areas is a function of their individualist rather than population level behaviour; hence, predictability in presence is difficult. This contrasts with the predictable behaviour of black bears, which intrude into urban areas for food; seasonal fruits, urban green spaces and organic garbage (Merkle et al., 2013). Black bears are more linked to property damage, urban penetration and general nuisance behavior (Decker et al., 1981; Herrero and Higgins 1999; Freedman et al., 2003; Morzillo et al., 2007). Compared with black bears, cougars are frequently seen as more feared, predatory, unpredictable and secretive, and more dangerous to humans especially children (Beier, 1991; Davis et al., 2001; Campbell and Lancaster 2010; Campbell 2012). Compared with brown bears, the cougar is less feared, with a much less "nefarious image" than the larger brown bear (Kellert et al., 1996: 5). This, due to the large size of the brown bear, its reputed ferocity and greater visibility, does not however negate the elusive threat of a cougar attack (Pelton et al., 1976; Kellert 1994; Campbell 2012).

Cougar behaviour and presence are relevant to urban planning when structures are built that are either preferred or avoided by cougars. Indirect concerns are the habitats of prey species and livestock, and possible rivals such as large dogs and domestic cats. As urban planning is also an exercise in social interaction, it concerns public attitudes to cougar presence in these different landcover types, and possible ameliorative actions.

An important literature-based hypothesis is that human-cougar conflicts may emerge because cougars prefer urban green spaces to built areas, these placed also valued for human recreation, family presence, transit and human health, conflicts may emerge. A second hypothesis would be that, unlike bears, cougars do not commonly forage for human waste,

but have more predatory intentions, hence the justified concern for pet animals and children in recreational, residential and transit areas (Campbell and Lancaster 2010). Consequently, a third hypothesis would be that there would a substantial impact on human quality of life, occasioned by fear, tension and location avoidance by concerned people, and this may create negative public attitudes to cougars. These points will be considered in turn, through a synthesis of relevant literature.

## URBAN GREEN SPACES AND COUGAR PRESENCE

Greenbelts, greenhearts and smaller urban green spaces are important manifestations of socially and environmentally sensitive urban planning (Fernandez-Juricic 2000; Park and Lee 2000; Chace et al., 2003; Hostetler and Knowles-Yanez 2003; Konijnendijk 2003; Morancho, 2003; Savard et al., 2000; Chiari and Seeland 2004; White et al., 2005). Urban green areas are defined variably, but there is a consensus that such landcover is characterised by varied proportions of trees, shrubs and grasses, surrounding urban areas (in the case of greenbelts), inside urban areas (in the case of greenhearts) and in scattered spots within an urban area (in the case of smaller, isolated green spaces) (Kuhn 2003; Campbell 2009). Urban green areas are expanding, due to the increased rates of urbanisation, the recreational and health interests of urban dwellers, and wildlife conservation (Bird et al., 1996; Belant 1997; Jokimaki 1999, 2003; Pirnat 2000; Fernandez-Juricic 2000; Savardetal 2000; Chiari and Seeland 2004; Cornelis and Hermy 2004; Erickson 2004).

An important consideration is cougar presence in urban green or mixed green and built areas, as transients, occasional inhabitants or even permanent residents (Campbell 2012). Few studies have documented the role of green space size and vegetation configuration for cougar presence (Campbell 2012). Some studies note that urban cougars are principally found in urban green patches and corridors, which include dense vegetation (Keston et al., 2011a, b, 2013). This is especially the case when cougars use such areas for hunting, relaxing, transit, territorial marking and family support, due to the presence of cover, and prey species (see also Burdett et al., 2010; White et al., 2011).

There is evidence that while cougars prefer green spaces for various purposes, they also frequent areas of higher heterogeneity, including both green and built landcover for transit or foraging (Campbell 2012). These studies complicate the green space hypothesis. Shuey (2008) gives evidence that there is no linear relation between cougar presence and green areas. In this study there were more cougar-human encounters in grassland and suburban land-cover types than in evergreen tree growth (preferred cougar habitat), even when the latter covered the more of the area studied. In addition, in heterogeneous landcover, there were more encounters near human-modified land cover distant from natural cougar habitat. By contrast, in homogeneous landcover, there were more encounters near natural land-cover types and fewer near human-modified land cover. By this logic, cities with highly heterogeneous landcover might witness more cougar-human conflicts in developed areas.

There is also evidence that cougars are present in built areas to a greater degree than is commonly supposed. In many cases cougars are able to use residential matrix when green spaces and corridors were absent, rapidly moving from one green space to another in the night, reducing possible human contact (Kerston et al., 2011b). This elusive behaviour, with

minimal contact with people, allows a "high potential for coexistence" between people and cougars (Keston et al., 2013 p.1). Kerston et al., (2013) note that "cougars and people appear to coexist better than previously perceived and use of areas close to people is likely to continue if these environments provide ample stalking and security cover, adequate prey resources, and limited human interference." These habits would also enable the cougars to reach those heterogeneous landscapes far from natural habitat where as noted by Shuey (2008), contacts are frequent. This adaptive utilization of urban non-green matrix for discreet passage and presence is of serious importance of urban configuration, because it conflicts with common perceptions of predictable green space untilization, and has implications for human quality of life and human-cougar conflicts outside the interactions in green spaces.

## THE COUGAR AND HUMAN QUALITY OF LIFE IN URBAN NORTH AMERICA

This section explores definitions of human quality of life (QOL), and the possible role of urban cougars in this issue. Human quality of life, a vital aspect of urban planning is argued to be "multidimensional" and hence difficult to define (Felce and Perry 1995; Felce and Perry 1996; Hughes and Hwang, 1996; Cummins, 1997a 1997b; Schalock, 1997, 2000, 2002). Nevertheless, some authors have elaborated diverse definitions, from which may be abstracted five key dimensions: physical well-being, material well-being, social well-being, emotional well-being, and development and activity. (Felce and Perry (1995). These dimensions are relevant to age, culture, socio-economic situation and other temporal and regional factors (Elorriaga et al., 2000; Campbell and Lancaster 2009). Because large predators have contact with people through invasive behaviour and human intrusion into habitats, such contacts are relevant to studies of QOL (Herrero and Higgins, 1999; Whittaker and Burns, 2001; Treves and Karanth, 2003; Kleiven et al., 2004; Loe and Roskaft, 2004; Gore et al., 2006; Spencer et al., 2007; Campbell and Lancaster 2010). Historically, the perception is that large carnivores threaten people and hence QOL and compete for valued environments such as recreational spaces. They therefore potentially affect all the QOL dimensions (physical well-being, material well-being, social well-being, emotional well-being, and development and activity). Felids that kill or maim people degrade people's physical and social well-being. Awareness of large felid proximity may affect human emotional health. Where felids intrude into valued areas, such as farmland, water sources, recreational areas and urban suburbs, material well-being may decline, as may peoples' developments and activities (Williamson 2002; Bowman et al., 2004; Gore 2006). In the case of the cougar, QOL may be linked more to fear than actual sightings and to feelings rather than actual presence and as such complicate conservation efforts within urban planning. The elusive and adaptable nature of the cougar and public fear of predation, appear to create a more complex problem than that of bear presence.

These complex issues intrude into the global conflict between conservation policy (*rationale* - large carnivores deserve conservation and may enhance QOL) and opposed concerns (*rationale* - primacy of safety, hunting or land use concerns, and QOL decline) (Kellert 1994; Campbell and Lancaster 2010; Campbell 2012; Schaltegger and Beständig 2012; Holthe and Baldus 2013). A study by Wolch et al., (1997: 106) noted that a dominant

theme in the media of the United States has portrayed the cougar as "a disruption to urban life, a nuisance to society, or a threat to humans." They further document negative media references (balanced with more positive references to conservation) to cougars as "serial killers", such statements linking cougars and "premeditated criminal behaviour", playing "on popular worries about rising crime and lawlessness" (p.109). Of course, "in any civilization, killers aren't allowed to run loose" (Perry 1994). There were also hints that cougars had begun to make a conscious choice to change their historic predatory patterns and secretive lifestyle in order to feast on pets, simply because they suddenly got "lazy" and no longer wish to exert themselves in a challenging hunt" (Wolch et al., 1997: 110). They argue that "such a characterization draws on deeply ingrained notions about the value of work, the moral laxity of those suspected of evading labour, and their status as undeserving of public support or protection." The judgement is clear: the cougar is a loose terror that be stopped.

These ideas, in conflict with equally powerful arguments for conservation find practical application in conservation and recreation areas, urban sprawl and agricultural intensification. These represent polarized land uses relevant to the high mobility of large felids and QOL concerns (Grumbine 1990; Karanth and Stith 1999; Robinson and Bennett, 2000; Balme et al., 2010). Large carnivore conservation for social benefit is arguably possible, given public tolerance and awareness of neutral or positive impacts of QOL (Linnell 2001; Karanth and Chellam, 2009). Therefore, urban planning and design, with attendant focus on relevant human behaviors, activities and attitudes, and indepth ecological information at species and population levels may be important for successful large carnivore conservation (Fonturbel and Simonetti 2011; Campbell 2012).

To clarify matters, there are two distinct issues: human attitudes to large carnivores (as beliefs, fears and observations can affect QOL) and actual attacks or other physical contacts on people that may also have a psychological impact. As noted above, age, culture, socio-economic situation and other temporal and regional factors affect perceptions of QOL dimensions (Elorriaga et al., 2000). Campbell's (2012) and Campbell and Lancaster's (2010) studies of large carnivores in North America hypothesised that women and older people are more afraid of large carnivores and hence more likely to see a negative impact on quality of life, while being more supportive of carnivore conservation as a benefit in rural habitat. These hypotheses were consistent with the relevant literature (Kellert, 1994; Pelton et al., 1976; Teel et al., 2002; McKee 2003; Deurbrouck 2007; Hayward and Somers 2009; Thornton and Quinn 2009; Morzillo et al., 2010). However, the findings of the first study were that more women than men believed that cougars increased the quality of life (while bears reduced it); while majorities of men thought they decreased the quality of life, age being irrelevant (Campbell 2012). In the related study, people did not think that cougars reduced quality of life, regardless of gender or age, and were unlikely (unlike bears) to invade houses, refuse dumps and/or damage property (Campbell and Lancaster 2010). As a result, significant majorities of people thought that cougars did not engage in troublesome behaviours (by comparison, significant majorities thought bears were troublesome). In both studies, people relied on hearsay, factual scientific information and their own judgement. More information on cougar behaviour might be helpful, despite the difficulty inherent in predicting its elusive behaviour.

These studies reveal variable perspectives on the relevance of social attitudes to cougar presence in places of human habitation. Public advocacy of cougar conservation as relevant to social and animal benefit, and concerns for public safety are particularly important, as these

issues may influence urban concerns such as property values, residential renting and recreational use, especially with frequent conflicts in built areas. Therefore, concerning the hypothesis of negative public attitudes in response to cougar presence, the conclusions are indeterminate and complex

## CONCLUSION

The evidence provided in this chapter points to substantial use of urban areas by cougars, with only limited contacts due to the cougar's elusive nature. Selected cases show that all types of cougars may be present in any type of landcover, even built landscapes, hence although green spaces are preferred cover, lack of green space may not necessarily prevent cougar presence if sufficient alternate cover and/or prey exist. These results complicate the posed hypotheses and illustrate the need for more conclusive information. Studies of cougar urban behaviour has focussed largely on the their landcover preferences: namely; green spaces and natural habitat suburban areas and also on potential danger to people and pet animals. Important gaps, however remain concerning cougar use of non-habitat for transit, territorial marking and/or free ranging. Hence, the practice of green space development may be only partially relevant to understanding cougar presence. Also under investigated are the the psychological and physical impacts of cougar presence. The ubiquitous nature of cougar presence and the need for green spaces precludes the development of an urban design to discourage cougar presence. The limited studies do not a support a conclusively negative or positive public view on QOL in cougar presence. Therefore, the challenge of urban planning is to focus on public education, further ecological studies, social impact assessments and regular presence monitoring in all contexts, enabling more accurate evaluation of cougar presence and urban infrastructural and social context. From a greater understanding of these issues may emerge increased benefits for both people and cougars.

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*Chapter 3*

# LANDSCAPE AND URBAN PLANNING: A SYSTEMIC APPROACH

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## ABSTRACT

This chapter aims to present landscape and urban planning as systemic tools for renewed urban intervention, offering possibilities for a physical-spatial restructuring of urban landscapes and for a better quality of life. The current proposal considers the landscape both as a system and as an active part of the whole urban planning process. In this process, the recognition and analysis of the relationships between various landscape systems, including urban, biophysical, and socio-cultural, along with social participation, play an important role and might work as the basis for creating systemic planning guidelines focused on the proposal of a system of open spaces as a structuring element of urban occupation.

## INTRODUCTION

The development of cities has, in general, followed an extended pattern, with a wide occupation of territory. This pattern usually follows the logic of road connections and other new ways of growth, which do not always pay due attention to the available landscape

resources, and thus often generate great imbalances in the urban landscape between the development/protection of open and occupied spaces and the needs of the people who live in it. It can be observed that the urban growth of many cities around the world, especially in recent decades, has been facing serious problems with regard to extensive urban occupation of the territory, which often results in settlements and roadways without cohesive plans of development, and open spaces widely segmented by the urban occupation mainly as protected land or land expecting new occupation, apart from socio-cultural disruptions and other factors.

In this context, urban landscapes tend to be seen as fragmented with regard to some of their most significant systems, namely their urban, biophysical, and socio-cultural systems.

Current urban planning guidelines, focused on extensive urban occupation, may play an important role in allowing and promoting such occupation and fragmentation of urban landscapes.

However, this fact also suggests that urban planning guidelines may play a key role in reversing this picture, that is, in restructuring it and in preserving the important systems of urban landscapes through urban interventions based on values that respect the integrity of the systems as a whole in the process of planning open and occupied spaces in an interrelated way, while paying attention to open spaces as possible structuring elements of the urban occupation. These urban interventions can also enhance and provide alternative actions, contributing to the performance of landscape dynamics and the preservation of resources in accordance with collective demands.

In this way, the various landscape systems including the urban, biophysical, and socio-cultural systems are understood as the basis for the understanding and analysis of the landscape, together with social participation as a collective designation from the citizens about the direction and destination of their landscape. Such an understanding makes possible fruitful interfaces regarding open and occupied spaces, with repercussions on the determination of urban planning guidelines and their implementation, focused on restructuring the urban landscape through the proposal of a system of open spaces as a structuring element of the urban occupation (Tardin, 2013).

It is believed that the interface between social participation and arguments from the technical analysis of landscape systems can generate valuable information to establish a dialogue between different social agents. This can form the basis for the planning of a system of open spaces as a possibility of renewing urban planning guidelines, in which nature and culture can be understood from a synergistic relationship in the process of continuous construction of the landscape.

In this sense, there is clearly a need to better understand the complexity of landscapes and the rescue of resources because such an understanding may provide an opportunity to generate new guidelines for urban planning and consequent renewed urban interventions on the related territory. Thus, acting on the territory according to its landscape systems, and especially open spaces, might serve as a key to “reading” and “interpreting” it, and for creating concrete intervention proposals for the delimitation of land use/occupation and activities with the intention of creating more balanced cities (Tardin, 2013).

In this way, urban planning based on landscape systems might act in the opposite direction of current urban planning tendencies focused on extensive urban occupation. First, it would identify the resources from open and occupied spaces along with collective demands, and then focus on how one can work to preserve and to create a system of open spaces while

also conducting the urban occupation and fulfilling its needs according to the collective demands, available resources, elements, and processes of open spaces. This would require planning by thinking first of what should not be occupied and why, and second of what should be occupied, why, and how, according to the elements and processes of the open space system and the people's intention. While such a procedure might create some technical arguments in the decision-making process in planning, at the same time it would help to influence urban development toward a more balanced approach.

It is important to observe and listen first, before intervention, so that one can recognize and analyze the urban landscape not only as a combination of systems, but also through the eyes of its citizens. The goal is to understand the landscape in its complexity before building urban landscapes, and to create a more balanced and cohesive relationship between open and occupied spaces, together with the people's intention. To explain this approach, this chapter is composed of five parts: 1 – *Urban landscape as a system*. This part aims to understand the concept of landscape and its particular complexities; 2 – *Systems of the urban landscape and concepts for planning*. This part aims to recognize the urban landscape and its elements and processes within a system and how it can influence the urban planning process; 3 – *Landscape and urban planning: Extensive urban occupation and landscape fragmentation.* This part describes current urban landscape fragmentation and the inefficacy of traditional plans, focused on extensive urban occupation, in promoting landscape integration, while also neglecting an analysis of landscape as a system in the planning process; 4 – *Planning a system of open spaces as a structuring element of urban occupation.* This part proposes a system of open spaces as a structuring element of urban occupation and as being able to produce an interrelated urban landscape with the potential to establish new relationships between the relevant parts; 5 – *Interface between social participation and technical analysis in planning the urban landscape.* This part deals with the importance of social participation in the revelation of the intangible connections between the physical-spatial landscape and the values and meanings bestowed on it by the people who live in it; it also focuses on the people's intention to act on the landscape as an important component to be considered in the process of planning.[1]

## URBAN LANDSCAPE AS A SYSTEM

In general, landscapes can be interpreted as the interaction between humans and nature over time, through the maintenance and/or adaptation of the natural environment to human needs and the consequent human interpretation of this creation according to its past and present practices and future aspirations. The urban landscape presupposes something vivid, which could be interpreted according to each individual and each society's specific view, and which results in the "construction-transformation" of the landscape over time (Cosgrove, 1984; Berque, 2009).

This approach assumes an understanding of nature as devoid of "intention," which would derive from human interpretation of the environment. However, while human intention

[1] Part of this chapter was first published in Portuguese. Reference: Tardin, R (2011). "Ordenação Sistêmica da Paisagem." In: Reis, Almir Francisco. (Org.), Arquitetura, Urbanidade e Meio Ambiente (pp. 151-172). Florianópolis: Editora UFSC.

determines the transformation of the environment, human intention is also influenced by the environment. That is, the intention itself is inseparably embedded in the process of transformation of and interaction with the environment.

In this sense, to recognize the landscape is, ultimately, to recognize what is decisive in the determination of who we are as a collective. In other words, it is the consideration of the landscape as a collective resource, as the collective action with the physical-spatial/functional territory. This collective action gives character to each particular landscape and shapes the landscape according to a collective intention. Thus, all landscapes are unique, resulting from the dynamic interaction of man and nature over time.

In this way, the landscape is the result of temporal, spatial, and functional processes, and also as the result of man's interpretation of his environment, which, according to the values of each society, is a result of the interrelationship between nature and culture. Thus, the landscape is the result of the objective observation of the physical-spatial environment and of the collective or individual experience regarding it, in a process of constant mutation. This allows for an understanding of nature and culture as interrelated processes with a complex order that permeates the spatial and time scales.

The urban landscape can be represented by elements and processes of different natures, including biophysical, urban, and socio-cultural processes, which have physical, spatial, and functional instances, and by various human interpretations of these. Together, they determine a landscape’s character. The understanding of a landscape and its different aspects might be accomplished simultaneously across different levels or scales, and through relationships between elements and processes. This means that the structure of the landscape remains as, and constitutes, itself in a system.

A system is viewed as a set of elements capable of establishing physical-spatial/functional relationships as well as relationships related to the human experience of the landscape, all of which are simultaneously intricate and open, including the environment and the people who experience it. For the configuration of a system, it is important to recognize its elements, processes, and the relationships established between them and their surroundings, under mutual influences and relative autonomy (Santos, 2002; Folch, 2003).

Thinking in terms of systems allows for the extrapolation of the borders that delimit the elements and leads to the perception that the sets formed by such elements and processes are intimately integrated and definitively associated, both naturally and culturally, and are complementary in their functional and spatial conception (Santos, 2002).

A possible understanding of the landscape is achieved through the perception of its elements and processes arranged in a system. It is through such perception and the structuring of different dimensions and different forms of a landscape that one can understand not only the landscape itself, but also the many spatial and functional relationships related to it, and the possibilities of living in it. As such, one realizes that there is strong interdependency among the various dimensions of the landscape and, hence, among its elements (Folch, 2003).

In this context, the identification of the elements and processes of the urban landscape in a system requires the recognition of their parts and how they might be structured in different scales between regions and cities, together with the values and meanings assigned to them by a specific community. It is important to consider that the systemic organizations between elements and processes of the landscape can be endless, equal to the number of possible landscapes.

From this fact results a physical-spatial instance that can be embraced by our senses. Physically, one can understand the urban landscape from the parts occupied by settlements and infrastructure and the parts free of occupation, the open spaces (Font, 1999). In other words, one can say that the physical-spatial urban landscape is formed by the urban occupation and by the presence of spaces free from occupation, in varying scales, between the urban and the regional, which are intimately related. Moreover, the urban landscape involves a non-physical-spatial instance made of interpretations, values, and meanings, all of which are attributed to a certain place by the people who live in it.

An understanding of the urban landscape presupposes an understanding of the region and the city as interlinked structures organized based on existing conditions under which material and immaterial processes, ranging from the systems of open spaces, infrastructure, and settlements, to the social and cultural daily lives of each place, are developed.

Observation of the physical-spatial urban landscape in a system, between open and occupied spaces, allows us to understand how the landscape has been built, and how the elements, processes, and relationships developed over time. Conversely, knowing the people's intention allows us to recognize the immaterial urban landscape, the affective dimension of the landscape, the current human experience, and its future intentions on its own landscape (Faga, 2006; Observatori del Paisatge of Catalonia, 2010; among others). Finally, both the physical-spatial dimension and the immaterial dimension are essential for planning landscapes in an integrated way.

The landscape holds great complexity while congregating the resources of the territory and the keys for its recognition and interpretation towards its effective planning and management. In this sense, to build a sustainable urban landscape means to create a good quality of life in our cities, with the preservation and development of fundamental resources that both generate and sustain it in its totality.

## SYSTEMS OF THE URBAN LANDSCAPE AND CONCEPTS FOR PLANNING

Talk of the urban landscape and its elements and processes in a system ultimately involves discussing an integrated landscape, with attention given to the local and the regional landscape at the same time, and to the various elements, processes, and relationships that make it up. In this interpretation, open spaces and occupied spaces form a systemic whole and are the physical-spatial basis for human experience and human interpretation.

Knowing the elements and processes that form the urban landscape and the values and meanings assigned to them is very important. This is because such knowledge enables the possibility of knowing each part of the landscape and its particularities, and how their analysis and evaluation may be important as guidelines for urban planning and for the definition of urban interventions. On the other hand, discovering the meanings of the elements and processes of landscapes enables us to think of the possibilities of intervention that focus on the balance between collective needs and collective resources, which can ultimately result in planning, inhabiting, and living according to the needs of each piece of territory and its respective communities.

The systems of the urban landscape include:

- The urban system, which consists basically of the elements and processes related to urbanization (open spaces and occupied spaces), their physical-spatial configurations, their established uses and activities, and their planning rules. These are parts of the city that comprise the spatial/functional structure, all of which are essential for urban life (Font et al, 1999; Salvador Palomo, 2003; Tardin, 2013; among others).
- The biophysical system, which is related to the natural elements and natural processes realized on open spaces. It consists of the elements necessary for the development of natural processes, such as vegetation, slope gradients, soil, water systems, and climate (McHarg, 1969; Gambino, 1992; Forman, 1995; among others).
- The socio-cultural system, which is related to the life of a community, its values, and its meanings. These values will be present in the arts (architecture, music, painting, sculpture, etc.), in the techniques and chains of production, in the distribution and consumption of goods, in religion, in philosophy, and in ordinary daily life. They are values and meanings assigned to the physical-spatial structure of the landscape and its organization, followed by their respective impacts on human relationships with the territory (Dematteis, 1995; Cosgrove, 1984; Folch, 2003, among others). Indeed, it is important to highlight the importance of recognizing the perceptions and affective attachments citizens have about a particular place by listening to what they have to say about it rather than observing and analyzing the landscape in an abstract way, devoid of real people's intentions (Faga, 2006; Observatori del Paisatge of Catalonia, 2010; among others).

Investing time in the analysis of the different systems that comprise landscapes leads to the understanding that landscapes are the result of temporal processes along with spatial and functional processes, and of the interpretations of people with regard to their environment, according to their needs, affective attachments, and lifestyles. This is because the values of each society change with time, along with its attempts at planning the physical-spatial environment. In this sense, having knowledge of the history of how elements and processes have been transformed over time implies the possibility of understanding the origins of the current problems and current potentials of a landscape, which is important for planning it successfully.

A material-immaterial analysis of landscape systems allows for the extrapolation of boundaries that define spaces (e.g., the administrative boundaries) and leads to the perception that the landscape is closely integrated and has its systems definitely associated, whether they are urban, biophysical, or socio-cultural systems. This interpretation represents a possible "reading" of landscape systems in the interest of a full apprehension of nature and the human experience of the landscape. However, this is not demarcated by rigid boundaries and, in contrast, presents great fluidity between elements, processes, and scales.

Thus, experiencing the landscape presupposes knowledge of its systems, their articulation, and their subsequent breakdown in the process of formation and transformation of the landscape, which are completely independent of abstract limits. This results in an understanding of, and acting on, the landscape to recognize it at its essence, its intricacies, its structure, its body, and especially its systemic processes under human experience.

Considering the landscape in this way may have important repercussions on the planning process, regardless of whether one is considering a city or a region.

In the urban landscape, various systems comprise a single system that should be taken into account systematically by planning to understand and to evaluate the landscape and to intervene in its internal structure. Thus, it is possible to act in the systems, providing them with a continuous movement, which allows for the development of the dynamics of each of their parts in constant interaction and closely related to the human experience of the landscape. Taking this systematic approach into consideration, some concepts for planning the urban landscape in a system should be observed as principles to guide one's recognition and decisions regarding the systems of the landscape:

- Diversity. The degree of co-existence and interrelation between different elements and processes in the systems of the landscape, both natural and human, to maintain physical-spatial/functional integrity and the "life" of the landscape in space and time.
- Equity. The degree of distribution of landscape resources in space and time to maintain its diversity, considering the costs and benefits of this process.
- Efficiency. The degree of optimization of the use of landscape resources in landscape construction to maintain its diversity and equity, considering the costs and benefits of this process.

The application of these concepts in the planning of the urban landscape can denote a certain quality for a landscape. This quality includes the degree of congruence between the dimensions of each system in its interaction with the others, with respect to the spaces they occupy, to the functions they accomplish, to the possible human experiences of it, and to the amount of time needed for the development of each dynamic involved in the processes.

Also, in the application of these concepts, a concrete understanding of the physical-spatial and functional processes of the landscape systems, through observation of the urban landscape (open spaces and occupied spaces) and its temporal character, and of the current collective intentions on a landscape comprises important data for the recognition of the past and present of the dynamics of such a landscape. This includes mapping this data, relating it to other data, and proposing concrete projects for planning. Thus, one can realize technical arguments to develop projects and planning towards effective actions on a specific urban landscape.

Based on these concepts, one seeks to recognize and to evaluate the current systems of the landscape and to specify the quality of the landscape, either existing or to be achieved, by relating material and immaterial instances in a balanced way through technical arguments that will guide the urban planning and its repercussions on open spaces and occupied spaces. Practically speaking, according to these concepts and the landscape systems, as general intentions for urban planning to get quality for a landscape, one can mention:

- To value the preservation of the natural environment, necessary for the maintenance of natural elements and natural processes.
- To value the visual attributes of a landscape that give it a special identity.
- To value social inclusion to access the resources the urban landscape offers, especially public services and facilities combined with satisfactory conditions for housing and network accessibility.

- To value local traditional communities and their living conditions to preserve local cultural characteristics.
- To value a sustainable and inclusive economy, considered from inclusive production chains, and which is socially, culturally, and biophysically responsible.
- To promote urban settlements towards the construction of optimized infrastructure and towards proposed land uses, buildings, and urban open spaces that may be structured by the system of open spaces and perform as a result of the interface between the systems of the landscape and the appreciation of its attributes.

## LANDSCAPE AND URBAN PLANNING: EXTENSIVE URBAN OCCUPATION AND LANDSCAPE FRAGMENTATION

The development of cities has generally followed an extended pattern, with a large territory occupation based usually on the logic of connecting roads and new forms of growth. It is often driven by strong real estate development whose intention is usually to occupy without proper attention to the landscape, which creates imbalances. Attention tends not to be paid to the preservation of resources and the values of the systems of the landscape, which are composed by the physical-spatial environment and its inhabiting people as an indissociable set that sustains itself and renews itself over the years.

In many cases, the formation of most cities has progressed through the application of an introverted logic of construction, producing spaces that tend to be unrelated. Fragmentation of the landscape can be viewed as the product of a number of factors. These include the non-consideration of citizens' intentions, the construction of infrastructure that has little to do with the environment, the presence of settlements that are often not well articulated, the insufficient presence of urban open spaces that often tend to be empty, and the existence of protected areas designed as nature sanctuaries that are, therefore, turned inward by their very nature. In general, in this context, urban and biophysical systems are seen as antagonistic and are reflections of a segmented “reading” of both parts, including the spatial, social, and functional segmentations. Many of the effects of this reality are due to positions taken by urban planning, which traditionally tend to encourage extensive occupation versus the protection of nature.

Usually, plans with a focus on urban occupation tend to consider environmental legislation as constituting restrictions on development, or as "limits" to urban settlements, which tend to be built as the negative side of nature. In this dynamic, the “logic” of urban occupation juxtaposes with the "logic" of environmental legislation, and neither one tends to incorporate systemic thinking about their resolutions (Tardin, 2013).

In this perspective, there is a predominance of plots of nature protection areas and already occupied areas, along with predictions for new urban occupations. This process does not consider the potential of open spaces as important elements for the integration among parts of the built landscape, the preservation of important biophysical and socio-cultural attributes of the landscape, and as possible structuring elements of urban occupation. Also, this approach does not consider open spaces as assets in the process of urban development, different from traditional environmental reserves, and capable of structuring the urban occupation in its development process (Tardin, 2013).

Physically, the result of such kind of planning tends to be an imbalanced urban landscape composed of fragmentary relationships among important systems of the landscape. To redirect this picture one can think of the adoption of physical-spatial planning criteria based on the perspective of the interrelationship between open spaces and occupied spaces and their dynamics as a whole, such as the urban, biophysical, or socio-cultural dynamics, along with social participation. On the other hand, there is also a need to determine, to control, and to manage the construction of urban settlements and the conformation of open spaces more related to, and based on, human values, and on the resources of the landscape.

In light of these circumstances, one can notice that, usually, in the traditional planning of the urban landscape there is a lack of strategic guidelines dealing with landscape complexity, with its distinct instances and inevitable evolution. This means that guidelines are needed that are broad in scale and capable of associating the urban and regional landscapes based on their systems and variables of analysis. Specifically, this could take the form of guidelines that go beyond area delimitation and its respective use of soil and type of occupation, and that could be more focused on concrete projects for the urban landscape for further action on it by creating planning, design and management strategies for both open spaces and occupied spaces. This could also take the form of guidelines that reflect an alternative way for planning based on the concept of a system of open spaces as a structuring element for the development of urban occupation (Tardin, 2013).

Such guidelines could reverse the traditional tendency of the extensive occupation of territory and propose an interrelationship of landscape systems along with the human experience of the landscape through the planning of the system of open spaces, mainly in non-consolidated areas, that present greater flexibility regarding their future designations in the process of urban development.

Hence, such guidelines might ensure both systemic analyses and systemic actions on landscapes by encouraging urban development and the maintenance of territory resources in an integrated way. In this conception, the biophysical system, the urban system, and the socio-cultural system comprise a single system in which nature and culture come together as one; they are interrelated and establish synergic relationships with each other reflected in both open and occupied spaces.

## PLANNING A SYSTEM OF OPEN SPACES AS A STRUCTURING ELEMENT OF URBAN OCCUPATION

Understanding of the complex nature of the urban landscape is critical to its construction, in which occupation and open spaces comprise a whole, and in which the planning of these in an interrelated way can intervene substantially in the definition of urban occupation, and vice versa, reversing the currently fragmented urban frame. Such understanding allows for the proposal of a system of open spaces as a structuring element of urban occupation and a form of guidance for urban planning that is able to produce a sutured urban landscape with the potential to establish new relationships between its relevant parts. It also allows for the planning of the urban landscape in a systemic way through the interrelated relationships among various processes. It is thus important to recognize open spaces together with occupied spaces, and the primacy of collective values, as fixed points for decision-making in the

planning of urban landscapes, with an emphasis on the creation of a system of open space as a structuring element of, and directly related to, the infrastructure, mainly roadways, and settlements (Tardin, 2013).

Specifically, this can take the form of predicting open spaces with the intention to protect, define, and relate them to the surrounding roads and settlements, whether existing or yet to come; predicting the roadway infrastructure while considering the definition of the road network and its variations, such as the areas of flow between the urban occupation parts or between the open spaces, and in accordance with the system of open spaces and settlements; and predicting settlements that follow a plan in accordance with the system of open spaces and related to the roadway infrastructure (Tardin, 2013).

Planning a system of open spaces as the first step in planning the urban landscape involves determining those areas where it is not advisable to occupy or that must be occupied under certain conditions, such as ensuring the protection of the collective resources of paramount importance for the biophysical, urban, and socio-cultural processes. Restrictions in relation to the urban occupation of open spaces can be determined according to the following implications (Tardin, 2013):

- The need for the development of natural processes, such as spaces and connections necessary for water dynamics, fauna and flora, and soil, as well as the observation of the risks that engender such dynamics, e.g., the possibility of flooding or landslides.
- The need for the valorization of the visual structure of the landscape, as a fundamental attribute for the maintenance of the visual identity of a place.
- The need to control and to integrate the urban occupation, including: limiting the scope of occupation, having more open space in very densely populated areas, creating open spaces between fragmented settlements that have little to do with each other in order to articulate them, and creating some public soil reserves to further negotiations regarding the development of urban occupation.
- The need to attend to the demands related to socio-cultural values by identifying the relationships between the community and their landscape, such as the values that are designated to the open spaces, whether they are visual, historical, social, religious, or productive. These values are relevant to the use and distribution of such spaces as a way to balance their presence and the opportunities for the development of activities and affective values that form the basis of the daily life of a community.

As a result of this analysis, one can construct a diagnosis for open spaces that includes a determination of their strengths and weaknesses. The strengths of open spaces can include any resources and values that should be preserved or developed, while the weaknesses can include any resources and values that must be changed or that have no great relevance to the organization of the system. This allows us to identify areas that should be preserved and areas that are more conducive to urban occupation, which can be structured by the presence of open spaces and their attributes.

At the same time the system of open spaces is established, along with urban occupation, it is important to think about the possibility of optimizing existing urban occupation with regard to settlements and roadway infrastructure and the importance it has in the development of the dynamics of the various landscape systems. Practically speaking, in the case of settlements it is important to take actions aimed at, among other things, the renewal of

existing settlements and the creation of new settlements, which are, if the circumstances warrant, structured by the system of open spaces that consider the dynamics of the various landscape systems. Here, it is beneficial to use strategies that increase the possibility of integrating the urban fabrics, balancing the use of soils, and preserving nature and social life.

The creation of new nuclei could incorporate low cost construction, increased control of the urban expansion according to the system of open spaces, and the definition of new patterns of settlements with, for example, the introduction of natural elements and natural processes in the construction of settlements, either through water (which could define the main roads and water connections) or vegetation (which could penetrate and determine the occupation of spaces around the buildings), thereby structuring it (Tardin, 2013).

Moreover, the restructuring of existing urban settlements could assist in the consideration of open spaces as an articulating element between settlements. Also, it is important to pay attention to the possible compaction of settlements, the use of existing public facilities, the rehabilitation of degraded settlements, and the preservation of built heritage, among other possibilities. Additionally, one can favor the functional autonomy of settlements, a greater diversity of activities and people, and a better distribution of uses. The creation of new public facilities, where required, helps to produce greater equity among communities. On the other hand, one can favor the establishment of new uses that relate the interior of settlements with the surrounding open spaces, a mixture of various types of buildings, and the introduction of rhythms and spatial sequences, and also encourage the creation of multiple centers. Conversely, the proposal of urban uses and rural uses in the natural environment can favor the relationship between settlements and open spaces, with, for example, a sufficient amount of public facilities, a sufficient supply of water activities, the possibility of logging, or the possibility of farming with cultivation techniques and the types of crops suited to the functions of the local biophysical processes and visual perceptions (Hough, 1998; Tardin, 2013; among others).

In this sense, planning open and occupied spaces together can help to cope with existing settlements and future ones in a systemic way. Such planning points to the need to inhabit the urban landscape in a sustainable way and according to the demands of the collective. The objective is thus to achieve an efficiency of urban occupation based on the costs and benefits it involves, whether they are related to the socio-cultural system, biophysical system, or the urban system. Apart from the spatial and functional decisions related to the settlements themselves (such as related to land use, density, and type of construction), which are derived from the types of analyses traditionally taken by urban planning, the consideration of established relationships between open and occupied spaces might affect and restructure the definitions of the settlements in different ways and according to the elements and processes of the system of open spaces as guidance in the construction of the urban occupation, such as with respect to its most appropriate land uses, land subdivisions, land occupation, density, and expansion (or lack thereof). Moreover, the consideration of established relationships between open and occupied spaces might affect the definition of roadway infrastructure and the possibilities of experiencing the landscape.

In such a case, the restructuring of road infrastructure involves considering the roadway network distribution with a focus on the resources and values of the landscape and people’s needs aligned with the system of open spaces, for example, by respecting the topography and the natural processes; taking advantage of the vegetation and water to structure the design of the roadway network; avoiding the "barrier effect” of water, animals, and plants, which can

be caused by roadways, by promoting passes through sections of the road; respecting and valuing visual, socio-cultural, and biophysical processes when designing the roads by the creation of lookouts, sidewalks for pedestrians, and places for alternative means of transportation; and adapting and implementing projects for the water supply, sanitation, the electricity supply (and alternative sources of energy), the selective collection of waste, and communication services (McHarg, 1969; Hough, 1998; Tardin, 2013; among others).

In addition, with regard to roadway infrastructure, besides allowing for the occupation of the urban landscape along with increased mobility, it also helps to establish important relationships among the components of the landscape between open spaces and occupied spaces, and the respective dynamics of the landscape. However, it is important to highlight the priority of optimizing the use of existing urban infrastructure, which refers to acting in favor of the compaction of the urban occupation, and avoiding its dispersion.

The project of roads could include, for example, proposing roads with attention to the hierarchy of spaces (e.g., main access streets, streets of internal distribution, access roads to buildings), encouraging coexistence between vehicles and people, promoting functional and spatial relationships between settlements, encouraging the use of public alternative transportation means, proposing the creation of pathways that penetrate natural spaces and connect the network of rural roads to urban roads, proposing the revaluation of the network of historic roads with a civic character and that is appropriate for leisure, and proposing the revaluation of the watercourse margins as possible ways for pedestrians and bicycles (McHarg, 1969; Hough, 1998; Tardin, 2013; among others).

In the process of planning the system of open spaces, cartography represents an important tool for registering observations and understandings of the landscape, the problems and potentials of each system, and the interrelationships established among the systems. Through cartography, one can record the elements and processes of the landscape, its values and meanings, and also its mutual affectations, thereby identifying where problems may or may not occur, and places for existing potentials. It is worth mentioning that the characteristics that engender cartography as a possible way to crystallize processes at any given time require constant updating. This necessity, however, does not decrease its importance in the planning of the urban landscape. In contrast, it enables the medium to serve as an effective tool for communication, design, and the demonstration of analyses and proposals, because it constitutes a tangible representation of the possibilities of intervention. Also, cartography may represent a possible interface between technical analysis and the recording of the demands of the collective, thus functioning as a collective letter of intention for the planning of the urban landscape (Observatori del Paisatge of Catalonia, 2010).

## INTERFACE BETWEEN SOCIAL PARTICIPATION AND TECHNICAL ANALYSIS IN PLANNING THE URBAN LANDSCAPE

The landscape as a collective fact develops a collective character given to it by the people who live in it and who affect the landscape's construction as well as being affected by it. That is, there are values and meanings attributed to a landscape and a collective intention to build a landscape that should be recognized and discussed with people and their representative institutions (governmental) and both the private sector and non-governmental sector, all of

which should be brought into the decision-making process of planning the urban landscape (Faga, 2006; Observatori del Paisatge of Catalonia, 2010; among others).

The importance of social participation in urban planning is already known (Hague and Jenkins, 2005; Faga, 2006; among others). The process of social participation involves listening, interpreting, going back to listen to citizens again, running new interpretations, and returning yet again to repeat the process. It is a process in which the listening, interpreting, and checking the given information allow for the identification of some collective intentions regarding a specific landscape (Faga, 2006; Observatori del Paisatge of Catalonia, 2010; among others).

In this sense, social participation allows for the identification of values and meanings attributed to a particular landscape by the experiences of the people living on it, the identification of their "reading" of it, and the identification of the consequent narratives people build as a construction of their own landscapes. This could be, for example, the values and meanings that can be attributed to the visual perceptions of a certain landscape, to its social uses, to the current and past beliefs of the people, to the economic activities carried out on the landscape, and to the inhabitants' daily life experiences and affective attachments, which vary over time and work to configure the reason for the existence of a given landscape (Observatori del Paisatge of Catalonia, 2010).

In addition, social participation allows for the identification of practices that give a landscape its character, as well as the collective intentions that serve to maintain or transform those practices. These practices belong to the citizens of a place which may be represented by any individual citizen and institutions involved in the process of construction of a landscape.

Thus, the identification and documentation of the values and meanings attributed to a landscape summed to form the collective intention to build a landscape and represent a radiography of the collective intentions regarding the present and future of a landscape. This radiography enables discussions and commitments among the parts involved in the process of planning, and it allows one to create guidelines for the planning of the urban landscape.

In this context, social participation held concurrently with technical analysis in the process of conception of a plan should allow for the elaboration of the process of planning as intended by the citizens in close negotiation with institutions. However, apprehension of the collective intentions related to social participation engenders a given time and a certain impossibility of covering all of the citizen's intentions, or even of obtaining a consensus, given the diversity of people and conflicts. Other limitations to the legitimacy of the process of social participation relate to, for example, who and how many people attend meetings, how such meetings are structured and developed, and the issue of whether there is (or is not) a real intention to develop a fully inclusive participation process in planning. Although social participation has increasingly (since the 1960s) gained status as an effective guideline for the deliberations of plans, it still faces restrictions on how it is performed, and when it is performed in the process of planning. It also faces restrictions on the legitimate use of social participation in the actual decision-makings process of planning, which might be contested owing to the possibility of being a manipulated process, which is a real risk. In many cases, social participation is reduced to the presentation to the public of the findings of a plan "built in the dark," far from public debate. In other cases, collective considerations can suffer arbitrary inductions from an incomplete interpretation, which, for example, favors one sector over another, which would amount to more of a manipulation of the social participation process than the result of an effective participation process itself (Arnstein, 1969).

However, despite such drawbacks, it is believed that the process of social participation represents an opportunity to build a collective and serious discourse followed by collective decisions, which together with technical arguments derived from analyses of the systems of the landscape and specifically from the proposal of a system of open spaces form guidelines for planning the urban landscape. In this sense, the whole (i.e., technical arguments plus social participation) forms a set of two-way movements in which technical knowledge can be made available that assists in reflection and the joint construction of concrete proposals for action on the urban landscape around the collective demands of planning.

The final product could be a plan understood and legitimated as a collective construction and designation of a community on its own landscape. This plan should reflect collective values, collective meanings, and collective practices, molding present and future scenarios according to the goals, interests, and conflicts present in the landscape. In this process, the technical arguments can emphasize aspects of the physical-spatial landscape that had not been previously observed by the citizens, and they can also emphasize any potential impacts, positive or negative, of the intentions of the citizens on the dynamics of the landscape. In this process, the planner should act as a "catalyst agent" by structuring the guidelines for planning, which should reflect the dialogue between social participation and technical analysis. The structuring of the guidelines for planning involves facilitating collective decision-making where technical analysis and the arguments that come from it might help to clarify disagreements and to guide political discussions, while also indicating possible consequences and ways forward to take a particular decision. In this sense, the collective discourse can be taken as the motivation, or the reason why certain relations between the systems of the landscape should be established by planning with the support of technical arguments, thereby indicating possible planning guidelines.

Thus, the interface between social participation and technical arguments can result in guidelines for urban planning that are more compatible with the proposed construction of a systemic landscape. In this way, the possibility is created to contribute to the social organization around the collective planning of the urban landscape reflected in the decisions taken in the planning process. Thus, the plan is seen as a guide to the collective construction of the landscape based on well-delineated technical arguments. The plan, therefore, internalizes one of its key roles: the defense of collective values as a basis for the public management of the resources of the landscape. In this context, one can realize better answers to some important questions that could be raised regarding a plan: For whom is the landscape for? Who plans it? How is the planning done? Why do the planning? To what ends does the planning serve? In addition, collective planning helps to ensure that any gains and losses in the planning process are enthroned in the decisions and responsibilities shared by the stakeholders.

## CONCLUSION

A systemic approach to planning the urban landscape implies, ultimately, the creation of a collective project of the landscape, which can be thought of as a response to the question of what kind of landscape a collective wants to realize. A collective project derived from the interaction between the recognition of the various systems of a landscape, and specifically

from a proposal of a system of open spaces as a structuring element of urban occupation, and social participation can determine a new agenda for a city. This corresponds to a more strategic and dynamic view of planning than the traditional perspective of plans taken separately from a systemic view of the landscape, or the perspective of plans that do not consider the collective intentions or their broader impacts on landscape systems, all of which tend to lead to ineffectiveness in addition to greater fragmentation of the landscape.

The possible relationships between the recognition and analysis of the elements and processes of the systems of the landscape, along with the proposal of a system of open spaces, social participation, and their combined effects on planning, together represent the interfaces in the deliberations of urban planning and the countless possibilities of developing systemic projects of different scales between cities and regions. This does not indicate an abstract landscape, but rather a lived landscape, that is, a human landscape, whose planning can be guided by concrete proposals for action rather than by patches or abstract lines.

In this context, it is emphasized the importance of considering the systems of the landscape, the proposal of a system of open spaces, and social participation as active agents of urban planning that provide measurable arguments for negotiation and public debate for the purpose of building proposals for urban intervention. This requires the understanding of the landscape systems along with the understanding of the values assigned to those systems, and the systemic relationships among them, which will then form the basis for urban planning guidelines through the proposal of a system of open spaces.

Such guidelines lead to consolidate a complex view of the landscape and, consequently, represent the recognition of the importance that the landscape has acquired in urban planning and, especially, the system of open spaces in the conduction of the future growth of occupied territory. These guidelines look for urban intervention alternatives and seek to make viable the sustainability and efficiency of the landscape, with the view of the landscape as an urban, biophysical, and socio-cultural asset. To this end, the analysis of and acting on the landscape involves the elaboration of urban planning that is focused on the specific needs of each place, according to the resources available as well as the landscape's unique values.

In this context, the main challenge for planning the urban landscape focuses on creating guidelines capable of reflecting the landscape quality to conduct the elaboration, execution, and follow-up of urban development. Specifically, these include guidelines that result in instruments of decision, through landscape criteria capable of supporting territorial development and its management processes, and guidelines in which the landscape as a whole gets a leading role in the process of planning, and in which the system of open spaces can serve as the conductor of the structuring of urban occupation.

However, the implementation of such planning also depends on the proper and integrated management of resources, with effective supervision over the development of the landscape. Moreover, such planning also implies the conjunction of spatial planning with permanent public policies that can enable the resulting proposals.

In sum, a systemic approach to landscape and urban planning, as presented here, is closely related to the recognition of the systems of the landscape, the proposal of a system of open spaces, along with social participation, as a basis for urban planning, which includes: trans-disciplinarity, as the integration of different approaches on the landscape that are usually represented by speeches and actions that tend to exist in isolation; trans-scalarity, which is the understanding of the multiple scales of the processes carried out across the landscape, which are interrelated in a system; trans-temporality, which is the awareness that

there is a past that must be understood and a future that depends on our actions and intentions in the present, which should be recognized and managed, and which should ultimately lead to more satisfactory results.

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*Chapter 4*

# URBAN PLANNING: PRACTICES, CHALLENGES AND BENEFITS FOR IMMIGRANTS

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## ABSTRACT

This chapter analyses the relations between the characteristics of different groups of immigrants and their integration. A decision-support system is developed that was founded on a management information system, a set of integration indicators, and cartographic and simulation interfaces for the simulation of territorially-focused policies.

This research is intended to improve municipal decisions and their implementation in order to promote an effective socio-economic, professional and civic local integration of immigrants, considering their population and settlement characteristics. It is applied, as a case study, to the Oporto Metropolitan Area (Portugal), but can be easily extended to other urban and metropolitan areas.

**Keywords**: Settlement patterns, immigrants' integration, decision-support systems, urban policies

## INTRODUCTION

Immigrants[1] are increasingly important for demographic, social and economic sustainability of developed countries, within a scope of global environments, ageing

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[1] A Portuguese immigrant is every person resident in Portugal who does not have Portuguese nationality (according to the concept adopted by the Aliens and Borders Service (SEF) and by the Portuguese National Statistics Institute (INE)).

populations, and free circulation of people (Fortuijn et al., 1998; Ellis, 2001; Garbaye, 2002; Bolt et al., 2008). So politicians and decision-makers are required to settle integration policies that support social and economic competitiveness, cohesion and sustainability, especially in the fields of housing and neighbourhoods, labour market and involvement in local communities (Andersen and Van Kempen, 2003; Dekker and Van Kempen, 2004; Van Beckhoven and Van Kempen, 2006; Van Marissing et al., 2006; Musterd and Van Kempen, 2007; Rebelo, 2010). Immigrants´ and integration issues have been studied since the seventies by the European Council and by the OECD Continuous Reporting System on Migration (SOPEMI). The European Commission has also sponsored since 1997 research and framework studies on migration, and several reports since the adoption of the Communication on Immigration, Integration and Employment, in 2003 (Heckmann et al., 2010). All these studies have generally encompassed the harmonization of common terms, data sources, indicators, and sustainable devices (Freeman, 1995; Borjas, 1996; Hansen, 1999; Rogers and Tillie, 2001; Entzinger and Biezveld, 2003; CNEL, 2004; Penninx, 2004; Geddes and Niessen, 2005; Di Bartolomeo and Di Bartolomeo, 2007). They subsequently have developed information and monitoring systems (Prominstat, 2012) and indexes (Mipex, 2012) to support the evaluation, measurement and comparison of integration policies´ performance among different countries, namely through the provision of data online (what have increased the visibility and awareness of national integration policies and of international trends). But these remarkable progresses in policy harmonization among different countries have not been kept up with studies focused on more specific territorial integration and on specific groups of immigrants. Within this scope, this research complements the current state of the art, making the transition between the political and legal framework of integration (at the macro level) to the settlement of concrete policies. It begins by the analysis of the settlement patterns of different groups of immigrants considering their ethnic and socio-economic-professional characteristics. It, then, develops a set of tools to design, implement and measure more specific territorially-scoped policies (at the micro level) in order to promote their effective local integration. This strengthens cause-and-effect relations between immigrants and host-societies, thus supporting more effective integration processes.

As a brief outline, this chapter first presents the theoretical state of the art on integration. The reasons underlying settlement patterns that most strongly shape immigrants´ territorial and socio-economic-professional integration are then described. Following on, a decision-support system is proposed and applied to the Oporto Metropolitan Area that includes a set of indicators to measure their territorial and socio-economic-professional integration. These are connected upstream with a territorial management information system, and downstream with cartographic display and simulation modules. These enable interventions on relevant territorial or socio-economic-professional variables, simulating alternative hypothetical scenarios whose impacts are assessed, computed and displayed on maps. Finally results are presented and discussed, followed by a section of conclusions and recommendations.

## THEORETICAL FRAMEWORK

Integration consists in a set of dynamic functional processes of reciprocal adjustment between immigrants and natives within a certain host-society that ensure them equal rights,

duties and responsibilities (Wellman, 1988; Goering et al., 1995; Kleit, 2001; Massey, 1990; Logan et al., 1996). This involves the participation of immigrants in key civic and socio-economic fields in host-societies. Conversely, they should respect the basic law, norms and values, without renouncing their ethnic and cultural identity and characteristics (European Commission, 2003; Heckmann et al., 2010; Mipex, 2012; Prominstat, 2012).

Most studies on integration are theoretically placed between the neoclassical theoretical view (integration as one-way assimilation processes) and more recent analyses (integration as multiculturalist processes) (Heckmann et al., 2010).

The current state of the art points out four main integration fields (Heckmann et al., 2010): structural integration (social integration in host-society's institutions); cultural integration (values, norms and language skills); interactive integration (interpersonal and transnational networks); and identificative integration (sense of belonging). These fields are assessed under three different perspectives: personal and systemic openness of the main society, immigrants´ contextual issues, and societal issues. The society's openness expresses through natives´ attitudes towards immigrants and ethnic minorities (Scott, 1980; Wellman, 1988; Massey, 1990; Goering et al., 1995; Ellis, 2001; Kleit, 2001; Madoré, 2005; Logan, 2006), including discriminating behaviours (Fonseca et al., 2002; Malheiros, 2002; Musterd et al., 2007), dominant social discourses and accessibility to key institutions. Immigrants´ contextual issues refer to their ethnic-cultural background, age, stay length, transnational networks and activities, cultural norms (Massey, 1990; Ellis, 2001; Madoré, 2005; Logan, 2006), and other immigrant-related activities (Scott, 1980; Wellman, 1988; Li, 1998; Rosebaum et al., 1999; Cameron, 2000; Wyly et al., 2001). The societal context refers to the characteristics of host-societies (Fortuijn et al., 1998; Bolt et al., 2008), to social or cultural sub-groups, and to socio-spatial criteria (namely neighbourhood composition, features and trends) (Logan et al., 1996; Arbaci, 2008; Heckmann et al., 2010).

Recent research on integration mainly focuses on national levels. About half the studies analyse structural integration (immigrants´ participation in the labour market, their educational attainments, housing situation, citizenship and access to the health system, and the consequences of integration to the host-society), and the other half covers cultural, interactive and identificative integration (Heckmann et al., 2010). Few analysis, however, are centred on host-societies´ initiatives towards integration.

Decision-makers and researchers in the bosom of the European Union have harmonized integration policies based on a thorough grasp of how immigration influence societies and vice-versa, and have developed harmonized databases. Such is the case of Prominstat that renders compatible statistical (and administrative) data on immigrants among 27 European countries (EU countries + Norway and Switzerland, excluding Romania and Bulgaria) (Prominstat, 2012) in order to support comparative quantitative research. Different monitoring systems have also been implemented, based on trans-European common goals, concepts, indicators and assessment mechanisms in the wake of the adoption, in 2004, of the Common Basic Principles for Immigrant Integration Policy in the EU (see Heckmann et al., 2010). These monitoring systems interconnect data, extend it to enclose different dimensions of integration, compare results, adjust policies, monitor and measure the evolution of integration (Council of the European Union, 2004; Heckmann et al., 2010, Niessen, 2009).

The main data sources are census data, counts, registers and surveys. Census data are systematically and exhaustively collected, covers all the individuals that live in a certain area and allow the identification of specific groups, is reliable, and enables cross-section and

longitudinal analysis. They are, nevertheless, quite expensive, data are only collected each ten years, and undercount illegal immigrants[2]. Counts are regular and involve low costs (as they found on administrative data), but often mismatch theoretical concepts, and are more focused on specific social fields, cover more limited periods, and may concern cases or individuals. Registers are longitudinal in scope, focused on strict themes, don'ts usually keep historical data over long periods, and results may be biased because they mainly refer either to those recently arrived or to long-term residents. Surveys provide additional background qualitative data, support longitudinal and either multi-thematic or more detailed analysis, but often questions are left without answers. The main data troubles of these data sources arise because data aren't always compatible neither with theoretical concepts nor with other data, and the periods covered are often mismatched.

Decision support systems (DSS's) get ahead of monitoring systems, as they extend their functionalities, and render operational socio-economic, territorial and civic integration policies. Indeed they are flexible interactive computational systems that support the resolution of non-structured or semi-structured problems[3]. They resort to analytical models, spatial databases, decision maker's wisdom, and to an interactive interface. Besides, they are conceived as ad hoc systems, started and controlled by decision-makers, and able to point out quick responses. Geographic information systems are specific decision-support systems that use geographic databases to build up and display maps and other graphs, stressing patterns and connections. These DSS's systematize and treat data (collected at regular intervals) so to figure out reality and respective evolution, thus supporting better decisions. For these reasons, they should be used by administrators and policy-makers both in strategic and in operational decisions.

The indicators used both by monitoring and decision-support systems may split into two different kinds: contextual or input indicators (that measure governmental policies and integration tools in quantitative and qualitative terms), and performance, output or results indicators (that refer to the situation effectively achieved by key-groups) (Huddleston 2009).

The current most representative input indicator is the Migrant Integration Policy Index (MIPEX), adopted by the whole EU members, as well as by Norway, Switzerland, Canada, USA, Australia and Japan. It quantifies the opinion of national academics and top institutions concerning immigration law and public policies, in seven different political fields (mobility in the labour market, family rejoin, education, political participation, long-term residence, access to nationality, and anti-discrimination) (Mipex, 2012) and, as a result, settles a quantified scale (index) to measure global integration. This index enables the measurement, ordering and comparison of policy performance towards integration goals – equal rights, responsibilities and opportunities -, as well as cross section comparative analysis, and longitudinal studies. It also supports the design of new laws, regulations and policies (Mipex, 2012).

At the operational level, the "EU Blue Card System" is a tool that supports the implementation of the European common integration policies aimed at the attraction of high skilled immigrants into EU countries (providing them with the same residential and economic

[2] Data on illegal immigrants is very difficult to collect and probably only specific surveys could give some insights. CLANDESTINO - the current database on irregular migration (http://irregular-migration.net/) - doesn't provide statistical data for Portugal.

[3] Structured decisions refer to situations where the course of action can be specified beforehand. Semi-structured decisions further depend on other factors.

rights as natives). It promotes the economic development of Europe and its competitiveness as compared to the USA, Canada, Australia or New Zealand. However, it is criticized as it distinguishes between immigrants (Bluecard, 2012).

Governmental policies are obviously prominent as they settle the legal and political framework for integration (Mipex, 2012). And the inclusion of different integration policies within a sole index is interesting from a theoretical international standpoint, as it gauges the absolute and relative performance of integration policies (Di Bartolomeo and Di Bartolomeo, 2007). Besides, it underlies governmental strategic guidelines and their inclusion in law. However, this assessment is general for each country as it assesses integration for the whole relevant political fields, and for the whole immigrants (regardless their inherent ethnic features), so it hampers a detailed micro analysis of the different integration sides (especially those that impact territory the most). In order to define concrete planning and management measures targeted to immigrants, it is important that specific facets of integration are easily displayed, perceived and quantified, and that specific groups of immigrants are studied in more detail (INTI, 2006) as they hold human, socio-economic and professional features that distinguish them. So reconciled and longitudinal data and results indicators (Niessen, 2009; Heckmann et al., 2010) should be used to describe the whole dimensions of integration (and the complex underling reasons), and should clearly identify and describe the target groups or subgroups, as well as natives.

Despite every effort of European countries to promote integration (especially the structural one), the identification of labour, housing and civic opportunities and their implementation in local economies encompass the development of attractive neighbourhoods. These should be able to engender proper conditions to immigrants´ personal, socio-economic and professional development, encouraging their local involvement and participation (cultural, interative and identificative integration) (Mipex, 2012).

Thus the definition of local policies require a deeper assessment of the reasons underlying immigrants settlement patterns[4] that mostly shape their socio-economic and territorial integration, considering their contextual features (Massey, 1990; Fonseca, 1999; Fonseca et al., 2002; Malheiros, 2002; Peach, 2002; Musterd and Van Kempen, 2007): territorial characteristics; socio-spatial differentiation; performance of housing and labour markets; and spatial and socio-economic-professional mobility. These reasons condition immigrants´ perception and appropriation of neighbourhoods (Scott, 1980; Fieldhouse, 1999) that exert different impacts on their spatial, social and economic-professional integration (Fortuijn et al., 1998; Iredale, 2002; Benson-Rea and Rawlinson, 2003; Logan, 2006; Bolt et al., 2008). Thus computation and display of the settlement patterns of different groups of immigrants provide for the analysis of their integration. Next is presented a brief description and justification of the importance of each of these reasons to explain immigrants´ settlement patterns, and how they shape their integration.

Immigrants settle in a pre-existent physical environment, characterised by certain urban morphologies and building typologies, and by certain sociological neighbourhoods (Wellman, 1988; Li, 1998; Rosebaum et al., 1999; Cameron, 2000; Wyly et al., 2001). Their settlements are conditioned by the personal and systemic openness of the host-society, that marks their exposition to native population and to other communities (Goering et al., 1995; Gould and

[4] Settlement processes should, therefore, ensure that immigrants stay in the host-society and support their participation and integration in its social and economic structures.

Turner, 1997; Kleit, 2001), their socio-economic performance (Goering et al., 1995; Kleit, 2001), and their access to social, economic and professional opportunities (Galster, 1987; Massey, 1990; Ellen and Turner, 1997; Fortuijn et al., 1998; Rosebaum et al., 1999; Iredale, 2002; Benson-Rea and Rawlinson, 2003; Logan, 2006; Bolt et al., 2008). Immigrants develop their interpersonal networks, either with natives or with immigrants (cultural and interactive integration), and develop their sense of belonging (identificative integration) within their neighbourhoods, what guides both their socio-economic performance and their access to key-institutions. Land use density (Frenkel and Ashkenazi, 2008) and the spatial distribution of buildings may be easily rendered operational (Galster et al., 2001; Ewing et al, 2002).

Urban and housing policies, housing markets´ structures, access to home and to urban facilities, and the public transports system (Ewing et al., 2002) strongly shape immigrants´ residential and work locations and, consequently, their socio-economic and professional structural integration (Wellman, 1988; Massey, 1990; Goering et al., 1995; Rosebaum et al., 1999; Kleit, 2001; Malheiros, 2002; Peach, 2002; Musterd and Van Kempen, 2007), thus being essential in the social reproduction of individuals (identificative integration) (Massey, 1990; Fonseca et al., 2002; Malheiros, 2002; Peach, 2002; Musterd and Van Kempen, 2007).

The socio-spatial differentiation mainly results from the characteristics of the urban local economies (Malheiros, 2002; Arbaci, 2008), the territorial distribution of investments (which engender jobs) (Massey, 1990), the system of urban transports (and the mobility it implies), and the existence of housing and urban infrastructures and equipments near the main employment poles. The inter-relations between the socio-economic territorial context of the host-society and immigrants´ demographic, economic and professional features also explain settlement patterns, as they support the identification of the activities most responsible for the attraction of immigrant labour, and of their homes´ location and accessibility (Massey, 1990; Fonseca, 1999; Fonseca et al., 2002; Malheiros, 2002).

Within a global environment, firms increasingly adopt internationalization, outsourcing, and specialization strategies; choose flexible organizational structures; resort to varying and diverse raw material and labour sources; serve a wide range of markets; pursue swift relocation and labour recruitment policies; spread throughout huge territories, and connect different functional poles with varying territorial cover (Salt and Findlay, 1989). These characteristics influence labour markets and, subsequently, immigrants´ settlement patterns, as firms cease to keep their own permanent workers, and resort to diversified, temporary and flexible labour instead. This reflects on the kinds of available employments, on the importance immigrants attach to work, on the relative location of home and work, on the spatial mobility and turnover of work posts, and on local economies´ receptivity to their academic backgrounds, professional skills and entrepreneurial abilities (Benson-Rea and Rawlinson, 2003).

The evolution of immigrants' locations throughout time reflects respective spatial mobility. It depends on the distances to the main and secondary centres where most firms and services locate (Alonso, 1964), and is also conditioned by family budgets assigned to home, transports and other expenses, by home-work relative locations, and by the morphological and typological characteristics of alternative locations (Crone and Voith, 1999). Socio-economic and professional mobility, by its turn, depends on the perception that urban economies distribute resources and opportunities unevenly in space, so immigrants move in order to reach the highest social and professional levels they manage to (Massey, 1990; Alba and

Logan, 1992; Logan et al., 1996; Fonseca, 1999; Fonseca et al., 2002; Malheiros, 2002; Peach, 2002; Musterd and Van Kempen, 2007; Arbaci, 2008).

The attraction exerted on immigrants by territorial socio-economic and professional characteristics depends on their contextual features, namely their motivations, academic qualifications, and professional skills (Logan, 2006), on the trade-off between professional and family/community reasons, on labour agreements, and on their employment expectations (Borjas, 1994). Immigrants respond to labour supply either taking jobs not searched for by natives, or searching for more qualified jobs (Massey, 1990; Altonji and Card, 1991; LaLonde and Topel, 1991; Borjas et al., 1996; Ellen and Turner, 1997; Fieldhouse, 1999; Rosebaum et al., 1999). The interaction among all those reasons explains differences among immigrants' socio-economic-professional mobility patterns (Massey, 1990; Rosebaum et al., 1999). Within this background, each immigrant should pursue his own cognitive, social and cultural skills in order to attain higher socio-economic positions in host-societies (Heckmann et al., 2010).

## METHODS

### Methodological Outline

The research reported in this chapter aims at supporting immigrants´ integration planning and management, based on its relation to respective land use patterns. So a decision-support system was developed in order to render operational the links between settlement patterns and the reasons that underlie them (Figure 1). This system assesses integration and monitors its evolution under the spatial and the socio-economic-professional perspectives. Besides, as it includes upstream a huge metropolitan management information system and downstream a display and simulation interface, it renders especially flexible the study of integration along time, and the comparison among different urban and metropolitan realities.

The proposed management information system is made of two databases, developed at the parish level. The former assembles exhaustive data on each individual's demographic, economic and professional characteristics, thus covering the whole population living in the studied metropolitan area. The latter assembles data on the territorial characteristics. These databases should be upgraded on regular intervals.

The decision-support system includes this data (Chart 1) into a set of indicators that support the identification, quantification and display of the influence exerted on immigrants´ integration by the socio-spatial differentiation, the performance of the housing and labour markets; and their spatial and socio-economic-professional mobility.

These indicators are computed at the parish level, and then grouped by municipality. The analysis is carried out comparing the values of the indicators between two or more distinct moments, in order to assess their evolution in-between.

The socio-spatial differentiation due to the characteristics of the urban economies is expressed by the relative distribution of each group of immigrants according to his professional (or economic) features in relation to natives´. It may be then cartographically compared with the distribution of the main economic activities or investments (that approach the territorial distribution of employment opportunities). The performance of the housing

market in relation to a certain group may be approached from the comparison of respective distribution with the density of construction (Rebelo, 2010). The performance of the labour market is assessed through the computation of the proportion of immigrants that hold certain professional (or economic) characteristics in the homologous total active population. The spatial mobility is computed as the territorial distribution of a certain group of immigrants throughout different moments in time. Finally, the socio-economic-professional mobility is appraised from the territorial distribution of career advancements towards certain professional target-groups.

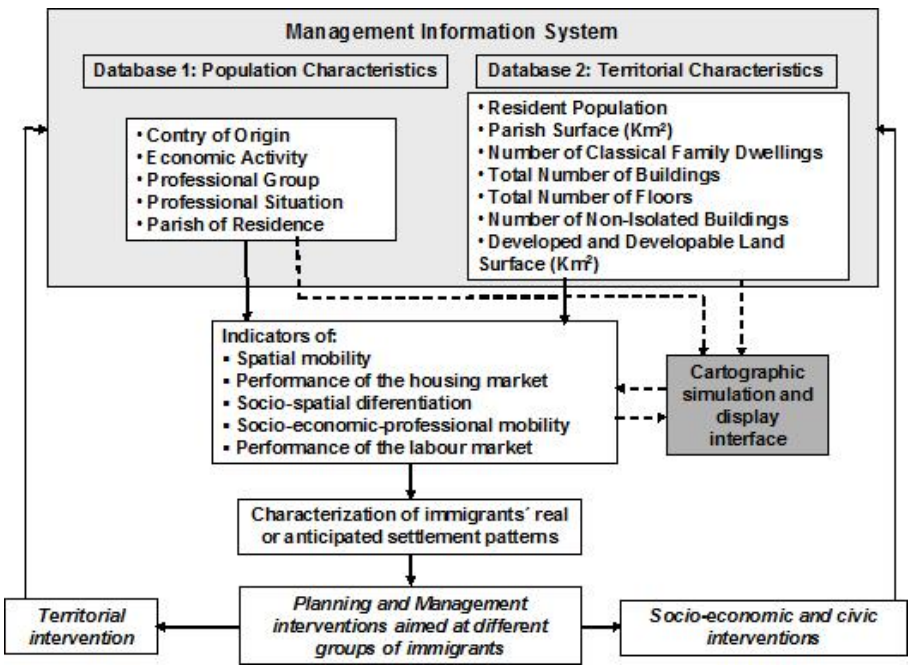


Figure 1. Outline of the proposed decision-support system.

Finally, the simulation and display interface supports the test of alternative decision scenarios that result from changes in the factors that underlie the territorial patterns. The effect of these hypothetical decisions on immigrants´ integration may be assessed accordingly (Rebelo, 2010), namely through the cartographic display of cross-section data and indicators, the comparison among different groups of immigrants, and the comparison of homologous groups among distinct urban/metropolitan areas.

The overlapping of maps with different territorial, socio-economic or professional data clearly points out areas where territorial intervention should be pursued, according to local-settled goals. So this decision-support system supports the design of integration strategies and policies in housing and labour markets and sociological fields, and the subsequent design of implementation measures. These interventions may occur whether at strategic or at operational levels: in the former through the provision of housing, employments, and access to equipments, and in the latter through the access to specific working posts, or through civic or political participation in communities.

| Indicators | Computation of the Indicators |
|---|---|
| **Spatial mobility** | Parish of residence of each immigrant or group of immigrants |
| **Performance of the housing market*** | $\frac{\text{Total number of buildings}}{\text{Developed and developable urban area}}$ |
| **Socio-spatial differentiation*** | $\frac{\frac{\text{Nº of immigrants that belong to a certain professional group *}}{\text{Total number of immigrants that belong to all professional groups *}}}{\frac{\text{Total nº of people that belong to the studied professional group * in the Oporto M. Area}}{\text{Total nº of people that belong to all professional groups * in the Oporto M. Area}}}$ |
| **Socio-economic-professional mobility*** | $\frac{\text{Nº of immigrants that ascended to a certain professional group *}}{\text{Total nº of immigrants that belong to this professional group *}}$ |
| **Performance of the labour market*** | $\frac{\text{Nº of immigrants that belong to a certain professional group *}}{\text{Total number of people that belong to the studied professional group *}}$ |

* Despite in this example the indicators are computed according to immigrants´ professional group, the same computation method may be applied considering immigrants´ economic activity or professional situation instead.

Chart 1. Indicators of immigrants´ integration used in this research.

## Analysis of Immigrants' Integration in the Oporto Metropolitan Area

In the next section is depicted the planning perspective that results from the application of the proposed methodology to the Oporto Metropolitan Area[5]. Some hints are further provided in order to extend its application to management purposes. The Oporto Metropolitan Area locates in the north of Portugal and is made of nine municipalities (Espinho, Gondomar, Maia, Matosinhos, Porto, Póvoa de Varzim, Valongo, Vila do Conde and Vila Nova de Gaia) and a hundred and thirty parishes (Figure 2). According to the population census (INE, 2001), in this metropolitan area lived 1 208 026 natives and 52 654 immigrants (that amounted to about 4,2% of total population). About 72% of working Portuguese-speaking African immigrants holds secondary, middle or high education studies (against only 41,6% of working natives). They are, further, the ones that mostly work in the tertiary sector of the economy (79,1% versus 62% of natives), after the Brazilian immigrants (83,4%). About 46,2% of those immigrants work in upper professional groups (public administration, directors and firms´ upper staff; intellectual and scientific experts; and intermediate level technicians and professionals) (versus 27,7% of natives), only surpassed by Brazilian immigrants (49,9%). Additionally, they are the second ethnic-cultural group with higher percentage of workers for somebody else (86,3%, after 92,9% of East European immigrants). Finally, Portuguese-speaking African workers are the ones whose parishes of work most diverge from the parishes of residence (78,1% versus 71% of natives).

[5] As this analysis mainly centres in planning purposes, it resorts to data collected and treated from population censuses (despite I tried to apply the methodology to the recent census carried out in 2011, the results weren't yet available). The classes of data used for each variable conform to the notation adopted by the Portuguese National Statistics Institute (INE).


Figure 2. Municipalities and parishes of the Oporto metropolitan area.

Working immigrants that live in this metropolitan area came from West European countries (19,9%), Brazil (11,1%), East European countries (1,9%), Portuguese-speaking African countries (53%), and other foreign countries (14,1%) (Rebelo, 2010) (Chart 2).

| | | West Europe (%) | Brazil (%) | East Europe (%) | Portuguese-speaking African countries (%) | Other foreign countries (%) | Total immigrants (%) | Total natives (%) |
|---|---|---|---|---|---|---|---|---|
| Academic Background | Without academic degree | 0,2 | 0,3 | 1,2 | 0,5 | 1,6 | 0,6 | 0,9 |
| | Basic Education | 28,2 | 25,7 | 26,7 | 27,5 | 28,0 | 27,5 | 57,5 |
| | Secondary Education | 31,2 | 32,0 | 34,0 | 31,7 | 32,8 | 31,8 | 22,5 |
| | Middle or higher education | 40,4 | 42,0 | 38,1 | 40,3 | 37,6 | 40,1 | 19,1 |
| Sector pf economic activity | Primary sector | 1,0 | 0,0 | 1,0 | 0,2 | 1,6 | 0,6 | 1,8 |
| | Secondary sector | 31,8 | 16,6 | 64,0 | 20,7 | 38,5 | 26,3 | 36,2 |
| | Tertiary sector | 67,2 | 83,4 | 35,0 | 79,1 | 59,9 | 73,1 | 62,0 |
| Professional Group | Army | 0,4 | 0,1 | 0,0 | 0,4 | 0,3 | 0,3 | 0,3 |
| | Public administration, directors and firms' upper staff | 9,1 | 13,1 | 2,6 | 8,6 | 10,3 | 9,3 | 7,4 |
| | Intellectual and scientific experts | 18,7 | 19,2 | 12,8 | 20,5 | 17,5 | 19,5 | 9,5 |
| | Intermediate level technicians and professionals | 14,6 | 17,6 | 9,4 | 17,1 | 15,5 | 16,3 | 10,8 |
| | Administrative staff and similar | 12,9 | 10,4 | 2,7 | 16,4 | 13,1 | 14,3 | 12,5 |
| | Service staff and sellers | 15,3 | 20,0 | 6,6 | 14,0 | 17,1 | 15,2 | 14,3 |
| | Farmers and qualified workers of agriculture and fishery | 0,7 | 0,2 | 0,4 | 0,3 | 0,5 | 0,4 | 1,4 |
| | Workmen, craftsmen and similar workers | 14,3 | 8,2 | 35,8 | 9,2 | 12,0 | 11,0 | 21,3 |
| | Operator of plants and engines and assembly workers | 5,7 | 2,6 | 6,2 | 4,1 | 4,9 | 4,4 | 8,4 |
| | Non-qualified workers | 8,3 | 8,6 | 23,5 | 9,4 | 8,8 | 9,3 | 14,1 |
| Professional Situation | Employers | 9,3 | 15,6 | 3,9 | 8,7 | 12,8 | 10,1 | 9,2 |
| | Self Employed workers | 3,5 | 4,1 | 1,0 | 3,2 | 5,5 | 3,7 | 4,7 |
| | Workers for somebody else | 84,9 | 78,0 | 92,9 | 86,3 | 79,6 | 84,2 | 84,7 |
| | Other professional situations | 2,3 | 2,3 | 2,2 | 1,8 | 2,1 | 2,0 | 1,4 |
| Location of work in relation to residence | In the same parish | 25,2 | 27,2 | 41,8 | 21,9 | 27,8 | 24,4 | 29,0 |
| | In a different parish in the same municipality | 31,2 | 31,3 | 26,5 | 30,3 | 30,5 | 30,5 | 32,6 |
| | In another municipality | 41,8 | 40,2 | 31,4 | 46,5 | 40,6 | 43,8 | 37,1 |
| | Abroad | 1,8 | 1,3 | 0,3 | 1,3 | 1,1 | 1,3 | 1,3 |

Chart 2. Distribution of the academic qualifications, economic activity, professional group, professional situation, and work-residence relative locations of the working population of the main groups of immigrants that lived in the Oporto Metropolitan Area in 2001 (source: INE).

## Application of the Methodology and Obtained Results

This section reports the application of the developed methodology to study the integration of Portuguese-speaking African immigrants that work in upper professional groups (Chart 3)[6].

The indicator of spatial mobility - approached by the spatial distribution of these active immigrants - shows their expressive residential spread to the whole suburban area (especially towards Maia, Gondomar, and Vila Nova de Gaia) and its strengthening along the coast (Vila Nova de Gaia and Vila do Conde municipalities), opposite to its substantial reduction in the metropolitan core (Porto municipality) (Figure 3):

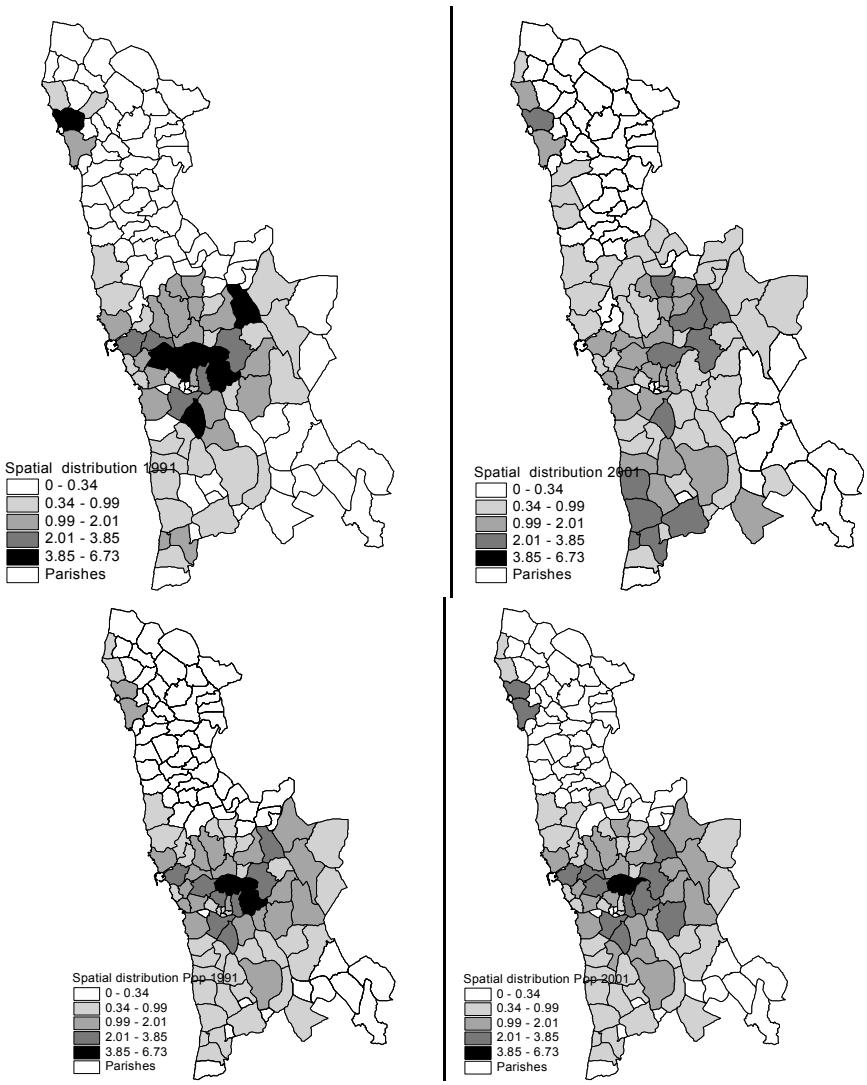


Figure 3. Spatial distribution of Portuguese-speaking African immigrants (above) and of total population (underneath) in 1991 and 2001 (in percentage).

[6] Despite this analysis was carried out at the parish level, the obtained results are herein assembled by municipality in order to organize data and display it cartographically, thus favouring both the discussion and the conclusions.

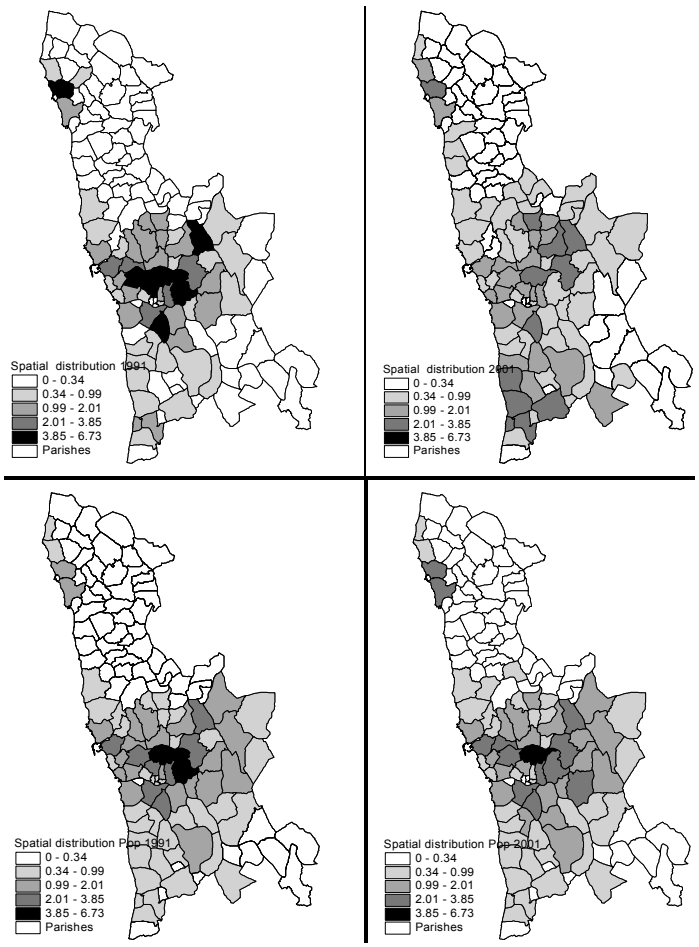


Figure 4. Indicator of performance of Portuguese speaking African immigrants in the housing market in the Oporto metropolitan area, in 1991 and 2001.

The integration of a certain group of immigrants in the housing market is assessed by the comparison of the indicator of housing performance with the spatial distribution of that group. A building densification process took place between 1991 and 2001, as pointed out by the rise in that indicator (that passed from 91,9 to 626,7 buildings/km$^2$, on average). This market dynamics favoured the spread of Portuguese-speaking African immigrants to Maia municipality, the suburban zone (Valongo, Gondomar and Vila Nova de Gaia municipalities), and the urban cores of Vila do Conde and Póvoa de Varzim. In 2001 the prominent building concentrations occurred in Porto, Matosinhos, Vila Nova de Gaia and Gondomar municipalities (Figure 4).

Despite Portuguese-speaking African immigrants that belong to upper professional groups generally decreased their percentage in relation to the homologous population, they still keep high values for their indicator of socio-spatial differentiation throughout the whole metropolitan area (it passed from 1,78 in 1991 to 1,61 in 2001), except for Vila do Conde and Espinho municipalities (Figure 5).

| | | | | Espinho | Gondomar | Maia | Matosinhos | Porto | Póvoa de Varzim | Valongo | Vila do Conde | Vila Nova de Gaia | Oporto Metropolitan Area |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Indicator of Spatial Mobility | 1991 | Number of active Portuguese-speaking African immigrants | (1) | 505 | 985 | 1034 | 1543 | 3992 | 698 | 857 | 458 | 2288 | 12360 |
| | | Percentage of active Portuguese-speaking African immigrants | (2)=(1)/[Total (1)]*100 | 4,1 | 8,0 | 8,4 | 12,5 | 32,3 | 5,6 | 6,9 | 3,7 | 18,5 | 100,0 |
| | 2001 | Number of active Portuguese-speaking African immigrants | (3) | 539 | 1874 | 2196 | 2342 | 4588 | 1061 | 1392 | 822 | 4310 | 19124 |
| | | Percentage of active Portuguese-speaking African immigrants | (4)=(3)/[Total (3)]*100 | 2,8 | 9,8 | 11,5 | 12,2 | 24,0 | 5,5 | 7,3 | 4,3 | 22,5 | 100,0 |
| | Percentage variation of the indicator of spatial mobility (1991-2001) | | (5)=[(4)-(2)/(2)]*100 | -31,0 | 23,0 | 37,3 | -1,9 | -25,7 | -1,8 | 5,0 | 16,0 | 21,7 | 0,0 |
| Indicator of Performance of the Housing Market | 1991 | Number of buildings | (1) | 7885 | 45519 | 25527 | 45205 | 92392 | 15957 | 17173 | 18862 | 69669 | 338189 |
| | | Developed and developable area ($Km^2$) | (2) | 25,26 | 110,95 | 3097,2 | 47,73 | 41,65 | 52,98 | 61,61 | 94,28 | 147,38 | 3679,1 |
| | | Indicator of performance of the housing market | (3)=(1)/(2) | 312,2 | 410,3 | 8,2 | 947,1 | 2218,3 | 301,2 | 278,7 | 200,1 | 472,7 | 91,9 |
| | 2001 | Number of buildings | (4) | 8307 | 62060 | 36908 | 55356 | 94758 | 20632 | 23618 | 25995 | 93780 | 421414 |
| | | Developed and developable area ($Km^2$) | (5) | 25,26 | 110,95 | 90,59 | 47,73 | 41,65 | 52,98 | 61,61 | 94,28 | 147,38 | 672,43 |
| | | Indicator of performance of the housing market | (6)=(4)/(5) | 328,9 | 559,4 | 407,4 | 1159,8 | 2275,1 | 389,4 | 383,3 | 275,7 | 636,3 | 626,7 |
| | Variation of the indicator of performance of the housing market (1991-2001) (%) | | (7)=[(6)-(3)]/[3]*100 | 5,4 | 36,3 | 4843,2 | 22,5 | 2,6 | 29,3 | 37,5 | 37,8 | 34,6 | 581,8 |
| Indicator of Socio-Spatial Differentiation | 1991 | Number of active P-s African immigrants that belong to upper professional groups | (1) | 157 | 318 | 351 | 552 | 1745 | 203 | 249 | 99 | 779 | 4453 |
| | | Number of active P-s African immigrants that belong to all professional groups | (2) | 505 | 985 | 1034 | 1543 | 3992 | 698 | 857 | 458 | 2288 | 12360 |
| | | Total active population that belong to upper professional groups | (3) | 3261 | 10584 | 8468 | 14892 | 43339 | 3513 | 5386 | 3631 | 21089 | 114163 |
| | | Total active population that belong to all professional groups | (4) | 16608 | 68465 | 46926 | 75221 | 141597 | 26001 | 36453 | 32012 | 121483 | 564766 |
| | | Indicator of socio-spatial differentiation (1991) | (5)=(1)/(2) | 0,31 | 0,32 | 0,34 | 0,36 | 0,44 | 0,29 | 0,29 | 0,22 | 0,34 | 0,36 |
| | | | (6)=(3)/(4) | 0,20 | 0,15 | 0,18 | 0,20 | 0,31 | 0,14 | 0,15 | 0,11 | 0,17 | 0,20 |
| | | | (7)=(5)/(6) | 1,58 | 2,09 | 1,88 | 1,81 | 1,43 | 2,15 | 1,97 | 1,91 | 1,96 | 1,78 |
| | 2001 | Number of active P-s African immigrants that belong to upper professional groups | (8) | 222 | 737 | 1094 | 1146 | 2403 | 441 | 580 | 334 | 1885 | 8842 |
| | | Number of active P-s African immigrants that belong to all professional groups | (9) | 539 | 1874 | 2196 | 2342 | 4588 | 1061 | 1392 | 822 | 4310 | 19124 |
| | | Total active population that belong to upper professional groups | (10) | 4115 | 19108 | 20294 | 25467 | 50063 | 6860 | 9986 | 7410 | 39305 | 182608 |
| | | Total active population that belong to all Professional Groups | (11) | 16471 | 83376 | 64839 | 84696 | 124067 | 31988 | 44585 | 37390 | 150365 | 637777 |
| | | Indicator of socio-spatial differentiation (2001) | (12)=(8)/(9) | 0,41 | 0,39 | 0,50 | 0,49 | 0,52 | 0,42 | 0,42 | 0,41 | 0,44 | 0,46 |
| | | | (13)=(10)/(11) | 0,25 | 0,23 | 0,31 | 0,30 | 0,40 | 0,21 | 0,22 | 0,20 | 0,26 | 0,29 |
| | | | (14)=(12)]/(13) | 1,65 | 1,72 | 1,59 | 1,63 | 1,30 | 1,94 | 1,86 | 2,05 | 1,67 | 1,61 |
| | Variation of the indicator of socio-spatial differentiation (1991-2001) (%) | | (15)=[(14)-(7)/(7)]*100 | 4,1 | -17,8 | -15,4 | -9,9 | -9,1 | -10,0 | -5,4 | 7,6 | -14,7 | -9,4 |
| Indicator of Socio-Economic-Professional Mobility | 1991 | Number of active P-s African immigrants that belong to upper professional groups | (1) | 157 | 318 | 351 | 552 | 1745 | 203 | 249 | 99 | 779 | 4453 |
| | | Number of active P-s African immigrants that belong to all professional groups | (2) | 505 | 985 | 1034 | 1543 | 3992 | 698 | 857 | 458 | 2288 | 12360 |
| | | Percentage of active P-s African immigrants that belong to upper professional groups | (3)=[(1)/(2)]*100 | 31,09 | 32,28 | 33,95 | 35,77 | 43,71 | 29,08 | 29,05 | 21,62 | 34,05 | 36,03 |
| | 2001 | Number of active P-s African immigrants that belong to upper professional groups | (4) | 222 | 737 | 1094 | 1146 | 2403 | 441 | 580 | 334 | 1885 | 8842 |
| | | Number of active P-s African immigrants that belong to all professional groups | (5) | 539 | 1874 | 2196 | 2342 | 4588 | 1061 | 1392 | 822 | 4310 | 19124 |
| | | Percentage of active P-s African immigrants that belong to upper professional groups | (6)=[(4)/(5)]*100 | 41,19 | 39,33 | 49,82 | 48,93 | 52,38 | 41,56 | 41,67 | 40,63 | 43,74 | 46,24 |
| | 1991-2001 | Number of new entries of active P-s African immigrants to upper professional groups | (7)=(3)/100*(5) | 168 | 605 | 745 | 838 | 2006 | 309 | 404 | 178 | 1467 | 6890 |
| | | Professional advancement of active P-s African immigrants to upper professional groups | (8)=(4)-(7) | 54 | 132 | 349 | 308 | 397 | 132 | 176 | 156 | 418 | 1952 |
| | | Indicator of Socio-Economic-Professional Mobility (1991-2001) (%) | (9)=[(8)/(4)]*100 | 24,52 | 17,91 | 31,86 | 26,89 | 16,54 | 30,03 | 30,27 | 46,80 | 22,15 | 22,08 |
| Indicator of Performance of the Labour Market | 1991 | Number of active P-s African immigrants that belong to upper professional groups | (1) | 157 | 318 | 351 | 552 | 1745 | 203 | 249 | 99 | 779 | 4453 |
| | | Total active population that belong to upper professional groups | (2) | 3261 | 10584 | 8468 | 14892 | 43339 | 3513 | 5386 | 3631 | 21089 | 114163 |
| | | Indicator of performance of p-S African immigrants in the labour market (%) | (3)=[(1)/(2)]*100 | 4,81 | 3,00 | 4,15 | 3,71 | 4,03 | 5,78 | 4,62 | 2,73 | 3,69 | 3,90 |
| | 2001 | Number of active P-s African immigrants that belong to upper professional groups | (4) | 222 | 737 | 1094 | 1146 | 2403 | 441 | 580 | 334 | 1885 | 8842 |
| | | Total active population that belong to upper Professional Groups | (5) | 4115 | 19108 | 20294 | 25467 | 50063 | 6860 | 9986 | 7410 | 39305 | 182608 |
| | | Indicator of performance of p-S African immigrants in the labour market (%) | (6)=[(4)/(5)]*100 | 5,39 | 3,86 | 5,39 | 4,50 | 4,80 | 6,43 | 5,81 | 4,51 | 4,80 | 4,84 |
| | Variation of the indicator of performance of the labour market (1991-2001) | | (7)=[(6)-(3)]/[3]*100 | 12,1 | 28,4 | 30,1 | 21,4 | 19,2 | 11,2 | 25,6 | 65,3 | 29,8 | 24,1 |

Chart 3. Computation of the indicators of spatial mobility, socio-spatial differentiation, socio-economic-professional mobility, performance in the housing market and performance in the labour market for Portuguese-speaking African immigrants, in 1991 and 2001, and respective evolution (Source: INE, author).

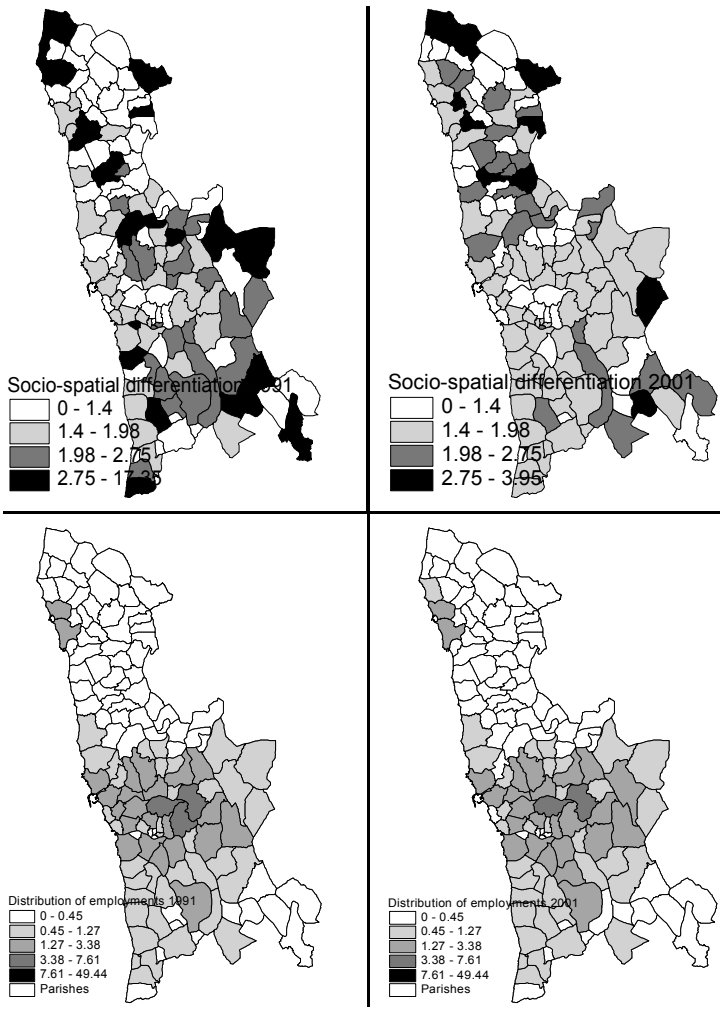


Figure 5. Indicator of socio-spatial differentiation of upper professional groups of Portuguese-speaking African immigrants (above) and distribution of employments (underneath) in 1991 and 2001.

The reinforcement of the presence of upper professional-holders within this population group is explained by the increasing arrival of high-qualified immigrants, on the one hand, and by career advancements, on the other (tested ahead by the indicator of socio-economic-professional mobility). The former is computed by the product between the percentage of immigrants in upper professional groups – this percentage is supposed to remain equal to its 1991´s value – and the total number of immigrants in 2001. The latter is given by the difference between the total number of immigrants belonging to upper professional groups in 2001 and the number of new entries in these professional groups from outside that took place in the meantime. The values of this indicator (given by the percentage of career advancements to upper professional groups in relation to the total number of immigrants in these groups) show that Portuguese-speaking African immigrants belonging to the upper professional groups passed from 36,03% in 1991 to 46,24% in 2001; and about 22,1% of the latter (1952 in 8842) were promoted, what amounts to approximately 2,26% promotions in a ten-year period. Their presence was strengthened in the urban cores of Vila do Conde and Póvoa de

Varzim, in the suburban area (Maia, Valongo, Matosinhos, Vila Nova de Gaia and Gondomar municipalities), as well as in the metropolitan core (Porto), (note that Figure 6 shows the indicator of socio-economic-professional mobility in relation to the base-year of 1991).

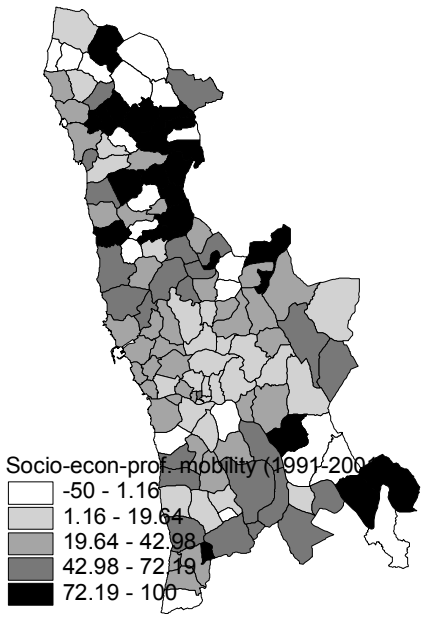


Figure 6. Indicator of socio-economic-professional mobility of Portuguese-speaking African immigrants that climbed to upper professional groups between 1991 and 2001.

The indicator of the performance in the labour market of Portuguese-speaking African immigrants that belong to upper professional groups has increased, on average, from 3,90% in 1991 to 4,84% in 2001. Indeed, whereas the number of working Portuguese-speaking African immigrants increased 54,7% during the decade, the corresponding increase in their upper professional groups went up to 98,6%. The cartographic analysis stresses the significant strengthening of the weight of these upper skilled professionals in total population throughout the whole suburban area (especially in Maia; Gondomar, Vila Nova de Gaia, and Valongo municipalities), and also along the coast (especially in Vila do Conde municipality) (Figure 7).

During the implementation phase, the results obtained from this model are overlapped – in different layers – with cartographic displays of urban morphologies and building typologies (an example is presented in Figure 8; see Rebelo, 2010). This procedure enables the identification and test – through the introduction in the simulation and display interface of fictitious data – of alternative location scenarios as a response to business, regional or urban initiatives, considering whether immigrants´ characteristics or territorial characteristics, and the reasons underlying settlement patterns.

This methodology may be further applied to management-focused goals. For such purposes, the metropolitan management information system should be supplied and updated with proper data at shorter regular intervals[7] – on an annual or even six-monthly basis.

[7] So the highest management potential of this system (the highest accurate results) directs to the countries that replaced the Census approach by a continuous record system of resident population and its main features, as is

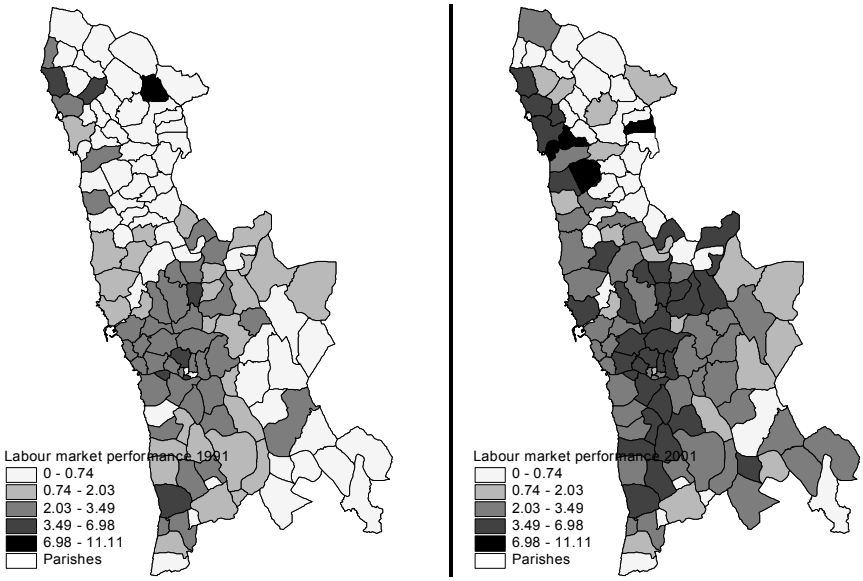


Figure 7. Indicator of the labour performance of Portuguese-speaking African upper professionals in the Oporto metropolitan area, in 1991 and 2001.


Figure 8. Overlapping of different territorial characteristics with the spatial distribution of Portuguese-speaking African immigrants, their socio-spatial differentiation, socio-economic-professional mobility, and performance in the labour market (example).

the case of some Scandinavian countries (where the most reliable and complete data on population is continuously updated).

## DISCUSSION OF RESULTS

Settlement patterns of Portuguese-speaking African immigrants - shaped by their socio-spatial differentiation, spatial and socio-economic-professional mobility, and by their performance in housing and labour markets –, together with some issues on the personal and systemic openness of the host-society, immigrants´ contextual facets, and societal issues condition immigrants´ spatial, socio-economic and professional integration.

As far as the spatial mobility of working Portuguese-speaking African immigrants is concerned, they strongly settle in the metropolitan centre and suburban area, favoured by their spatial diffusion and continuous spread. This is highlighted by their immigration share in this metropolitan area (53%), and by their territorial distribution and average population density similar to natives´. Their increasing exposure to local population - shaped by suburbanization processes, by housing and labour characteristics (Malheiros, 2002; Arbaci, 2008), and by their academic and professional backgrounds - strengthen both their spatial and socio-economic-professional integration.

The remaining Portuguese-speaking African immigrants settle in inland sparsely populated metropolitan areas, responding to specific labour requirements (especially in health and high-technology fields) natives aren't able to, considering that most belong to upper professional groups (46,2%), mainly work in the tertiary sector (79,1%) and work for somebody else (86,3%). The official recognition of academic and professional qualifications has further supported the articulation between labour requirements and immigrants´ skills, and has played an important role in their integration.

The attained results show that firms and services located in the metropolitan core and in the urban centres of the metropolitan area exert a strong attraction on public administrators, directors and firms´ upper staff; intellectual and scientific experts; and intermediate level technicians and professionals that came from Portuguese-speaking African countries (Rebelo, 2010). This socio-spatial differentiation results from the conjunction of labour opportunities, immigrants´ closeness to respective ethnic-cultural communities, and the performance of their welcome and guiding networks, considering that their academic levels and professional skills are generally higher than natives´. The recent development of local economies (especially in the inland metropolitan southeast), the implementation of strong public investments (mainly in transport infrastructure) and private investments (at the industrial level), the housing supply in excess of demand, and the increase in housing construction has favoured the suburban location of most immigrants. Besides, considering the tradeoffs among house, transports and other expenses, that they most work in the tertiary sector (79,1%), and the well-structured network of public transports, suburbanization processes support higher home-work mobility levels (78,1% of these immigrants live and work in different parishes and/or municipalities). Many other immigrants´ contextual issues have additionally favoured the success of their socio-spatial integration in urban and suburban fabrics, such as their longstanding migratory flows, their multiculturalist standing (they share culture and language with natives), their high exposure to natives, and the importance they attach to family and friendship ties. Societal issues, including suburbanization processes, urban dynamics and policies, housing provision, and access to credit or to rental markets also shape considerably the settlement patterns of Portuguese-speaking African immigrants (including their neighbourhoods and social networks) (Malheiros, 2002; Arbaci, 2008). On the one hand, urban policies currently carried

out by some municipalities in this metropolitan area engendered spatial stratification processes that have guided wealthier families to more central locations or to coastal areas and lower-income families to suburban areas. On the other hand, the characteristics and motivations that underlie the migratory flows have conveyed specific housing concerns. Thus Portuguese-speaking African immigrants – that exhibit longstanding staying perspectives, and culturally favour home acquisition – easily access home loans because their families or friends stand surety for them. Lower-income immigrants, by their turn, have taken advantage from housing succession and filtering processes, from second-hand and renting markets, as well as from lodging policies aimed at lower social classes that allow immigrants to temporarily occupy, rent or sub-rent older buildings.

The analysis of the spatial distribution of Portuguese-speaking African immigrants that climbed to upper professional groups further stresses the importance of suburbanization processes that (considering their high share in total population and their longstanding migratory inflow) fostered the attraction of new generations of immigrants. These new generations have progressively integrated into the suburban socio-economic fabric what, together with other good professional opportunities, has favoured their spatial mobility, and their economic, social and professional ascent.

Despite the prevailing multiculturalist social discourses, as the metropolitan local economies mainly found on traditional activities´ small and medium-sized firms, most employers can't realize the important role immigrants deserve in new businesses´ creation. Due to their general high academic and professional levels and their previous experience in different economies, they hold great flexibility to fit new labour requirements, usually exceeding the professional immobility of most natives, scarcely prepared to respond to new professional challenges.

## CONCLUSION

A better awareness of integration policies and of their implementation tools, and the assessment and comparison of their performance in the course of time will certainly contribute to their improvement. Within the European context, Portugal ranks second (after Sweden) in the immigrants´ global integration index (Mipex, 2012), and ranks first in the group of recent labour migration countries, namely in what concerns the access to the labour market, and the recognition of qualifications and skills obtained abroad (Mipex, 2012). The current environment of economic crisis and the social changes, however, neither decreased immigration requirements, nor turned native population against immigrants or called their integration into question[8] (Mipex, 2012).

But national policies assess integration for immigrants in all. And despite Portugal grants equal working conditions, it often ignores the specific challenges they face, what requests concrete integration policies at the local level, and more focused on specific groups.

The decision-support system herein presented fits into the perspectives of different groups of immigrants that should benefit from integration policies, as it founds on concrete

[8] On the contrary, this support was even strengthened considering the high solidarity levels among the whole population, especially found on the strong multiculturalist tradition of good acquaintanceship among different peoples.

data on their features and settlement patterns, and uses results indicators to compare them with natives´. It further monitors integration from different views, as it relates it with many socio-economic and professional attributes that underlie immigrants´ settlement patterns, considering the characteristics of host-societies, their personal and systemic openness and immigrants´ contextual factors. So it supports a systematized analysis of the integration process over time, and the comparison among different groups of immigrants, even if they inhabit distinct urban or metropolitan areas. Its ability to monitor land use patterns settles a platform for the harmonization of different strategies, policies and measures within the scope of different institutional and legal frameworks, as well as the conciliation of economic and territorial strategies and policies with immigrants´ integration ones. Additionally, its cartographic and display interfaces enable the test of alternative scenarios for policy design and implementation. This proposal also provides for the reinforcement of immigrants´ attraction devices (similar to the EU Bluecard system), aimed to attach skilled labour to local economies.

This system should become even more effective either in cross-section or longitudinal analysis if, in the wake of the international data reconciling efforts (and its extension to regional/local levels), registers are linked together through identifiers, such as personal identification numbers (despite this system already exists in some countries, such as Norway, these numbers aren't clearly assigned in all EU members) (Heckmann et al., 2010). This better organization of data should be able to cover a larger diversity of thematic fields and immigrants´ features, also providing greater effectiveness to monitor integration and respective evolution. Longitudinal analyses require historical registers for longer terms, and the extension of measurements into the future, thus showing the long-range inter-gerational character of integration (Heckmann et al., 2010)[9].

Strategies, policies and measures aimed at the integration of immigrants - founded on this analysis – may split into three distinct groups concerning: the housing market, the labour market, and citizenship/governance participation. As far as the provision of suitable housing, infrastructures and equipments is concerned, some concrete interventions may consist of (Fonseca, 2007): access to own or rented home; strengthening of accessibility from residential areas to main employment, trade and services centres; qualification of neighbourhoods and provision of suitable public spaces, infrastructure and equipments; support to family rejoin; and involvement of economic agents, non-governmental agencies, and general population in planning processes. Some possible measures to favour the assignment of proper employments to immigrants are: better integration of the different economic functions and sectors; prevention of employment discrimination; support to along-life learning and professional retraining; and stimulus to trade initiatives led or shared by immigrants. The involvement and participation of all citizens may be encouraged through the articulation of governance tools (Fonseca, 2007), including a better coordination of policies at central, metropolitan and municipal levels; the promotion of cultural, interactive and integrative planning involving economic agents, non-governmental agencies and general population; responses targeted to specific ethnic-cultural needs; the reinforcement of territorially-scoped institutions; and the involvement of all citizens in problem solving.

[9] Integration processes reflect in structural, social and emotional changes that keep up with cohort development.

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*Chapter 5*

# THE POST-OLYMPIC GAMES' SPATIAL SOCIO-ECONOMIC VULNERABILITY AND ITS RESTRUCTURE PROCESS: CASE STUDY AT CENTRAL AREA OF OLYMPIC GAMES IN BEIJING, CHINA

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## ABSTRACT

The 2008 Beijing Olympic Games has brought large amounts of tourists to the Beijing City since 2008. The Beijing City Officials used capital economic zone strategies and its comprehensive planning process to support the 2008 Olympic Games. The success of its tourism industry not only improved the Beijing City appearance, but also increased the city developments.

However this speedy city development has increased its social spatial vulnerability over these years. This research uses qualitative research approach—in-depth interview and field study to explore Beijing City's post-Olympic city developments and its spatial conflict phenomena. That is, the traditional city development strategies use city infrastructure developments and urban growth cores to increase regional growth; however, the environmental capacity is not enough to hold Beijing City developments in such a short period. On top of that, the resiliency of the city is has decreasing because of the environmental justice issues. This research found that the Beijing City as a whole has

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improved its city appearance, city economic level and its infrastructure developments; on the other hand, however, the environmental injustice treatment forced minorities and lower income households move to the city margin. The findings of this research ring a bell of social vulnerability issues to the local officials and planners especially in a short-term speedy city development situation. It also provides an in-depth view of the environmental justice issues to the literature.

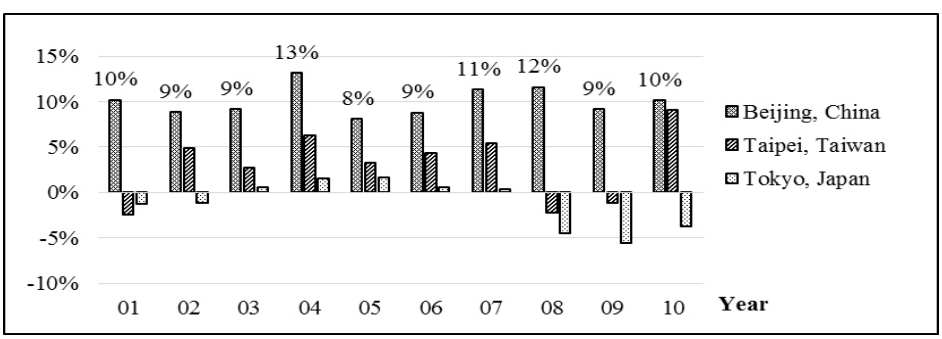
## INTRODUCTION

The year of 2008 has a significant meaning to Chinese government. First, the 2008 Sichuan Earthquake resulted in 69,180 casualties. Chinese central government, local government, and local residents putted a lot of effort into the disaster recovery process (Hung and Liu, 2012).

The new constructions and land use patterns had huge impact on local areas in turns of planning and economic developments during the Sichuan earthquake recovery process. On the other hand, Beijing City hosted the Olympic Games during the summer of 2008. The Beijing City government had prepared the 2008 Olympic Games since 2001. The Beijing City government reconstructed the Olympic Games venues and its surrounding areas by implementing the *Beijing City Comprehensive Plan* and *2008 Olympic Games Action Plan* (Li, 2008). In fact, the Beijing City's 2008 Gross Domestic Product (GDP) growth rate not only was the second highest during 2001 to 2010, it was also much higher than Taipei, Taiwan and Tokyo, Japan's GDP (Figure 1).

It is to believe that hosting the Olympic Games is part of the reasons for the high GDP growth rate in Beijing City. That is, by hosting the 2008 Olympic Games, Beijing City successfully survived from the 2007-2008 Global Financial Crises which were considered as the worst financial crisis since the Great Depression. Beijing City has long been a well-developed tourism industry city comparing to previous Olympic Games hosting cities. The historical and cultural tourism sites attracted travelers and sports lovers to Beijing City. The media attention and tourism industry prevented Beijing City from suffering the 2008 financial crisis.

To date, several research articles have addressed the economic impacts on Beijing City after the 2008 Olympic Games (Chai, 2007; Tan, 2008; Xu, 2008).




Source: Beijing Municipal Bureau of Statistics (2013), Statistics of Tokyo (2013).

Figure 1. GDP growth rate for Beijing, Taipei, and Tokyo (2000-2010).

However, very few researches touched the social economic vulnerability issues even though huge amounts of population were relocated for the new constructions on the Olympic venues. AS_3 from the School of Public Management, Beijing University mentioned that

> …Almost none of the researchers done any research on social vulnerability issues before or after the 2008 Olympic Games. Most of the researches were either discussing the venues reusable issues or the economic impacts before and after the games…..

Therefore this study will focus on social vulnerability impact for Beijing City after the 2008 Olympic Games and provide useful insight to the planning and disaster literature body.

## LITERATURE REVIEW

### Vulnerability Issues in Beijing City

The 2008 Olympic Games clearly established the partnership between the Beijing City government and businesses. For example, using public policies and building codes to relocate the lower income neighborhoods which were originally located near the Olympic venues and bring in the new and luxury apartments to attract the middle class households. The new neighborhoods definitely increased the property values and made Beijing City a more clean and livable city; however, the enforced neighborhood relocation generated problems such as social inequality and social vulnerability. There are several definition for vulnerability. Burton (1978) defined vulnerability as the vulnerable situation that originally resulted from human settlements and developments. Smith et al (2006) pointed out that vulnerability is the disaster risk for a society or an economic entity. Pelling (2003) separated vulnerability issues into two different parts—social vulnerability and physical vulnerability. In addition, social vulnerability and economical losses are highly correlated to each other (Mileti, 1999; Liu, Shi, and Ge, 2006). This study will reveal Beijing's vulnerable situation by indicating the failure of its urban development strategies in the vulnerability perspective. In other words, Beijing City was still a developing city before 2008. Its industry, transportation, policy and environmental (water and land shortage) conditions were difficult to host the Olympic Games during that time. In order to host this international event, local government had to make massive changes to the city in a very short period (seven years) and which caused environmental, social, and economical issues.

### Political Actors and Vulnerability

Pelling (2003) stated that the political actors are the key factors of reducing cities' vulnerability. The political actors need to cooperate in order to overcome vulnerability issues. Xu (2007) pointed out that some of the political actors cooperated to improve the Beijing City developments during the short construction period of Olympic venues. These political actors include Chinese Central Government, Beijing City Government, National owned businesses (Beijing Citic Group Corporation and Bnsig Housing and Construction Group Corporation),

and Beijing City residents. These entities grabbed the chance and transformed the Beijing City into a modern city and increased the city GDP; however, they overlooked the social and environmental issues. Therefore according to Pelling's theory (2003) Beijing City will have to rely on these political actors to overcome its vulnerability issues.

***Olympic Games and City Developments***

The Olympic Games can change cities' urban form by bring in new investments, constructions and city infrastructures. Stephen (2011) mentioned that Olympic Games can bring activities to accelerate the constructions and investments to a city and transform cities' spatial structure. Therefore, most of the Olympic Games hosting cities have decided hosting the games in areas that had relatively lower income and lower developments comparing to other regions in the city. In this way, local governments can accelerate the city developments by hosting the game. For example, the Olympic venues of 2012 London Summer Olympic Games was located in the east London which is a poor neighborhood with low development. London City government managed to bring in investments and redeveloped the east London area. Beijing City apparently did the same thing with London, but there was a big difference. Beijing City relocated the low income families and replaced them with middle class neighborhoods. Hiller (2000) stated that the decisions on Olympic venues could affect the cities' original spatial distribution and jeopardize low income families' living conditions and might end up having them move out the city. In addition, Zhou and Liu (2005) believed that a significant event for a city, such as Olympic Games, can result in land use pattern changes and land value changes. In this case, the Beijing City government used luxury housing and five stars hotels to improve the property values and forced the low income families to relocate. In fact, not only the commercial areas and residential areas suffered huge changes in a short time period, many agriculture lands were changed to residential or commercial use by city government policies. These farmers ended up losing their job and were forced to relocate to the edge of Beijing City metro area.

## METHOD

This research used unstructured in-depth interview associated with secondary literature reviews as its research method. In this case, conducting face to face in-depth interviews have several advantages for researchers to approach the actual stories during the incident (Tayor & Bogdan, 1984). For instance, our researchers were able to analyze the information which provided by interviewees' own words and his/her understanding. In addition, the literature review method could help researchers to recognize the current situation and what happened previously. The interviews were conducted during two periods—Jan. 6$^{th}$ to Jan. 13$^{th}$ and June 30$^{th}$ to July 6$^{th}$ during 2012. These interviewees included stakeholders such as government employees, national owned business employees, private owned business employees, and scholars from Beijing University, Tsinghua University, and Capital University of Economics and Business. By conducting these unstructured in-depth interviews, this research could avoid some weaknesses of quantitative survey research such as low-response rate, reactivity, simple answers, and fragmented information. In addition, the main idea of this study is to point out the inequity of the situation by analyzing the data provided from different stakeholders;

therefore, generalizing the results was not the intention of this study. Thus, a systematic quantitative data was unable to find for the purpose of this study.

# RESULTS

## The Olympic Venues

According to *Beijing Olympic Action Plan*, the Beijing Olympic Games followed the 1990 Beijing Asian Games guidelines. The venues were located in Chao Yang District (13 venues), Shi Jing Shan District (9 venues), and Hai Dian District (4 venues) in Beijing City (Figure 2). These districts provided convenience public transportation, compact population, and fine city infrastructures comparing to other districts in the city.

The process of submitting the applications for 2008 Summer Olympics was very intricate for Beijing City government. In fact, the city government submitted the first application at 2000, but it was a rejection. Part of the reasons of the rejection was because the proposed Olympics sites were an area with only agricultural lands, small townships, and several country parks. The International Olympic Committee decided that Beijing City was not able to host this international sport event. After received the rejection, the Chinese central government and Beijing City governments established the *2001 Olympics Games Action Plan* alone with the new building codes and *Beijing City Comprehensive Plan* to change Beijing City's urban form.

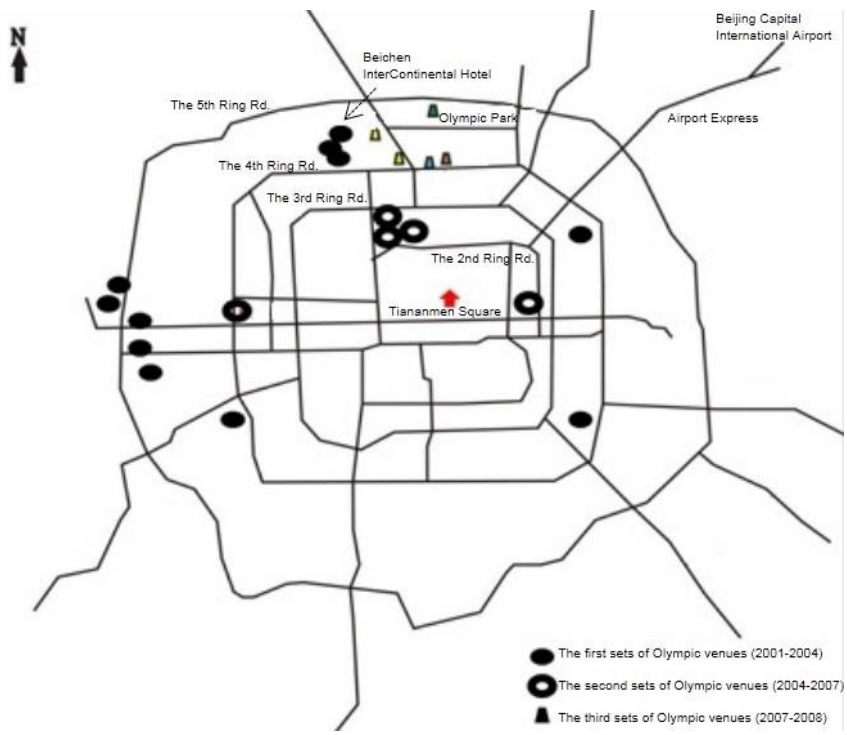



Figure 2. Study area and Beijing Olympic venues. The change of Beijing City and the low economic efficiency

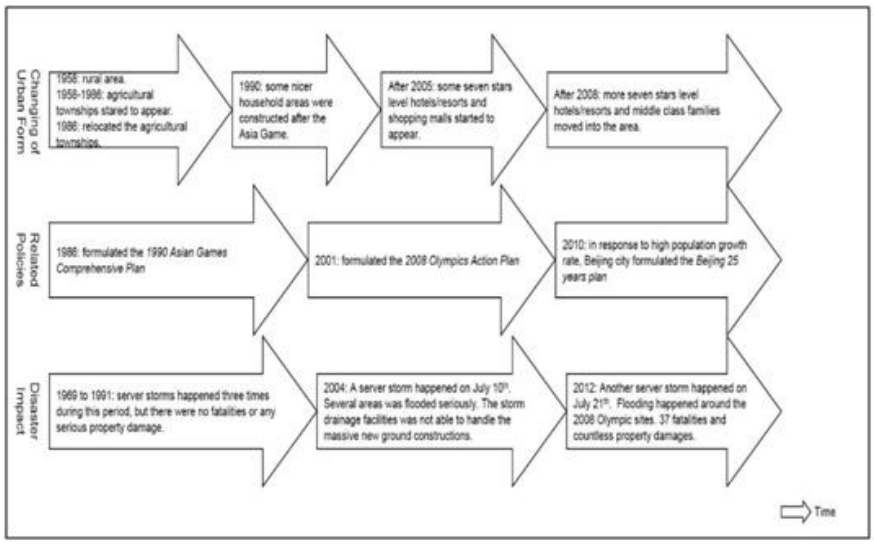



Figure 3. The urban form change, policy change and the disaster impact during 1958 to 2012.

The poor townships which located on the proposed Olympic venues were forced to relocate. The agricultural lands were changed to commercial and luxury residential areas. In addition, these codes and plans were not only applied to the proposed sites, it also applied to the areas that surround the venues. Although Beijing City was successfully become the host of 2008 summer Olympics after they submitted the second application on 2001, the changing of Beijing was irreversible. The significant change in the urban form without appropriate supporting systems (storm drainage facilities etc.) resulted in serious flood disasters during 2004 and 2012 (Figure 3).

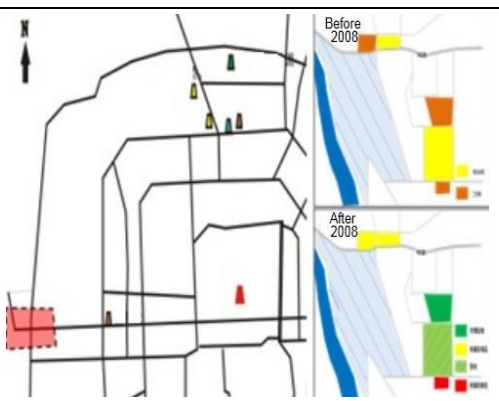
These massive amounts of constructions also had negative impacts on its economic efficiency. Several high rise buildings, shopping malls and luxury hotels were constructed around the Olympic venues (Table 1). However, the Olympic venues itself and the parks were not efficiently used by the residents before or after the 2008 Olympic Games. For many of the residents and scholars, they do not find the Olympic Games venues and parks attractive after the games. These venues stay empty and unused after 2008. In addition, the luxury shopping centers and expensive hotels do not attract local residents or tourists because of the terrible traffic problem these days. Interviewee AS_4 stated that:

> ……The 2008 Olympic Games did brought in a lot of luxury hotels and couple national research facilities to the cities; however, the flip side was that these Olympic venues or parks are not very useful to the citizens. On top of that, our local government still pays huge amounts of maintenance fees every year…

Interviewee AS_3 also shared very similar opinions:

> ……Residents in Beijing stopped coming to the Olympic venues after the Olympic Games. Some of the reasons are the traffic and some of them are the shopping malls. These shopping malls only sale luxury products and these products are more expensive than overseas because of the sales tax. So, people will just buy it online. Eventually, the shopping centers start to suffer from the lacking of costumers…..

**Table 1. The Spatial changes for the 2008 Summer Olympic venues sites**

| Political district | Land use change | The change of spatial pattern |
|---|---|---|
| Chao Yang District | Changing from scattered townships to high rise residential and commercial buildings. |   |
| Hai Dian District | Changing from labor intensive industrial areas to commerical areas and hi-tect industrail areas |   |
| Shi Jing Shan District | Changing from steel industry areas to tourist areas |   |

The commercial activities were not only suffered by the physical situations in Beijing City, it also suffered by its culture. Interviewee AS_2 mentioned that:

> ……You have to understand, shopping in Beijing is not easy. Even the tertiary industry is the main industry in Beijing these days, the attitude of our citizens does not change. Many of them are proud of being a resident in Beijing City and discriminate those people who are not originally from here or not living here. If you are a foreigner tourist you might be OK, but if you are a tourist from other parts of China, the people in Beijing will not respect you even the waiters or waitresses …..

Interviewee AS_5 critiqued the usage of one of the most famous Olympics constructions—the Bird Nest Stadium:

> ……the Bird Nest Stadium is unbelievably beautiful and it is super huge. As a resident in Beijing City I should be proud of the construction. It is true that we can be recognized because of the Bird Nest, but if you think about it, it is totally not worth it. After the Olympics, it has not been used by any other big event. Beijing City government pays millions of dollars to maintain it every year for what? The glory? …..

The above interview results were from parts of our interviewees. Most of our interviewees shared very similar information. These interviewees are the stakeholders in the public administrative entities and university scholars. They shared their points of view base on years of observation and research results. In fact, 42 billion US dollars were spent for the venues construction during 2001 to 2008. The residents and scholars do not consider the money was well spent. They believe most of the constructions during these periods were for government officials to show off their political power to the world. Several political issues were involved for the constructions. Some indicated that the bigger the construction was the more compensation the officials would get. These interview results summarized Beijing City's vulnerable economic situation after Olympic Games. In fact, the low economic efficiency was not the only issue. As pointed out earlier, figure 3 indicated that this is a price that all the residents in Beijing have to pay. Not only the money was wasted, the residents are living in a vulnerable environment currently.

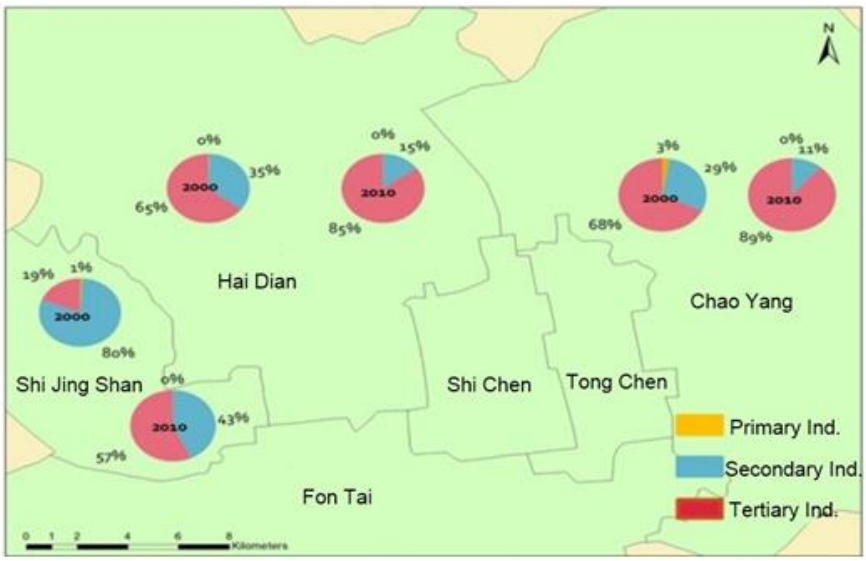
## THE CHANGE OF INDUSTRIES AND SOCIAL VULNERABILITY

According to Beijing City statistics, Chao Yang district has been an area which attracts international business travelers and foreign ambassadors for years. The Chao yang districts have long been a financial district even before the 2008 Olympic Games. Its tertiary industrial rates grow from 70% to 89% during 2000 to 2010 (Figure 4). On the other hand, Hai Dian district was classified as a Hi-Tech development region according to the *Beijing City comprehensive plan*. Its tertiary industrial rates also grow from 65% to 85%% during 2000 to 2010. The increase rate was around 20% (Figure 4).

The 2008 Olympics triggered the changing of industrial structure in Beijing City. The industrial change also resulted in population structure changes. One of the problems is that the elder population also increased alone with the total population. The lacking of elderly facilities made this group of people became vulnerable populations. Interviewee AS_3 stated that

> ……..huge amounts of people moved into the Second Ring Rd. area, parts of them are elderly peoples, but our city government was not prepared for that. Their living condition can be very vulnerable and uncomfortable, we certainly needs more public service to sustain this situation…..

The residents in Beijing City can be defined into two different category—the permanent residents and the temporary residents.




Source: Beijing Municipal Bureau of Statistics (2013).

Figure 4. The changing of industries in Chao Yang, Hai Dian and Shi Jing Shan Districts.

In China, residents are not allowed to move from cities to cities freely. They need to obtain a permit to live in a certain city. Beijing as one of the most developed cities, there are always huge amount of people try to move into this big city. Among the temporary residents, some of them tend to stay in the city even the permit is expired. Before 2007 and 2008, Beijing City government did not enforce this regulation strictly; however, during the 2007 and 2008, they strictly enforced this regulation due to the 2008 Olympic Games. The city government tried to present the world the best condition of the city by eliminating the illegal residents from Beijing City. On the other hand, it is not hard to imagine that after the 2008 Olympics, the Beijing City government were no longer concern this illegal resident situation and the amount of temporary residents starts to grow again (Table 2).

Compare the salary rate between Beijing City residents and other cities' residents; it is not difficult to find out that there is a big gap. Beijing City's average salary was ranked number three in China on 2011 (Beijing statistics, 2012). This salary gap encouraged people to move to Beijing to find jobs. Some people might not be able to acquire their legal documents to stay in Beijing City but their intentions stay the same. The living conditions and salaries are the most important driven force behind this situation. Although Beijing City improved its transportation system, living conditions, sidewalks, parks, and other city improvement constructions before and during the 2008 Olympic Games, this constructions were never enough for the increasing residents (both legal and illegal).

**Table 2. Population change in Beijing City (2005-2010) (unit: 1000)**

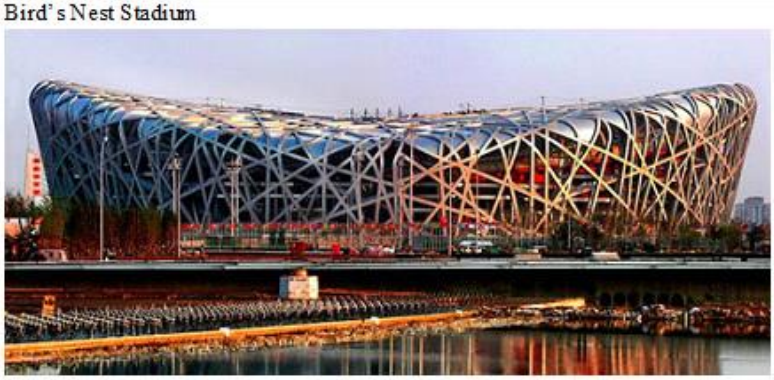
| Year | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|
| Permanent Residents | 11,807 | 11,976 | 12,133 | 12,299 | 12,458 | 12,578 |
| Annual Increase Rate | 1.53% | 1.43% | 1.31% | 1.37% | 1.29% | .96% |
| Temporary Residents | 3,351 | 5,169 | 5,549 | 5,659 | 6,092 | 7,594 |
| Annual Increase Rate | 3.98% | 54.25% | 7.35% | 1.98% | 7.65% | 24.65% |

On the contrary, these Olympic Games related constructions and improvements turned Beijing City even more attractive and made the situation even worse. Alone with the increasing adult populations, the vulnerable populations—elders, kids, disabilities etc… also increased significantly.

## DISCUSSION

The Bird's Nest Stadium (BNS) and the National Aquatics Center (NAC) are two of the most famous Olympic constructions in Beijing (figure 5). These two areas originally located on the edge of Beijing City areas in Chao Yang district during the 50s. In the year of 1986, Beijing City government changed it land use from agricultural lands to commercial use to fulfill the land needs for the 1990 Asia Game. In 2002, according to the *Olympic Action Plan*, city government started to construct several transportation systems and land development projects in these two areas.

Bird's Nest Stadium



National Aquatics Center

Source: Beijing Olympic City Development Association (2013).

Figure 5. Bird's Nest (BNS) and the National Aquatics Center (NAC).

These investments made BNS and NAC areas became areas with very high construction densities. Beijing City spent 42 billion US dollars to develop the Olympic sites during the period of 2001 to 2008; among this investments, BNS cost 3.5 billion US dollars an NAC cost almost .9 billion US dollars. The total 42 billion investments is much higher than 1996 Atlantic Summer Olympics (2.4 billion), 2000 Sydney Summer Olympics (1.5 billion), and 2004 Athens Summer Olympics (5 billion) (Kasimati & Dawson, 2009; Mihalike & Simonetta, 1999) and Beijing Summer Olympics is by far the most expensive Olympic Games. Similar to our interviews, Ouyang et al. (2009) stated that local governments generally use public expenditures for the sports events such as Olympic Games or Asia Games. Some local governments tried to fulfill the needs of public views and therefore invested huge amounts of money to the sport events. However once the game is finished, it become very difficult to maintain it. The BNS and NAC were built for the Olympic Games specifically. After the Olympic Games, Beijing City could not again host another sport event at this scale. The BNS and NAC became a financial burden to the Beijing City governments.

In addition, our interviewers (AS_3 and AS_4) also pointed out that the shopping malls and commercial activities suffered during the post-Olympic period. The population growth resulted serious traffic issues after the Olympic Games. Although Beijing City government constructed several subway systems before the Olympic Games, these subway systems were built for the purpose of Olympic Games not to solve the population growth issues. Thus, many residents stopped coming to the city center for their shopping and entertainment activities because of the terrible traffic conditions. On the other hand, the wealthy individuals tend to shop their luxury goods during international travels or through internet because it is actually cheaper than buying those products in the shopping malls in Beijing City. Therefore, the downtown area became a place just for tourists and most of the tourists do not stay more than two days in the downtown Beijing City.

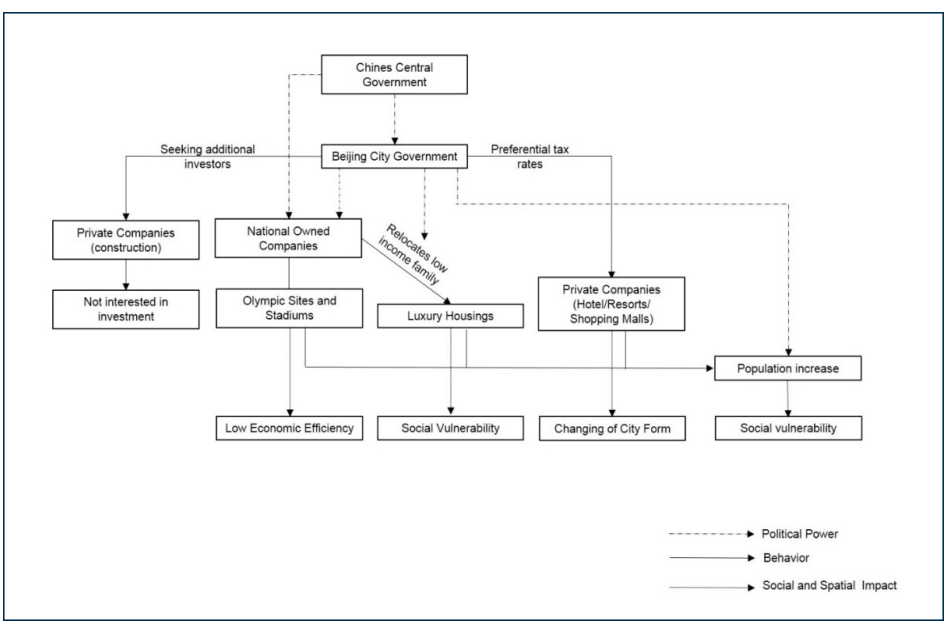



Figure 6. The political power among stakeholders and the social impacts of post-Olympic Games study in Beijing City.

All of above reasons made the commercial activities very difficult for all the huge and luxury shopping malls that constructed during the 2008 Olympic Games.

Similar to Atkinson et al. (2008), Baade and Matheson (2002) and Berg (2008), our interviewee AS_3 believes that the public expenditure of 2008 Beijing Olympic Games has a very serious problem. In fact, most (or none) of the private company were not willing to put investment into the Olympic Games constructions especially for BNS and NAC. The private companies believed it would be very hard (or impossible) to receive any revenue from this investments. Therefore these constructions were invested by the National owned companies (Beijing Citic Group Corporation and Bnsig Housing and Construction Group Corporation). After the Olympic Games, Chinese Central government no longer responsible for these Olympic venues and constructions; therefore Beijing City government ended up taking over the burden. Figure 6 illustrated the complexity of the power connections among stakeholders.

## CONCLUSION

The political power and the partnership among Chinese central government, Beijing City government, national owned companies and private companies were the key in these mass investments. Citizens have very limited power under an authoritarian political system like China. On the positive side, these key players proactively shaped the Beijing City into a highly developed urban area in eight years. Hung (2011) also indicated that this partnership between private sectors and public sectors can increase the speed of construction and changing the urban form in a very short period. Tompson (1984) stated that the ultimate goal of all the political agencies is to maximize their own benefit in the political arena. In a case like 2008 Beijing Summer Olympics, political actors also were seeking their maximum benefit. Beijing City government was intended to express city's beauty and improvement to the world. The owners of National owned companies only wanted to take charge in this important construction and they did not care winning or losing because they do not need to pay the bill. On the other hand, the private companies are able to take advantages on Beijing City's growing tourist industry. As for the residents of Beijing City, they were able to share the pride of living in a highly developed city, even though they might be the ultimate losers of this Olympic Games.

Unfortunately, however, the price of making such changes in a short period can be severely unsustainable. Figure 3 and Figure 6 shows that the changing of the urban form seriously resulted in several social vulnerability issues. (1) Social inequality issues: the relocation of poor neighborhood residents and the people who came to Beijing to seek job opportunities are becoming social issues. These groups of people's income level were not able to keep up the speed of Beijing's urban form change. The new developments and the luxury housings kept this group of people outside the city center. Some of them come to Beijing City to seek opportunities but they end up living in the edge of the city with poor conditions. (2) Economic vulnerability issues: the BNS and NAC were supposed to be used for events and celebrations; however, most of the events are not able to afford the BNS and NAC's using fee. In addition since it became landmarks after the Olympic Games, the Chinese central government formulated very strict rules of using it. As the result, these facilities have very low economic efficiency. (3) Disaster vulnerability issues: the flooding

event history showed that after the massive constructions during 2001 to 2008, Beijing City start to suffer from flooding issues. The supporting infrastructures were not able to sustain the city itself. In fact, the underground systems are still using the systems they built 50 years ago according to the interviewees in planning department. The above problems are the flip side of the glory 2008 Beijing Summer Olympics. It is very important for authorities to face the truth of the situations and improve their underground city supporting system and using the Olympic sites more efficiently.

## ACKNOWLEDGMENT

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*Chapter 6*

# URBAN LOW-INCOME HOUSING DEVELOPMENT IN GHANA: POLITICS, POLICY AND CHALLENGES

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## ABSTRACT

Globally, the provision of adequate housing has become a huge challenge for national authorities in most developing countries. More people are becoming homeless, slums and squatter settlements are increasing as the provision of housing is left to the private sector. Urban low income housing provision has not been satisfactorily handled within the formal sector. Although governments have developed housing programs with the view of addressing urban low income housing in Ghana, the end products have been taken over by the middle to high income groups. Moreover, urban low income housing development in Ghana is not aligned to any housing policy but rather crops up in political manifestoes. They end up being abandoned and urban low income households continue to suffer the most. These households have to depend on individual petty landlords to cater for their housing needs. Urban low income housing is now being 'facilitated' by government for the private sector to provide housing units. This system has not functioned effectively as the shortage of affordable housing in urban centers in Ghana keeps increasing. A qualitative research approach using reports, thesis, and population and housing censuses provided the information for this paper. It is recommended that urban low income housing should be handled proactively by policy makers without much political bias since it is households that suffer. Again, globally, urban low income housing is being considered as a social policy program which calls for more involvement of the public sector. At best there should be a public-private partnership to efficiently address urban low income housing in Ghana and other developing countries. Innovative housing forms such as multi-habited dwellings should be developed to meet the budget of the low income household instead of the colonial single-family dwellings which are more expensive to own.

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**Keywords:** Political economy, low income housing, multi-habitation, social housing, public-private partnership, Accra, Ghana

## INTRODUCTION

Globally, the provision of adequate housing has become a huge challenge for national authorities in most developing countries. More people are becoming homeless, slums and squatter settlements are increasing and house prices continue to escalate. The United Nations (UN) estimates that the urban population will increase to about 5 billion in 2030 after a steady growth from 1 billion in 1960, 2 billion in 1985, and 3.3 billion in 2008 (UNSD, 2008). In 2011, the world population reached 7 billion (UNSD, 2011). Population growth of cities has profound implications for urban low income housing development which governments cannot neglect. The general trend seems to suggest that such population increases have not been matched by a corresponding supply of housing resulting in a huge backlog.

Housing issues continue to remain as one of the unresolved policies of governments in the world after several years of housing demand (Struyk, 1988). In African cities, prohibitive regulations and administrative barriers restricting housing supply contribute to increase housing demand (Boudreaux, 2008). Similarly, rural-urban migration has affectedly inflated the high demand for housing in cities (Chisholm, 1992). Over the years urban house prices continue to be unaffordable to a significant number of urban low income households. House-price-to-income ratios in Africa and Asia are typically seven to nine times average incomes (Majale & Tipple, 2007). Insecure and expensive urban lands coupled with high cost of construction have curtailed urban low income households' quest to own a house in the urban centers (Buckley & Kalarical, 2005; Rono, 2007). Almost non-existing mortgage market coupled with discriminatory formal financing from banks prevents urban low income households from accessing housing finance. Urban low income rental housing has mainly been catered for by the private individual petty landlords in West Africa.

In Ghana (location shown in Figure 1), the housing backlog is estimated to be 1.5 million units as at 2012.Ghana's current residential property demand stands at 150,000 units per annum, with a shortfall of over 100,000 housing units. Current production of residential properties averages only 35,000 units per annum (KMA, 2013). The census in Table 1 indicates that the average household size in Ghana is 4.4 persons, with about 1.6 households per house, and a total of 3,392,745 housing units nationwide (GSS, 2012). Housing in Accra has become expensive and increasingly pricing middle and lower income groups out of the private housing market (Buckley & Mathema, 2008). The result is the proliferation of petty landlords building substandard housing with congested living conditions for a large majority of the city's residents in low income communities and in slums (Arku, 2012; Yankson, 2012b).

The World Bank Structural Adjustment Programs in 1980's tasked national governments to be facilitators of housing and not direct suppliers of housing. They were to create a stimulating environment through tax cuts for private housing developers, make available construction loans for developers and expand housing mortgage markets (Pacione, 2005). According to Renaud (1999), the World Bank advocated that priority should go to the development of well-structured housing markets with sound institutions and organized

professions, while avoiding policies that promote direct housing provision. Global trends of privatization, partnerships, cost recovery, efficiency and productivity in housing provision was encouraged in the developing countries (Sengupta & Tipple, 2007). As part of World Bank economic policies, Ghana government was tasked to offer financial incentives to housing developers as bait for affordable housing investment and to encourage competitiveness within the housing market. According to Arku (2009), these measures were seen not only as a way to increase housing supply but also as a way to provide a platform for investment in the housing industry and, ultimately, to promote economic growth.


Figure 1. Map of Ghana showing Accra (Adapted rom:www.mapsopensource.com/Ghanadistricts).

Although the policy attracted a huge number of real estate developers under the umbrella of Ghana Real Estate Development Association (GREDA) with about 400 registered members, tax incentives for private housing development in Ghana has rather encouraged high cost housing instead of affordable housing (Buckley & Mathema, 2008). This is captured in the Graphic Business (2013) as "*However, the sustained economic growth in the country, upsurge in foreign direct investments (FDIs) and an urge for money rather than service by most real estate companies have caused many members to build primarily for the middle to high income earners. That leaves those in the lower end of the market to fend for themselves or at best rent*". In addition, the lack of construction loans for private housing developers coupled with high interest rates from commercial banks have contributed to high cost buildings as funding for housing projects are solicited from the private financial markets. For example, the Bank for Housing and Construction (BHC), initially set up to give loans to private housing developers in Ghana, became liquidated in the year 2000 after it became bankrupt.

**Table 1. Stock of Houses and Households by Region, 2010**

| Region | Total population | No. of houses | No. of households | Distribution of Houses (%) | Rural share of Housing stock (%) | % increase in housing stock over 2000 | House-holds per house | Population per house | Average household size |
|---|---|---|---|---|---|---|---|---|---|
| All regions | 24,658,823 | 3,392,745 | 5,467,136 | 100.0 | 57.7 | 60.1 | 1.6 | 7.3 | 4.4 |
| Western | 2,376,021 | 380,104 | 553,635 | 11.2 | 67.5 | 51.4 | 1.5 | 6.3 | 4.2 |
| Central | 2,201,863 | 346,699 | 526,764 | 10.2 | 61.8 | 60.8 | 1.5 | 6.4 | 4.0 |
| Greater Accra | 4,010,054 | 474,621 | 1,036,426 | 14.0 | 13.0 | 73.4 | 2.2 | 8.4 | 3.8 |
| Volta | 2,118,252 | 399,953 | 495,603 | 11.8 | 72.2 | 53.8 | 1.2 | 5.3 | 4.2 |
| Eastern | 2,633,154 | 431,697 | 632,048 | 12.7 | 64.1 | 54.1 | 1.5 | 6.1 | 4.1 |
| Ashanti | 4,780,380 | 574,066 | 1,126,216 | 16.9 | 53.0 | 81.9 | 2.0 | 8.3 | 4.1 |
| BrongAhafo | 2,310,983 | 331,967 | 490,519 | 9.8 | 63.4 | 56.8 | 1.5 | 7.0 | 4.6 |
| Northern | 2,479,461 | 257,311 | 318,119 | 7.6 | 71.3 | 47.5 | 1.2 | 9.6 | 7.7 |
| Upper East | 1,046,545 | 114,034 | 177,631 | 3.4 | 79.2 | 30.4 | 1.6 | 9.2 | 5.8 |
| Upper West | 702,110 | 82,293 | 110,175 | 2.4 | 85.4 | 62.3 | 1.3 8.5 | 8.5 | 6.2 |

Source: 2010 Population and Housing Census.

Accra has its share of housing challenges. Being the capital city and the economic and administrative hub of the country, Accra has seen a considerable increase in population. In 2010, Accra had about 18% of its households residing in single family houses, 14.5% living in flats/apartments and semi-detached houses, while about 55.6% of the remaining households occupy multi-family dwellings (GSS, 2012). The 55.6% of the regions' population occupying multi-family housing in 2010 is a decrease from 70% in 2000 and 85% in 1994 (Konadu-Agyemang, 2001b; GSS, 2005). Over 95% of all houses supplied in Ghana are from the private market while only 5% are government supplied buildings (Government of Ghana, 2013). The changing cultural practices and the 'westernization' of family systems have created individualism leading to the construction of single family dwellings without considering the predominant multi-habited houses that has been a major source of housing provision among low income households (Peil, 1994; Tipple and Korboe, 1998; Tipple et al., 1998; Tipple et al., 1999; Konadu-Agyemang, 2001a). The situation is compounded by the construction of single family dwellings by government and private estate developers rather than multi-habited dwellings even though rental units from multi-habited housing continue to remain the prime method of accommodating urban low income households in Ghana (Peil, 1994).

Housing supply in Ghana is mainly from five sources; namely government sector, corporate sector, not-for-profit sector, individuals supply and informal sector. The corporate sector including Ghana Real Estate Developers Association (GREDA) supplies about 90% of the national housing stock. Habitat for Humanity and Peoples' Dialogue, a community based NGO that was born out of the eviction crises that loomed over the residents of Old Fadama, a squatter settlement in Accra (Afenah, 2010) and others supply just a minimal fraction of the housing stock. However, low income housing supply is mainly achieved through middle and low income individual petty landlords who build incrementally and rent out rooms. According to the 2010 population and housing census, only 7.2% of all the house types supplied in Accra are owned by the government (GSS, 2012).The most common method of residential building is the incremental building method (Karley, 2008). Renaud (1999) commented that households building through the incremental method often rely on informal housing finance, personal loans and they contract small craftsmen and tradesmen to build. Projects are done in phases and are tied to the households' income and could take an average of five years for a house to be completed (Tipple et al., 2004). The share of such mode of housing supply in Accra is estimated to be 80% of all houses built (Instiful, 2004). Table 2 gives a summary of the type of houses supplied in Accra in 2010.

History shows that the genesis of this housing deficit stems from the colonial era when comprehensive housing policy was not developed to effectively address urban low income housing supply (Yankson, 2012b: Addo, 2013).

Unfortunately, massive urban low income housing production has been critically tackled in just three eras of Ghana's urban development. This paper reviews the public sector urban low income housing provision in Ghana since the colonial era by looking at the politics policies, and the challenges associated with urban low income housing development. It traces the provision of low income housing from the colonial days when health was the driving force behind such housing programs to contemporary times when housing programs are stalled because of political differences and inefficient land management systems. The chapter concludes with some policy directions to improve urban low income housing initiatives in the Twenty First century.

**Table 2. Summary of house types in Ghana and Accra**

| Type of dwelling | All regions (%) | All regions: number | Greater Accra region |
|---|---|---|---|
| Separate house | 28.7 | 1,670,392 | 197,062 |
| Semi-detached house | 7.1 | 412,329 | 88,215 |
| Flat/ Apartment | 4.7 | 270,642 | 70,201 |
| Compound house (rooms) | 51.5 | 2,997,508 | 605,902 |
| Huts/buildings | 3.8 | 221,260 | 14,435 |
| Tent/ kiosk/containers/ living quarters | 2.4 | 137,720 | 77,716 |
| Uncompleted buildings | 1.6 | 94,913 | 33,094 |
| Other | 0.2 | 12,843 | 3,772 |
| Total houses | 100% | 5,817,607 | 1,090,397 |

Source: 2010 Population and Housing Census.

## POLITICS AND POLICIES OF URBAN LOW INCOME HOUSING DEVELOPMENT IN GHANA

### Colonial Era (before 1950)

The capital city of Ghana was first moved to Accra, a small fishing village, in 1877. Previously, Cape Coast was the capital city of Ghana where the colonial officers built and occupied the Cape Coast and Elmina castles. After relocating to Accra and establishing the political seat of government in the city, European officers were recruited from abroad to help modernize the city. These officers needed to be housed. This sparked the whole process of providing formal housing for officials. Houses were built around the Ridge areas and the Cantonments in central Accra, closer to the administrative areas and the Christianborg Castle, which was the seat of government. These official houses were described by Mabogunje (1978) as housing not too dissimilar from what the expatriates were used to in their home country having chimneys in this tropical weather. The hope was that the similarities in the houses constructed for the expatriates and what they left behind in England would reduce their sense of separation from home and alienation from their own society.

Providing housing for the indigenous people was not part of the mandate for public housing provision but rather bolstered by the discourse of health, hygiene and disease. While the Europeans occupied well-constructed and durable houses of cement blocks in the 'European' townships, the people living in the 'African' or 'native' townships occupied traditional compound houses made from mud. Songsore et al. (2004) and Grant and Yankson, (2003) have both described the duality of the residential differentiation of the 'native' townships and 'European' towns claiming that the 'European' towns were located on elevated grounds (ridges) while the native indigenous settlements were located in the coastal plains. The housing and settlement patterns of the 'African' townships were described as thatched buildings arranged in 'a haphazard manner and separated by narrow crooked streets' (Stanley,

1874) with a few 'large, better and in-good-state' buildings belonging to wealthy merchants, which stood out above the rest (Dickson, 1969).

Housing provision was still not considered in the overall development of the communities even during the 1907 bubonic plague outbreak. Rather, the plague led to residential segregation between the Europeans and the Africans. The non-provision of housing continued until 1924 cholera outbreak in Kumasi which necessitated slum clearance programs and re-housing of urban households in Kumasi and other parts of the country (Songsore et al., 2004; Songsore, 2003; Tipple & Korboe, 1998; Agyapong, 1990). The other two major events that required urban housing development were the return of veteran soldiers from the Second World War who needed to be housed and the devastating 1939 earthquake in Accra. The catastrophic earthquake set in motion the construction of estate houses in Korle Gonno, Christiansburg, Osu, South Labadi, Kaneshie, Sabon Zongo, and Abossey Okai by the colonial government for the affected households (Acquah, 1958).

These spontaneous interventions in the necessity-driven housing supply has been described by Hornsby-Odoi and Glover-Akpey (1988) as housing policies that did not hinge on the provision of mass housing but rather focused on the provision of rental bungalow housing for the colonial bureaucracy. Moreover, the early efforts of the colonial administration were not based on a detailed housing sector study and needs assessment (Acquaah-Harrison, 2004). According to Jones (2011), the segregation of urban space in colonial cities was the product of the fusion of scientific, racial and cultural theories. Not many other urban housing developments were undertaken till the establishment of self-government in 1950.

## Major Housing Initiatives during Nkrumah's Regime (1950 – 1966)

During the rule of self-government, the Convention Peoples Party (CPP), led by Dr Kwame Nkrumah as the Prime Minister, launched a Five-year Development Plan from 1951/52 – 1957 that led to the setting up of housing-related institutions such as the First Ghana Building Society, the Tema Development Corporation and the Ghana Housing Corporation for the delivering of housing. Prior to independence, under the advice of N. V. Schokbeton in the 1950's, model prefabricated panel houses were constructed in Accra, Kumasi, Sekondi-Takoradi and Cape Coast as part of the slum upgrading schemes (Agyapong, 1990). However, these houses were expensive, costing about $7000 per house, and the contract was abrogated upon the advice of the United Nations Housing Mission in 1954 (Abrams et al., 1956). Just about 64 houses out of the 1698 houses were constructed (Agyapong, 1990).

A severe housing demand caused by the presence of both European and African officials and migrants in the city searching for housing to rent resulted in speculative builders taking advantage of the situation (Amoah, 1964). The increase in Accra's population did not commensurate with increase in housing provision leading to expensive and unaffordable housing. The dire housing situation led to the creation and concentration of slums and the intensification of housing demand thereby raising land prices (Abrams et al., 1956). According to the Office of the Planning Commission (1964) the average occupancy rate by 1960 was 20 persons per house in Accra with 2.5 persons per room indicating overcrowding among the urban households. The government could not keep up with the high influx of

migrants into Accra that needed to be housed. The United Nation (UN) recommended that Ghana's housing development be structured based on four levels (Agyapong, 1990; Office of the Planning Commission, 1964; Abrams et al., 1956). These were:

- Households earning more than 800 pounds per annum and could afford to build their own houses should be encouraged to do so;
- Households earning between 400 – 800 pounds and could not afford to build their own houses but could afford a hire-purchase contract should be provided with housing by government on hire purchase;
- At the lower level where incomes were low and the population could not buy houses and yet can afford to build their own houses incrementally, they should be supported by government through land bank development and financial aid in terms of building materials;
- Government was to construct houses and subsidies rents for the population that could not afford to occupy any sort of house in the cities without subsidy.

In 1957 under the leadership of Dr. Kwame Nkrumah's CPP, Ghana attained independence. An extensive building scheme was launched in accordance with the CPP socialist agenda (Asabere, 1994). Government took up the challenge of providing subsidized housing for low income persons since housing was viewed as a fundamental human right of every Ghanaian. Though the housing policy bordered on social justice and service, this policy was defeated in terms of the inequality in quality and quantity of houses, households' ability to pay, variations in the amount of subsidies and the fact that government ignored the demographic structure of households (Agyapong, 1990).

The First Ghana Building Society was to spearhead the disbursement of loans to households to achieve the suggestions of the UN Housing Mission. The roof loan schemes were developed to address the housing problems in the rural areas while the wall loan schemes served the urban centers. This category of loan schemes was to help low income households complete houses that were yet to be roofed. Self-help housing was also introduced as a means of helping the urban low income households acquire their own houses. The government was to provide materials, loans and serviced sites at moderate rents to this category of households. Unfortunately, this proposal did not achieve the desired results since households just kept accumulating building materials without any funds for construction.

According to Agyapong (1990), the loans schemes that were set up to support the low income households were also taken over by middle to high income groups and government officials used the loans to finance their personal construction. Most of the loans were also not repaid and this led to the collapse of the loan schemes. The financial demise of the country in the 1960s as a result of the drop in cocoa prices on the global market resulted in high economic inflation thus making it difficult to sustain the housing subsidies. Eventually, these subsidies were withdrawn and the subsidized housing programs were stopped in 1962.

From 1963/64 – 1969/70 a Seven-year Development Plan for National Reconstruction and Development was commissioned (Office of the Planning Commission, 1964). This plan focused on the CPP's theme of 'work and happiness' and the socialist society. It had one of its main goals as *"a complete transformation of Ghana as a strong, industrialized socialist economy and society*" (Office of the Planning Commission, 1964: vi). Housing provision was

targeted towards the formal working force that needed to be housed. It was projected that 25,000 housing units will be built in Accra, Tema and Kumasi each while 35,000 housing units will be built in Sekondi-Takoradi. A budget of 13.2 million Ghana pounds was budgeted for low income housing only. The housing program was to be financed through private savings and investment in housing loans and mortgage facilities (Office of the Planning Commission, 1964). Unfortunately these housing programs were not achieved since Nkrumah was overthrown in 1966.

## Post Nkrumah Era (1966 – 1971)

After the overthrow of Nkrumah's CPP government, socialist housing provision became virtually absent from the subsequent military governments. The National Liberation Council (NLC) came into power from 1966 – 1969 emphasizing on the provision of low income housing under a liberal market economy. However little was done.

Dr. Busia's civilian government, Progress Party (PP), came into power from 1969 – 1972 promoting the liberal market economy. Rural co-operative housing developments were introduced with the aim of mobilizing capital for housing through building societies, housing co-operatives, banks and insurance companies and private financing was also established. An example is the Tema Housing Cooperative. The predominant policy was the aided self-help (Harris, 2003). According to Kumar (1996) an attempt was made to encourage home ownership among the urban low income households by legalizing informal developments on illegal land through the self-help programs in the 1980s. It was argued that home ownership economically empowers the household as part of the house or rooms are rented out or a business could be operated from the home (Kumar, 1996). Hence, owning a home by a low income household was considered a capital asset that will enable the household achieve their livelihood outcome. A new Ministry of Housing was established to improve upon the housing needs of both urban and rural dwellers. The Bank of Ghana set up a loan scheme from which public servants could borrow to build their own houses. Trustees of the Social Security Fund provided capital for the construction of low cost houses.

The aided self-help program instituted to promote home ownership in the urban centers targeted urban low income households with financing support from the government to help households build their personal homes. Harris (2003) and Choguill (2007) have described it as unsuccessful because it left the lowest one-fifth of the population unattended.

## Acheampong's Low Cost Housing Provision (1972 – 1978)

Another milestone in the provision of low income housing was during the Acheampong era. After the civilian rule came another military rule, the National Redemption Council (NRC) and the Supreme Military Council (SMC I and II) under the leadership of Colonel Acheampong from 1972 – 1978 and General Akuffo from 1978 – 1979. It operated a laissez-faire economy. A low cost housing scheme was developed under a Five-year Development Plan (1976 – 1980) which led to the construction of 2300 experimental low cost houses in Accra, Kumasi and Sekondi-Takoradi by SHC. This was in an attempt to remove the social

and economic injustices prevailing in the housing sector and in recognition of housing as a social service (Agyapong, 1990).

The State Housing Corporation (SHC), the Tema Development Corporation (TDC) and the State Construction Company (SCC) were all tasked to construct about 2000 low cost dwellings in all the regional capitals in Ghana (Sarfoh, 2010; Agyapong, 1990). The houses were initially given out on rental basis but because of the rent control policies, market rents were not charged and that led to huge losses (Tipple, 1994). The capital base of the corporations depleted which led to the discontinuation of the social housing programs. The large tracts of government lands that had been acquired for these housing projects were sold out to private developers. The houses were also sold out and they were acquired by the high to middle income households. The low income households could not afford to purchase them. The locations of these estate houses became attractive after a period of time inviting 'raiding' or gentrification from the higher income groups since the lower income groups could not afford to purchase them (Tipple, 1994; Mabogunje et al., 1978). In 2010, Social Security and National Insurance Trust disposed of 750 two bedroom housing units for about 25,000 Ghana Cedis ($13,000[1]) (Ghana News Agency, 2010).

The Bank for Housing and Construction (BHC) was established in 1974 with the mandate to mobilize and channel individual savings and resources into housing investment to promote house ownership and fund public housing. Similar to the other loan schemes, individuals and building contractors who borrowed money for construction defaulted in the repayment of loans. Operations of the bank were mixed with politics as government officials sought to seek loans for themselves as well as their relations (Agyapong, 1990). BHC was finally liquidated in year 2000. Since then, there have been several attempts by various governments to initiate social housing programs but to no avail due to lack of political will and lack of operative housing policy in Ghana (Agyapong, 1990).

## Other Housing Policies and Programmes (1979 – 1982)

In 1979, a coup-d'état, led by Flight-Lieutenant Rawlings under the Armed Forces Revolutionary Council (AFRC) came to briefly reinforce the rent control laws, establish State Houses Allocation Implementation Committee (SHAPIC) and seized properties with the notion that 'one man one house' policy should operate under a Marxist economy (Sarfoh, 2010).

No housing developments were carried out since the AFRC regime lasted for only three months then came Liman civilian government from 1979 – 1981. There was no initiation of new housing programs. This political environment was not favorable to Rawlings who through another coup-d'état seized power from 1981 – 1992 under a military rule and changing to civilian rule from 1992 – 2000.

[1] The exchange rate of the United States of America Dollar to Ghana Cedi is now 1:2.4 (2014). However, in 2010, the exchange rate was 1:1.4.

## The Structural Adjustment and Economic Recovery Programmes (1983 – 2000)

The Structural Adjustment and Economic Recovery Programs started in 1983 after the country had experienced deterioration in the macroeconomic base of the country (Yaro, 2004). The structural adjustment was to realign the economy, reduce the cumulative budget deficit and rehabilitate the economic and social infrastructure of the country (Sarris & Shams, 1991). President Rawlings, under the Provisional National Defense Council (PNDC) government initially operated the Marxist economy which gradually changed into the market-driven and laissez-faire economy. After the failure of the site and services approach to housing provision in the 1970s, international institutions including the World Bank advocated for a shift in housing policy in Ghana and other developing countries. Governments were encouraged by the Bank to adopt the 'enabling environment' approach by facilitating housing provision by the private sector and avoiding interventionist provision of public housing by the state (Keivani &Werna, 2001; Harris, 2003; UN Habitat, 2005). Luginaah et al. (2010) mentioned five neo-liberal housing policy changes in Ghana including:

- Withdrawal of government from direct housing production and financing;
- Stimulating growth of real estate sector (*i.e.*, private sector);
- Liberalizing land markets and building material industry;
- Encouraging formal private sector to construct rental housing units;
- Reforming housing institutions.

According to the authors, the objectives of the policy reforms was to open the housing sector to competition, improve efficiency in housing finance system, and increase housing supply through commercial development, foreign investment, and self-building. By this approach, it was anticipated that the formal private housing markets will work more efficiently and produce affordable housing. However, Yankson (2012a) in a study on urban low income housing situation in Accra observed that economic liberalization did not address the housing needs of low-income households in Accra. In a study of the housing conditions and socio-economic circumstances of landlords and tenant households it was observed that tenancy dynamics in Accra are conditioned by changing socio-economic circumstances of the country and that of the individual household (Yankson, 2012a). The highly privatized housing market did not determine the tenancy dynamics in the country. The author concluded that economic liberalization is not the solution to the housing needs of low-income households in Accra.

Attention was thus directed towards devising ways of providing the economic, financial, legal and institutional environment that was needed to support the housing sector (Choguill, 2007). Thus the Economic Reform Program (ERP) and the Structural Adjustment Programs (SAP) were put in place as part of the International Monetary Fund (IMF) and the World Bank conditionality. Ghana Real Estate Developers Association (GREDA) was formed in 1988 to encourage private participation in urban housing delivery.

Unfortunately the desired impact was not achieved since severe housing shortages are still experienced in Ghana and houses built by GREDA became unaffordable to many of the middle to low income households and the prohibitive policies prevented the low income

groups from accessing mortgages (Konadu-Agyemang, 2001c; Bank of Ghana, 2007). Erguden (2001) has described some of the challenges associated with the facilitative policy adopted by the public sector in urban low income housing provision after about 20 years of implementing such a policy. The author states that "*despite considerable progress achieved in developing countries in the past two decades in policy formulation, facilitating a shift of the public sector's role to strengthening of enabling strategies and focusing on the utilization of the potential and capacity of informal sectors, there is a widening gap between policy formulation and the implementation process, and the status of low-income housing delivery is far beyond being satisfactory*" (Erguden, 2001, p. 1). Constraints such as "*lack of effective implementation strategies, poor promotion of security of tenure, inadequate supply of affordable land and infrastructure, inadequacy of housing finance systems, poor utilization of local building materials and technologies, lack of support to small-scale construction activities, inappropriate standards and legislation, inadequate participation of communities in shelter development process and support to self-help, lack of focused research and experimental projects, poor utilization of research findings, are amongst such major constraints*" (Erguden, 2001, p. 1).

During the PNDC rule a draft National Shelter Strategy (1987 – 1992) and a draft National Housing Policy and Action Plan (1987 – 1990) were drawn up. They were to address urban housing provision but none of them was passed as a working document (MWRWH, 2009). UN Habitat (2005) suggested the incorporation of housing within the wider economic environment rather than dealing with it as a special sector requiring attention out of welfare consideration. This whole sector approach to housing contributed to the establishment of the Housing Sector Reform Program by the World Bank. The World Bank funded Urban II - Housing Sector Reform Program (1990 – 1998) which was the only housing program that came into fruition since it had a donor funding attached (MWRWH, 2009).

The establishment of the Home Finance Company (HFC) in 1990 was to generate secondary mortgage funds to be accessed by middle to higher income households to promote home ownership. By the year 2000, approximately 2000 housing units out of the anticipated 4100 units were disbursed through mortgage funding (World Bank, 2000). As usual, the low income households were not included in the system since government's urban low income housing finance has a high non-cost recovery component and the government was not in a position to carry the burden of heavy subsidies (World Bank, 2002). The number of mortgages disbursed over the years have been decreasing from 2402 mortgages at a value of 192 billion Cedis disbursed in 2001 to 1595 at a value of 260 billion Cedis in 2006 (Bank of Ghana, 2007).

The national shelter reform proposed that rental housing built by SHC and TDC should be sold out through mortgages from the HFC/SSNIT. It was cost ineffective for government to maintain the housing units while renters were not paying economic rents. Rents charged were less than the cost of maintaining the houses (Tipple, 1994, World Bank, 2000). Mass estate housing development, initiated in 1987 and ending in 2000, built by SSNIT, and of high quality had a highly subsidized interest rate which would have de-capitalized the Trust (World Bank, 2000). All these were to be sold out instead of renting. Moreover, it was estimated that inefficient and bankrupt housing *parastatals* (SHC and TDC) were sitting on valuable assets worth in excess of 2% of GDP, and that some fortunate civil servants were enjoying government housing benefits valued at several times their gross emolument (World Bank, 2000). In lieu of this some government houses were sold out.

The urban land administration also began under the URBAN II projects where land banks were to be created for government holding.

The SAP, which has been described as bringing untoward hardship on the population, at the same time fostered the liberalization of the economy which favoured the provision of housing for the middle – high income groups in the free urban housing market (Songsore et al., 2004; Boafo-Arthur, 1999; Barwa, 1995). On the other hand, the bottom 60 – 70% of the urban population who could not afford these costly housing became the losers as the state and private developers moved away from the unprofitable low income segment of the housing market (Songsore et al., 2004). The World Bank housing reform project did not cater for the provision of either housing finance or provision of housing units for the urban low income households since it was advocated that the government of Ghana would require too much subsidy to cater for that income group. According to Yankson (2012b), about 85 per cent of the national housing stock is provided by numerous small builders and individual owners and only 15 per cent is provided by quasi-public corporations, which operate like commercial developers, guided by the policy and programs of the government, and the private real estate developers who operate under the umbrella of GREDA.

In 1995, a 25-year National Development Policy Framework, developed under the NDC regime, codenamed 'Ghana VISION 2020' had an aim 'to transform Ghana from a poor, undeveloped low income country into a vibrant middle income country within a generation'. The strategy was to implement this program over five-year periods. In this policy framework, low cost housing was to be directed towards improving the shelter conditions of the urban low income household. According to Acquaah-Harrison (2004), the framework provided for the introduction of a new facility under the Social Security Scheme allowed contributors to withdraw a part of their contributions to the fund for the purpose of purchasing a house. However, none of the housing strategies were implemented due to lack of funds, lack of private sector participation, lack of political will and change in government that resulted in a change in policy directions (Acquaah-Harrison, 2004).

## Contemporary Urban Low Income Housing Situation (2000 – present)

When the New Patriotic Party (NPP) government took over from the National Democratic Congress (NDC) in 2000, the 'Vision 2020' was replaced with the 'Ghana Poverty Reduction Strategy I (GPRS)' in 2001. This policy was to address the provision of affordable low cost houses through labor intensive methods. Site and services land projects were also to be developed along the urban fringes for urban low income housing. This was to be led by the private sector while the government provides the necessary support with regards to basic infrastructure provision (National Development Planning Commission, 2002). As part of the GPRS I program, slums were to be upgraded. However, constraints such as inadequate housing finance, costly and cumbersome land markets, lack of adequate physical planning and infrastructure, costly building materials, design and construction hampered the housing delivery efforts (Acquaah-Harrison, 2004). An ISSER report (2004) also stated the challenges in housing provision as; lack of adequate financing, high lending rates, high prices in land and building materials and lack of adequate land for large scale housing projects. In 2005, the estimated shortage of houses was 1.2 million and about 140,000 new units were required to be delivered annually (MWRWH, 2009). However, in 2005, only about 30,000

housing units were produced leaving a deficit of 110,000 (MWRWH, 2009). The actual number of houses produced could not be accurately accounted for because of ineffective and uncoordinated planning regulations (MWRWH, 2009).

As part of the agenda to address urban housing issues in Ghana, several draft housing policies have been drawn up including; the Draft National Housing Policy (2009) which is still in the offing, the National Housing Policy and Action Plan (1987 – 1990), the National Shelter Strategy Volumes 1 and 2 (1993), the 'Istanbul Declaration and The Habitat Agenda'(June 1996), the National Shelter Strategy Part Two (revised in June 2000) and the report on 'Housing Programs and Action Plan to Implement the National Shelter Strategy' (2003). The goal of these policies was to provide adequate, decent and affordable housing that is accessible and sustainable with infrastructural facilities to satisfy the needs of the Ghanaian. The recent draft housing policy identified three major changes that needed to be addressed;

- Encourage the formal sector to serve a much larger segment of the income distribution,
- Build and finance housing for households with average incomes through inducements,
- Public sector housing solutions targeting households with incomes below average as a complement to informal individual housing provision and,
- Encourage Community Based Organizations and Non-Governmental Organizations to provide quality housing for the low income.

In line with the new draft national housing policy, 100,000 low cost houses were to be built at a unit price of GHC9000 ($9000[2]) (Mahama & Adarkwa-Antwi, 2006). In year 2009, government officials were accused of taking up the few completed units for their families and themselves (Daily Graphic, 2009). The change in government in 2008 led to the reign of Prof. Atta-Mills as leader of the NDC party. The initial housing project started in year 2006 stalled and the new government sought a loan to implement a different 200,000 housing units STX (South Korea)-Ghana Government low income/public officials housing units. In this case, the proposed cost of houses ranged between $50,000 and $70,000 per unit making them highly unaffordable to both the low and middle income classes. In addition to these housing projects, the NDC government has also committed private housing developers, WALLTECH and KAMPAC, to build 100,000 and 10,000 low income houses respectively (Ghana Web, 2010). However, in December 2011, the STX-Ghana Housing deal was abrogated due to internal wrangling within the company (Daily Guide, 2012).

## Draft National Housing Policy (2009)

The 2009 draft national housing policy is currently the draft policy guiding the production of housing in Ghana. The policy sought to address the following issues in urban housing development in Ghana:

[2] The exchange rate of the dollar to the cedi was 1:1 in 2006.

- Land cost and accessibility;
- Lack of access to credit;
- High cost of building materials;
- Lack of effective regulatory and monitoring mechanisms;
- Research and Development;
- Institutional Coordination;
- Governance for Housing Provision;
- Environment and housing;
- Energy and housing.

The aims for the housing policy include, first, to facilitate access to land for the low-income population to pave the way for an increase in housing stock through their own efforts and also assemble and allocate land so as to reduce overcrowding in slums and informal settlements and provide for new household formation. The second aim is to establish a sustainable housing process which will eventually enable all Ghanaians to secure housing with secure tenure, within a safe and healthy environment and viable communities in a manner that will make a positive contribution to a democratic and integrated society, within the shortest possible time frame. Under the overall aims the following specific objectives of the policy are:

- To accelerate home improvement, the upgrading and transformation of the existing housing stock;
- To improve the environment of human settlements with a view to raising the quality of life through the provision of good drinking water, sanitation and other basic services;
- To make housing programs more accessible to the poor;
- To promote greater private sector participation in housing delivery by creating an enabling environment through the elimination of constraints and improving access to resource inputs;
- To create an environment conducive to investment in housing for rental purpose;
- To promote orderly consolidated urban growth with acceptable minimum provision of physical and social infrastructure;

These aims and objectives are guided by the following principles;

- Housing as a basic human right;
- The role of government;
- People centered development
- Freedom of choice;
- Urban and rural balance;
- Sustainability and fiscal affordability;
- Consumer protection and education
- Accountability and monitoring;

# CHALLENGES IN URBAN LOW INCOME HOUSING DELIVERY IN GHANA

## Housing Delivery Process

Although the 2009 draft housing policy spells out in detail the aims and objectives of housing development in Ghana, the processes involved in housing provision in Ghana is fraught with many challenges. According to Karley (2008), housing delivery in Ghana is characterized by high cost and cumbersome land acquisition, lack of mortgage financing, utility infrastructure issues, inability to procure building materials at lower costs and inadequacy of labour. The nuances associated with urban housing development defeats government objective of making housing programmes more accessible to the poor and improving the quality of life of the urban poor.

## Access to Urban Land

The proportion for the cost of land is estimated to be around one fifth of the total cost of housing construction (Karley, 2008). For example, land prices in residential areas such as Cantonments, Labone and the Airport Residential Area ranged from US$250,000 to US$500,000 for about a 30metre by 25metre plot of land in 2013. Usually, cost of land in the urban peripheries is lower in price selling between US$1500 to US$5000 for a similar size of land. The price of land is dependent on the location and the infrastructure available. In addition to the high cost of land, the process of land acquisition in Accra is saddled with litigations as a result of multiple sales by different families claiming ownership over the same parcel of land. Litigations associated with land acquisition has led to destruction of houses, court cases over ownership of land and unreliable documents which financial institutions have rejected as collateral in sourcing for housing loans (Payne, 1997; Tipple & Korboe, 1998; Gough & Yankson, 2000; Karley, 2008). The issue of land litigations has not promoted greater private sector participation and a favorable environment for housing investment.

Access to and ownership of urban formal land is effectively precluded to all but a minority of affluent and influential people (Rick, 2004). Urban low income households' access to urban land in Accra is fraught with a myriad of challenges. Apart from the fact that urban lands within the central part of Accra are almost completely used up, the other areas are designated as high class residential areas while the price of available land in the urban peripheries is prohibitive to the urban low income household. Hence, urban low income households are compelled to buy cheaper lands in peripheries of Accra and non-developed areas.

After acquiring a piece of urban land, the buyer has to satisfy both customary requirements and enacted legislation present (LAP Coordination Unit, 2007). This results in cumbersome land acquisition and registration. In a bid to streamline the problems associated with urban land acquisition, a National Land Policy was formulated to address the problem of land acquisition in Ghana.

Previously, registration of land in Ghana involved several departments until recently when the Land Administration Project (LAP) was established coordinating the various

institutions involved in the registration of land in Ghana. Generally, land acquisition in Ghana has been described as laborious involving several complex processes (Gough & Yankson, 2000). The bureaucracy in land registration and the lack of transparencies have resulted in multiple registrations of lands in Ghana. Some officials working in the Lands Department, through corrupt practices, expunge the names of original land owners and introduce new owners in the lands records. While all these happenings are ongoing, the buyer with funds quickly develops the land asserting that 'the one who builds on the land is the first to occupy the land'. With this knowledge, a number of households begin constructing their buildings as a sign of occupying the land before registering the lands at the Lands Commission. This is contrary to the requirements of the building regulations.

Accra is the hub of Ghana's political and economic activities. It is the headquarters of both international and national organizations. By virtue of these administrative resources, individuals and organizations desire to own a piece of land in Accra. Very few lands in Accra are owned by Government while a majority is customarily owned by families and chiefs. Until recently, land in Accra was sold out as freehold as compared to lands in the Ashanti Region that are vested in the '*Ashantihene*[3]' stool. Hence, land in Kumasi is leased out and this has brought about some form of control and proper management. In the case of Accra, even vested lands owned by government are being sold out to individual politicians who may buy the state lands at reasonable prices and sell them at high prices (Daily Graphic, 2012).

Speculative buyers and real estate developers are also contributors of the high cost of land in Accra. These people acquire large tracts of land at cheap prices from the family heads or the chiefs and later resell them at very high prices. In some instances, individuals and speculative buyers have exchanged large acres of land for a car. After a period of time when families realise that family lands are almost sold out, then other family members try to resell the already sold out land to another person resulting in litigations. Multiple sale of land in Accra as a result of 'disintegration' and division of the family unit is a huge challenge in urban land management. Land in Accra has been monetized, attaching a high premium to it.

The phase one (2003 – 2008) of the Land Administration Project (LAP) had the following goals; (1) to harmonize land policies and the legislative framework with customary law for sustainable land administration, (2) to undertake institutional reform and capacity building for comprehensive improvement in the land administration system and (3) to establish an efficient, fair and transparent system of land titling, registration and valuation (LAP Coordination Unit, 2007). It was anticipated that this process would stall the litigations associated with land acquisition but that result was not achieved (Mahama & Adarkwa-Antwi, 2006). Recently it was recorded in the media that the Ghana Police had a clash with landowners in a suburb of Accra over the ownership of a piece of land (Daily Graphic, 2013).

## Access to Housing and Mortgage Finance

The second major challenge associated with urban low income housing delivery in Accra is the lack of access to mortgage finance or housing loans. The housing finance situation prevailing in Ghana defeats the policy objective of promoting private sector-led supply of affordable urban housing. An insignificant number of households purchased their houses in

[3] The paramount chief of the Ashanti Kingdom

Accra because mortgage housing finance is inaccessible to the majority of the households especially the lower income groups. The haphazard planning of low income housing in Accra with less durable materials affects the financing options available to urban low income households. Renaud (1999) argues that cities are built the way they are financed claiming that the visual outlook of a community tells how housing units and neighborhoods are financed. The 2009 draft housing policy identified that among the numerous difficulties associated with urban housing provision is the low capital base, absence of long-term borrowing options, high commercial lending rates and low household incomes (MWRWH, 2009).

According to a financial report prepared in 2009 by the Ghana Business News, macroeconomic instability, reflected by high and intractable inflation, high interest rates with huge spreads and a weak and volatile local currency, has characterized the Ghanaian economy over the past two decades thus creating disincentives for investments in long term instruments such as mortgages for sustainable housing development. The macroeconomic environment defeats government private sector involvement in affordable urban housing supply. The main strategy adopted by government currently is to provide greater access to credit particularly for the medium to low income groups through savings schemes (MWRWH, 2009). This was to be achieved through housing bonds by the locality, land for equity swap, incentives to encourage Non-Governmental Organizations (NGO) and Community Based Organizations (CBO) committed to housing provision for the low income groups and improved incentives to housing developers to attract investors. Private estate developers have also developed 'flexible' terms of repayment where an individual interested in purchasing a house makes about 30 – 50% down payment while the house is delivered over a two year period. The remaining amount is spread over a 10-year period. A significant number of households are not able to raise the required deposit.

The collapse of the Bank for Housing and Construction in 2000 also stifled the housing construction and mortgage market for both contractors and prospective home owners. In recent years short to medium term financing are the main products given by the banks. Other non-conventional financing such as savings schemes and cooperatives also generate inadequate funding to begin a new project except to complete projects already started. In Accra, there are three main types of housing finance operating, namely the private commercial banks, the informal savings and loan schemes, and the state financing sources through work places.

Commercial banks, financial institutions and mortgage agencies, such as HFC, offer limited housing mortgagees targeting only high income households. Urban low income households do not have access to these mortgages because first, their income would not qualify them for a mortgage considering the stringent repayment procedures, second about 80% of low income households' work in the informal sector without a defined monthly income. Fluctuating macroeconomic conditions and high inflation rates have resulted in high interest rates charged on loans. Loan disbursements are tied to formal employment systems. The Home Finance Company (HFC) was the main supplier of mortgages in the 1990s and 2000s until recently when their financial base decreased and they reduced the allocation. For example, in 2004 only 85 new loans were made by HFC (Tomlinson, 2007). In recent times a privately owned company, Ghana Home Loans (GHL) limited also disburses mortgages to the market for a repayment period of 15 years. GHL is a mortgage finance institution with key aim of providing competitively priced long term mortgage finance to facilitate home ownership as described in Box 1.

However, the conditions required to access these mortgages for houses are stringent and prohibitive to both middle and low income households. For first time owners, applicants are required to contribute at least 25% of the cost of house with an additional $200 mortgage processing fee as at 2010. The company advertises houses built by private real estate developers and these houses are very expensive and unaffordable to low income households. The company also offers medium and long term mortgages for the completion, rehabilitation and upgrading of homes of mortgagees.

**Box 1. Ghana Home Loans housing mortgage financing**

First Time Home Buyers: Applicants looking to buy their very first home. These are typically individuals or young couples (joint applicants) looking to establish a home. Applicants will be required to contribute at least 25% of the property value towards the purchase.
Target: Borrowers looking to acquire their first property
Interest Rate: Fixed or Variable
Maximum Loan: subject to credit profile
Maximum Term: 15
Loan to Value: up to 75%
Minimum Deposit: 25%
Facility Fee: 1%
Processing Fee: $200 (or Cedi equivalent)
Conditions: The property must be owner occupied
*Source: Ghana Home Loans website, 2010*

In accessing such a facility, the home owner is required to provide registered documents of the land coupled with building approval documents. However, most of these documents are absent when a low income household decides to build. Litigations over urban land in Accra have propelled a number of developers to quickly establish their presence on the land before the necessary documents are processed. The absence of all these necessary documents coupled with the informality of the nature of businesses engaged by the urban low income household as well as the low income levels serve as points for disqualification in applying for housing finance opportunities. In addition, formal banking institutions also require households to provide addresses and other utility bills to indicate a permanent location which disqualifies a number of urban low income households renting from a compound house to open a formal account. Due to all these encumbrances, a number of urban low income households involved in informal businesses are turning to informal micro finance or '*susu*' collectors. '*Susu'* collectors are informal savings collectors who usually visit the low income individuals doing any informal job and collect monies from them daily with the intention that individuals will be saving. However, there have been incidents when the '*susu*' collectors have bolted with the savings of individuals or have not been able to refund the savings of members.

Informal funds are generated from non-conventional microfinance sectors such as small scale savings, credit unions, cooperatives and Rotating Savings and Credit Associations (ROSCAS). Informal finance relies on small, very localized, mutual and irregular forms of finance which are pooled through ROSCAS (Renaud, 1999). This source of generating funds

is not adequate for immediate housing construction but rather for incremental building and extensions where the house is built in phases over a period of time. Most of the private households in Accra, both lower and higher income households, do not use mortgages to finance their housing construction.

State financing of urban low income housing in Accra is minimal especially when governments have adopted the enabling housing market strategy. According to the 2010 Population and Housing Census, the share of government supplied housing in Accra was just about 7.5% of the total housing stock (GSS, 2012). This proportion is highly insignificant and the governments built single family bungalows are inadequate with just about three bedrooms at most. Renaud (1999) describes such houses as being of high standards with very high cost but low value for occupants.

## Building Regulations and Standards

The restrictive building regulations and standards limits the production of urban low income housing in the cities in Ghana. The National Building Regulations, 1996 (L.I. 1630), applies to '*the erection, alteration or extension of a building.....*'. They set out regulations for constructing a building in Ghana with regards to design, permit, construction and requirements. In the case of a housing construction, it is expected that the developer submits detailed plans indicating floor plans, foundation details, sections, elevations, roof plans, structural drawings, electrical drawings and plumbing details to the planning authority. In addition to these plans, the developer has to submit a signed site plan by a Licensed Surveyor indicating the plot size and the layout on the ground before approval is given.

These detailed plans should be designed by an architect, a qualified engineer, a draughtsman, a licensed building surveyor or a building technician. However, the regulation also states that any house that is in excess of 120 square meters or a two or more stores building in the urban or metropolitan areas shall be designed by an architect in consultation with a qualified engineer but excludes the professional builders and draughtsman. However, this requirement is overlooked by a considerable number of households especially in lower income groups since they cannot afford the services of the professionals. At best, most of the houses are designed by a draughtsman who pays for a chartered architect to sign the drawings they produce.

The building regulation stipulates that a minimum of three months is required for an applicant to get a building permit before construction. However, this time period can often extend to over one year even after much lobbying. The delay serves as an excuse for illegal construction without building permit. During housing construction it is expected that the building should not be located on a recently reclaimed site, flood prone areas, water courses and on a site area smaller than 450sqm (330sqm when bounded by roads on three sides) with a frontage not less than 15m. Recently urban land of 15 by 24 meters defeats the requirements of the building regulations. The building regulations require that a minimum of 2.4 meters is left at the sides and the back of the building. No building housing development on a plot of land should exceed 60%. The national building regulations stipulate site coverage for various types of houses as follows (National Building Regulation, 1996):

| | |
|---|---|
| Single store detached | 50% |
| Two and three stores detached | 40% |
| Single store semi-detached | 60% |
| Two and three stores semi-detached | 50% |
| Two and three stores terrace | 50% |

## Building Materials

Although the use of traditional building material is not banned in housing construction in Ghana, approval for use of unconventional building material such as mud and laterite in buildings is subject to the discretion of the district planning officer. This requirement in the building regulations is usually overlooked in informal housing construction. In Ghana, the suitability of a building material is standardized and regulated under the Ghana Standard Code of Practice (GSCP) derived from the British Standard Code of Practice (BSCP).

The era of modernity has greatly impacted the housing construction industry in Ghana by having the market flooded with imported building materials such as floor and wall tiles from China and Spain, doors, ironmongery, roofing sheets and acrylic paints mainly from China. Although some of the components of the building have locally manufactured materials, the high import content of the raw materials such as ingots for roofing sheets and clinker for Portland cement increases the cost of production. In 2009, a communiqué issued at the end of a two day national housing conference in Accra, observed that there was about 65% import content in the construction industry. This percentage may be higher in 2012 when almost every building component is now imported from China. Currently, the dollar to cedi exchange rate is 1:2.4. This means that every item imported has to be sold about three times the cost price if taxes are factored into the overall cost. In 2009 the price of cement was sold for 10.50 Ghana Cedis ($4.00) but is now selling for 19.50 Ghana Cedis ($8.00) in January, 2014 in Accra. The over reliance on imported building materials has led to high cost of building in Ghana. The only two main building components that are accessed locally are sand and stone aggregates.

Although, Gidigasu (2005) suggests that 70% of Ghana land surface is covered with laterite and that the dominant lateritic materials in Ghana range from rocks, boulders, cobbles, pebbles, gravels, fine-grained sandy, silt, and clayey soils, use of traditional building materials such as laterite, clay and mud are almost absent in urban houses. The 2010 Population and Housing Census estimated that only 4% of the buildings in Accra are constructed out of mud/laterite-based material while about 60% of all the buildings are constructed out of cement-based material (GSS, 2012). Yeboah (2005) in a study comparing the cost of construction for different building materials showed major differences in construction cost in peripheral Accra as standards of materials and finishes vary. The UN Habitat in 2011 also compared the cost of construction for adobe; cements screed floor finish and Terrazzo finish and observed considerable differences (UN-HABITAT, 2011).

### Other Constraints in Housing Provision

Other constraints in urban low income housing delivery in Accra include inadequacy of skilled labour leading to lower quality jobs (UN-HABITAT, 2011). In most newly developing urban areas, infrastructure provision lags behind building development. According to Songsore (2003), nationally about 74.2% of all households have access to improved water supply which includes 41% with access to pipe-borne water (including public outdoor pipes and water piped into dwelling), 26.3% with access to borehole water with 6.9% relying on protected wells. The remaining 25% rely on other sources of water supply.

## CONCLUSION

Reviewing the political economy of urban low income housing provision since the colonial era, revealed that although urban low income housing provision was the center of most housing policies, the governments have not had the political will and finance to implement such policies on a large scale. Tracing through the historical provision of urban low income housing provision in Ghana, it is obvious that urban housing development is spontaneous, unplanned, unmanaged and unsustainable. No proper housing policy has served as a roadmap for governments in Ghana with regards to urban housing production in Ghana. Programs for urban low income housing are tied to political gimmick and not policy driven. Dr. Kwame Nkrumah, Ghana's first president and Colonel Acheampong were the two political figure heads who attempted addressing urban housing challenges and especially for the low income households although most of the houses were taken over by the middle to high income households.

In addition to the lack of a housing policy in Ghana urban housing development, the housing sector is bedeviled with a myriad of challenges which need to be efficiently managed to achieve a sustainable urban housing supply in Ghana. Ineffective urban land administration, absence of housing mortgage finance, unfavorable macroeconomic environment affect both investors' and individuals' quest to develop a competitive housing market. They are saddled with land litigations and high interest rates due to increasing inflationary rates. The cost of housing construction in Ghana is relatively high compared to the income levels of households and the national minimum wage. The high component of imported building materials in Ghana's housing construction has made the buildings expensive and at the same time stifled the small scale building manufacturing industries.

Again, urban households are faced with the high building standards and regulations that city authorities impose on them limiting efficient urban usage and creating expensive urban infrastructure. It is recommended that urban low income housing should be handled proactively by policy makers without much political bias since it is the household that suffers. Recent public housing programs have demonstrated political bias by being abandoned by subsequent government and leaving them uncompleted. This situation is fuelled by the absence of a national housing policy. The recent draft policy is still in the offing and it has not been passed to law.

## Challenges in Urban Land Management

Urban land should be managed efficiently by getting landowners and families partnering with government in the allocation of land to housing developers. A data base of urban land should be developed which will monitor the allocation of lands in the urban centers. A law should be passed to have all public and family lands logged in the data base. This will ensure that every parcel of land allocated is captured in the data base and prevent multiple sale of land. Monies accrued from the registration of such lands will serve as royalties for the families and the custodians of the land.

## Unfavorable Financial Macroeconomic Environment

There is the need to stabilize the inflationary rates of Ghana into a single digit number. This will in turn lower interest rates on loans and mortgages to developers and mortgagees. The microfinance sector should be resourced to give reasonable loans to clients since these microfinance institutions serve about 80% of the population who make up the informal sector. Workers contribution to the national social security scheme could also be used as collateral for mortgages.

## High Building Regulations and Standards

Innovative housing forms such as multi-habited dwellings should be developed to meet the budget of the low income household instead of the colonial single-family dwellings which are more expensive to own. Culturally, economically and socially, urban low income households dwell in multi-habited dwellings so as to take advantage of the low cost, informal social relations and family networks existing in such living arrangements. The informal social relations often play a key role in a household's coping strategies as they strive to achieve their livelihood needs.

## Use of Locally Available Building Material Instead of Imported Building Material

*Pozzolana* cement, clay bricks, stones and sand are locally accessed building materials that should be encouraged in urban housing construction in Ghana. Tibaijuka (2009) observed that houses with high component of locally produced building material and low skilled labour creates employment for a majority of artisans compared to luxury building with industrialized building techniques.

## Compact Urban Development Assisting Infrastructure Development

Compact urban development, according to Jenks & Burgess (2000) is the way forward in developing a sustainable urban form in developing countries. This form of development will ensure effective planning and efficient use of scarce urban land. This development will be achieved in Ghana if it is backed by an urban development policy that considers the totality of urban development as a whole and not as units. Peripheral and dispersed development is characterized by poverty, reduced quality of life for the poor and environmental degradation as agricultural land is used up. In addressing compact urban low income housing, multiple level multi-habited accommodations should be provided which will increase densities but avoid overcrowding as found in most low income communities in Ghana. Multilevel multi-habitation should be included in Ghana's urban low income housing development to ensure efficient urban land usage and infrastructure development.

Policy implications for both state and non-state interventions in urban low income housing development in Ghana are summarized in the table below.

**Table 1. Summary of the policy implications for state and non-state sectors**

| Policy | Policy implications | State sector intervention | Non-state sector intervention |
|---|---|---|---|
| Land | Ensure access to secure land tenure.<br>Provision of serviced urban land. | Allowing smaller land sizes<br>Cross subsidy of infrastructure provision | Subsided land from government |
| Compact housing development | Provision of multihabited dwellings.<br>Provision of supporting community facilities for the multihabited houses.<br>Promote vertical development as against the horizontal development. | Mixed development with some shared facilities<br>Housing management body | Fraction of houses built for low income households as tax rebates |
| Housing Cost and Financing Options | Promotion of savings and credit schemes specifically for housing.<br>Establish national housing fund.<br>Mobilization of community resources. | Direct involvement of government in provision.<br>Encourage hire-purchase through renting.<br>Public-Private partnership.<br>Formation of cooperatives. | MDAs to build for the lower levels (provident fund, end of service benefits)<br>Access to housing finance by petty landlords |
| Building Regulations and Standards | Lower building standards for multi habited dwellings.<br>Promote the use of indigenous building materials and skills | Approve multi habited houses.<br>Allow larger coverage on land.<br>Re-zoning for cross subsidy. | |

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*Chapter 7*

# NOISE IN AN URBAN SETTING – MEASUREMENTS, NOISE MAPPING, CITIZENS' RESPONSE TO NOISE

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## ABSTRACT

The rapidly expanding process of urbanization around the world commonly aggravates environmental pollution: gas emissions, water and noise pollution. The noise that reaches urban populations is generated by various sources, and may be of a simple or complex nature, including the noise generated by 1) transportation systems (road, railroad, air), 2) civil construction activities, and 3) a wide variety of leisure activities such as cultural events, sports events, etc. Many sectors of society are affected by noise, particularly noise that is generated by vehicle traffic. Traffic noise causes discomfort and irritation, especially during activities that require attention and concentration. In response to the increasing levels of urban and industrial noise pollution, numerous studies have focused on environments intended for activities that involve a cognitive load, such as educational and working environments.

This chapter discusses noise assessment in an urban setting based on *in situ* measurements of acoustic descriptors such as the equivalent continuous sound pressure level $L_{eq}$, statistical noise levels ($L_{10}$, $L_{50}$ and $L_{90}$), traffic noise index TNI, and noise pollution level $L_{np}$. In today's scenario it is crucial to understand the problem of urban noise by preparing and analyzing noise maps. This chapter describes the use of noise maps to study road and rail traffic noise in an urban setting. These maps are powerful allies in urban planning for noise control, especially in large cities. These models facilitate management and decision-making by public authorities aimed at finding solutions to potential environmental risks associated with urban noise. Models to predict noise levels at daytime and nighttime, generated by road traffic in cities are presented and

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discussed. In addition to noise measurements and calculations of noise mapping, understanding the complex problem of noise in cities requires understanding how urban residents perceive this serious environmental problem. Annoyance due to noise in the urban environment is analyzed in this chapter, through the study of noise generated by road and rail traffic.

## 1. INTRODUCTION

Global economic growth goes hand in hand with population growth, which leads to urban growth. According to the January 2011 edition of National Geographic (2011), only three cities in the world had a population of more than 10 million in 1975. Today there are 21 megacities with populations in excess of 10 million. This growing population inevitably implies several types of pollution, including noise pollution (see Belojevic et al., 1997; Zannin et al., 2002; da Paz et al. 2005; Belojevic et al., 1997; Jakovljevic et al., 2009; Zannin et al, 2013).

Several sectors of society are affected by noise pollution, particularly that generated by vehicle traffic. Traffic noise is particularly disturbing in activities that require attention and concentration. In response to the increasing levels of urban noise pollution, a variety of studies have focused on the quality and acoustic suitability of environments destined for activities involving high levels of intellectual and cognitive demands, such as educational and work environments (see Muzet, 2007; Zannin and Marcon, 2007; Astolfi et al., 2012; Zannin and Zwirtes, 2009; Zannin and Ferreira, 2009; Fernández et al., 2009).

This chapter describes noise assessment in an urban setting through *in situ* measurements of acoustic descriptors such as the equivalent continuous sound pressure level $L_{eq}$, statistical noise levels ($L_{10}$, $L_{50}$ and $L_{90}$), traffic noise index TNI, and noise pollution level $L_{np}$.

In today's scenario it is crucial to understand the problem of urban noise by preparing and analyzing noise maps. This chapter describes the use of noise maps to study road traffic noise in an urban setting. These maps are powerful allies in urban planning for noise control, especially in large cities. These models facilitate management and decision-making by public authorities aimed at finding solutions to potential environmental risks associated with urban noise.

This chapter also presents the study of annoyance due to noise in the urban environment, through the study of noise generated by road and rail traffic.

## 2. ENVIRONMENTAL NOISE ASSESSMENT

The International Organization for Standardization, ISO, has the following standards for assessing environmental noise: 1) ISO 1996-1 - Basic quantities and assessment procedure (ISO, 1996); 2) ISO 1996-2 - Acquisition of data pertinent to land use (ISO, 1996).

## 2.1. ISO 1996-1 – Basic Quantities and Assessment Procedure

National standards, regulations and acceptable noise limits can be established based on the principles described in this part of the standard. The ISO 1996-1 standard defines the basic items to be used to describe noise in community environments and describes basic assessment procedures. It also specifies methods to assess exposure to several types of environmental noise.

The standard provides adjustments for the assessment of noise levels from different sources, since the community's response to noise from different sources that produce the same sound pressure level may vary. The standard describes settings for sounds that have different characteristics, and also indicates settings for nighttime, weekends and holidays. These settings can be added to measurements or predictions of the equivalent continuous sound pressure level. Table 1 adapted from ISO 1996-1, describes the recommended settings.

**Table 1. Sound pressure level settings recommended by the ISO 1996-1 standard**

| Characterization of the sound source | Specification of the sound source | Level adjustment according to the specification of the sound source [dB] |
|---|---|---|
| Noise source | Road traffic<br>Aircraft<br>Railway<br>Industry | 0<br>3 to 6<br>-3 to -6<br>0 |
| Characteristics of the noise source | Normal Impulsive Sound<br>Strongly Impulsive Sound<br>Tonal Sound | 5<br>12<br>3 to 6 |
| Time period of the day | Evening<br>Nighttime<br>Weekends –<br>Daytime (7:00h to 22:00h) | 5<br>10<br>5 |

## 2.2. ISO 1996-2 – Acquisition of Data Pertinent to Land Use

The purpose of this standard is to provide data acquisition methods that describe environmental noise. This standard specifies that for data acquisition, the geographical description of the area to be assessed must be considered; the major sources must be characterized; the situation of the receiver, such as location, occupation, use and characterization of the immediate surroundings must be described; and weather conditions must be noted.

If there are tonal sounds, the standard recommends the following: 1) if audible and noticeable when measured in the 1/3 octave band, add 5 to 6 dB; 2) if inaudible and perceptible only when measured in a narrow band, add 2 to 3 dB. To adjust impulsive sounds one should proceed as follows: 1) in the case of strongly impulsive sounds such as explosions, add 11.7 dB to the measured environmental noise ($L_{Aeq}$); and 2) for impulsive sounds, add 3 dB to the measured environmental noise ($L_{Aeq}$).

The average sound level can be determined from measurements, calculations, or both. As for the measurement technique to be used, e.g., instrumentation, the number of microphone positions and the duration of the measurement depend on the type of source and receiver. The instruments should preferably be of type 1 or at least type 2. Measurements should be taken at the height of the receiver and at a distance of 1 to 2 meters from the facade. The time interval should be chosen so that it covers all the variations of noise emission and transmission. The measurement time will depend on the accuracy of the desired result.

In addition to reporting the results of measurements of existing environmental noise and the calculated results of the noise of planned activities, a presentation of noise zones can be included. It is recommended that the boundaries of the zones represent the difference in results in multiples of 5 dB. The standard includes two tables to represent these results by means of colors or crosshatching. The first table uses multiples of 5 dB and the second multiples of 10 dB. The details and scale of the map depend on: 1) the size, structure and use of the area in question; 2) the purpose of planning (large scale decisions at sites for new sources and receivers, changes in land use, final decision for new receivers); and 3) the phase of the planning procedure.

A noise map can be established as an official map on a given scale, describing relevant details of buildings, traffic installations, industrial areas, agricultural areas, vegetation and contour lines.

## 2.3. Brazilian Standard for Noise Assessment in Communities – NBR 10151

The NBR 10151 standard of ABNT – Brazilian Association of Technical Standards, aims to: 1) determine the conditions required for the assessment of acceptable noise levels in the community; 2) specify the method for measuring noise; and 3) specify corrections of measured levels if the noise presents special characteristics.

As for measurement procedures, the standard specifies that measurements should be taken outside the boundaries of the property that contains the source, and if there are complaints, measurements should be taken at locations indicated by the complainant. Corrections should be made if the noise presents special characteristics. These corrections should be made to better assess the irksomeness to the community. Measured values must be rounded to whole numbers. As for the measurement time, the standard establishes that the time considered must characterize the noise in question, and that only one measurement or a sequence of measurements can be taken. The microphone should be protected during the measurements, which should be taken at a height of 1.2 m from the ground and at least 2 m from the edge of the property that contains the source and from any reflective surface.

In addition to parameters for external measurements, the NBR 10151 standard establishes rules for internal measurements. Measurements inside buildings should be taken at least 1 m from any reflecting surface, and at least 3 points should be measured, separated by a distance of at least 0.5 m, if possible. In addition, the standard specifies that these measurements should be taken in conditions of normal use of the environment.

With regard to the measured parameters and corrections to be made, the standard specifies that, if the noise does not have tonal characteristics or impulsive components, the measured parameter is $L_{Aeq}$ (A-weighted equivalent continuous sound pressure level). However, if the noise has impulsive or impact characteristics, the maximum sound pressure

level, adjusted for fast response, should be measured and 5 dB (A) added to this measurement. If the noise has tonal components, the $L_{Aeq}$ should be measured or calculated and 5 dB(A) added to it. If the noise present tonal components and impulsive or impact characteristics, the aforementioned corrections should be made and the highest value taken as the result. Noise assessments should be done by comparing the measured values against the levels determined by the standard, according to activity and time of day. Nighttime and daytime periods depend on the habits of the population; however, the nighttime period should not start before 10 p.m. nor end before 7 a.m. the following day, and 9 a.m. if it is a Sunday or holiday. Assessments done indoors should be based on the same criteria as those used for outdoors, with a correction of 10 dB(A) for open windows, and of 15 dB(A) for closed windows. If the ambient noise level is higher than that specified in the table, it should be adopted as the evaluation criterion.

**Table 2. Noise levels according to land use established by the Brazilian ABNT standard NBR 10151**

| Type of Land Use | Noise levels $L_{eq}$ dB(A) | |
|---|---|---|
| | Daytime | Nighttime |
| Rural | 40 | 35 |
| Hospitals, Schools | 50 | 45 |
| Residential | 55 | 50 |
| Commercial | 60 | 55 |
| Industrial | 70 | 60 |

## 2.4. Curitiba Municipal Law No. 10625

This municipal law of Curitiba "establishes guidelines for urban noise, protection of public well-being and peace, and other matters." The law defines the time periods of: 1) Daytime: 7:01 to 19:00 h; 2) Evening: 19:01 to 22:00 h; and 3) Nighttime: 22:01 to 7:00 h. The law cites the NBR 10151 standard as a reference to be followed for measurements. Law 10625 establishes maximum noise levels according to urban zones, which are described in Table 3.

The first line in Table 3, which is more restrictive regarding noise, is also characterized for being more restrictive with regard to construction parameters. The "ZRs" specified on this first line are almost strictly residential zones with low population density, where only markets that meet the basic needs of the residents are being allowed.

The second line in the table also has fairly restrictive areas with regard to land use and also low population density. These areas are of mixed use, comprising shopping and residential areas. The "ZRS" are the residential zones. The "ZTs," which are transition zones, are boundary areas between conflicting zones, which are intended to buffer the impacts of land use and occupation. The "ZEs," or special zones, comprise large physical spaces,

characterized by existing or future buildings, equipment and facilities for large institutional uses.

The third line in Table 3 is characterized by areas of higher population density and commercial establishments, thus leading to higher urban sound pressure levels. This line includes areas such as "ZR4," the most densely populated residential area; "ZC," the central area with many shops, and heavy vehicle and pedestrian traffic; the "SE," the special structural sector, which is the city's main growth hub, characterized as an area of expansion of the traditional city center and as a commercial, services and transport corridor, underpinned by a ternary system of circulation (Law 9800/2000). The fourth line in Table 3 contains the areas that are home to very noisy activities, such as the "ZI" with industrial activities, the "ZES" with service activities and zones with sports activities.

**Table 3. Maximum sound pressure levels according to urban zones and time of day, established by Curitiba Municipal Law No. 10625**

| Type of use of the urban area | Daytime | Evening | Nighttime |
|---|---|---|---|
| Strictly residential zones<br>(ZR-1, ZR-2, ZR-3)<br>Green zones (green areas), etc. | 55 dB(A) | 50 dB(A) | 45 dB(A) |
| Special educational zone ZE-E,<br>Residential zones ZRs,<br>Transition zones ZT,<br>Special zones ZEs, etc. | 60 dB(A) | 55 dB(A) | 50 dB(A) |
| City center zone,<br>Mixed residential zone ZR-4,<br>Special zone of ZE-BR 476, etc. | 65 dB(A) | 60 dB(A) | 55 dB(A) |
| Industrial zone<br>Special service zones ZEs, Zones with sports activities, etc. | 70 dB(A) | 60 dB(A) | 60 dB(A) |

## 3. Acoustic Descriptors for the Assessment of Noise Pollution in Urban Settings

In traffic noise studies, the principal determining parameters are traffic volume, composition, road grade, and distance from the source to the receiver (e.g., Alves et al., 2004; Golebiewski et al., 2003; García and Faus, 1991; Calixto et al., 2008). Several studies have found a correlation between traffic noise and other parameters, including: 1) operational parameters, 2) road design parameters, and 3) atmospheric parameters (Priede, 1975).

The equivalent sound pressure level $L_{eq}$ is a constant average level, which, in terms of acoustic energy, is equivalent to the variable noise levels during the measuring period, expressed in decibels (dB) (Schultz, 1972).

In traffic noise studies, the most important levels are: 1) $L_{10}$, which represents the sound that was masked during 10% of the total measuring time, and can be considered a sound of short duration or low intensity compared with other sounds of the environment; and 2) $L_{90}$, which represents the sound that was masked during 90% of the total measuring time, and can

be considered the environment's background noise (Schultz, 1972). Knowledge of these levels is necessary in order to identify sound fluctuations within a sound spectrum, as well as sounds atypical of the event of interest (Bies and Hansen, 2002; Beranek, 1993).

The noise pollution level, $L_{np}$, is a value that describes the level of traffic noise considering the continuous noise level and its variability, i.e., temporal fluctuations of the levels (Ma et al., 2006; Beranek, 1993; Robinson, 1971). The formulation of this descriptor comprises the equivalent sound pressure level plus statistical noise levels (Schultz, 1972). Beranek's approximate equation, presented below, calculates the $L_{np}$ as a function of the statistical levels $L_{10}$ and $L_{90}$ (Beranek, 1960),

$$L_{np} = L_{eq} + \left(L_{10} - L_{90}\right) \text{ [dB(A)]} \tag{1}$$

where: $L_{np}$ = noise pollution level [dB(A)]; $L_{eq}$ = equivalent sound pressure level [dB(A)]; $L_{10}$ = statistical noise level at 10% [dB(A)]; $L_{90}$ = statistical noise level at 90% [dB(A)].

The traffic noise index, *TNI*, is also a descriptor of traffic noise, which takes into account the variability of noise, in terms of percentile levels, and is therefore a weighted combination of the extreme statistical levels (Ma et al., 2006; Langdon and Scholes, 1968; Griffiths and Langdon, 1968). Griffiths and Langdon (1968) proposed the expression below to calculate the traffic noise index:

$$TNI = 4.\left(L_{10} - L_{90}\right) + L_{90} - 30 \text{ [dB(A)]} \tag{2}$$

where: *TNI* = traffic noise index [dB(A)]; $L_{10}$ = statistical noise level at 10% [dB(A)]; and $L_{90}$ = statistical noise level at 90% [dB(A)].

The noise levels $L_{10}$ and $L_{90}$ are measured outdoors, sampled or continually, over a 24-hour period (Langdon and Scholes, 1968). Schultz (1972) proposes a limit level of 72 dB(A) for the $L_{np}$, and of 74 dB(A) for the *TNI*, considering a road with heavy traffic in a mixed area.

### 3.1. Evaluation of Urban Noise Based on $L_{np}$ and TNI

The city of Curitiba (Brazil) has two stretches of highway inside its urban perimeter. These stretches are called "roads-major avenues" (da Paz, E. C., 2004), because they are lined with dense demographic concentrations for a variety of uses, i.e., residential, commercial, industrial and services. The present research evaluated the acoustic environment of 20 kilometers of the northbound and southbound urban stretches of the highway, as indicated in Figure 1, by modeling measurement data. The measurements were taken at 24 monitoring points set up at 500-meter intervals.

Measurements were taken at each point according to the German standard RLS-90, at a distance of 25 m perpendicular to the road's axis, and 15 m perpendicular to the road's axis in cases where the monitoring points were very close to buildings. Each monitoring point was placed 1.2 m from the ground (Figure 2), and the total of measurements taken at each point

varied from 4 to 17, as a function of the variability of traffic flow over time. These measurements were taken simultaneously in both directions of the road.

The sound levels were measured using a Brüel and Kjaer 2238 Class I sound level meter set on its own tripod and a BK 4188 type microphone. The measuring time was set for 5 minutes and measurements were taken in the *fast* response mode, with evaluation on the A weighted curve, in a dynamic range of 40 to 120 dB. All the measurements were taken in good weather conditions (no rain or strong wind), and the device was equipped with a wind shield on straight stretches of more than 200 meters devoid of obstacles that could cause possible reflection or reduction of vehicle speed. Measurements were taken from 7:01 a.m. to 10:00 p.m. and from 10:00 p.m. to 7:00 a.m., making a total of 184 valid daytime and 92 nighttime measurements.

The sound level measurements were analyzed using the *EVALUATOR BK 7820* software. This software was used to calculate the mean values of daytime and nighttime equivalent sound pressure levels ( $\overline{L_{eq}}$ ) and statistical sound levels ($L_{10}$ and $L_{90}$) at each point, based on cumulative analysis graphs (Figures 3 and 4). The values of $\overline{L_{eq}}$ , $L_{10}$ and $L_{90}$ obtained from the graphic analysis were applied to the equations proposed by Beranek and by Griffiths and Langdon to obtain the sound pollution level and the traffic noise index at each point.

The results of the graphic analysis of the equivalent sound pressure level ( $\overline{L_{eq}}$ ) and the statistical levels ($L_{10}$ and $L_{90}$) were applied in the equation proposed by Beranek (see Eq. 1), and the daytime and nighttime sound pollution levels ($L_{np}$) were calculated from the mean values. The road traffic index was calculated using the equation proposed by Griffiths and Langdon (se Eq. 2). Figures 5 and 6 illustrate the results of the calculations of $L_{np}$ and *TNI*.

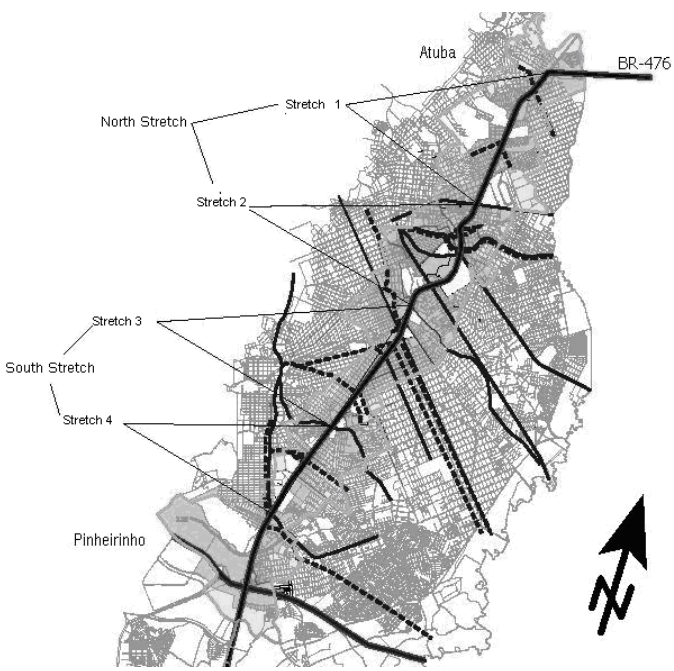


Figure 1. Map of the urban stretch of the BR 476 highway.

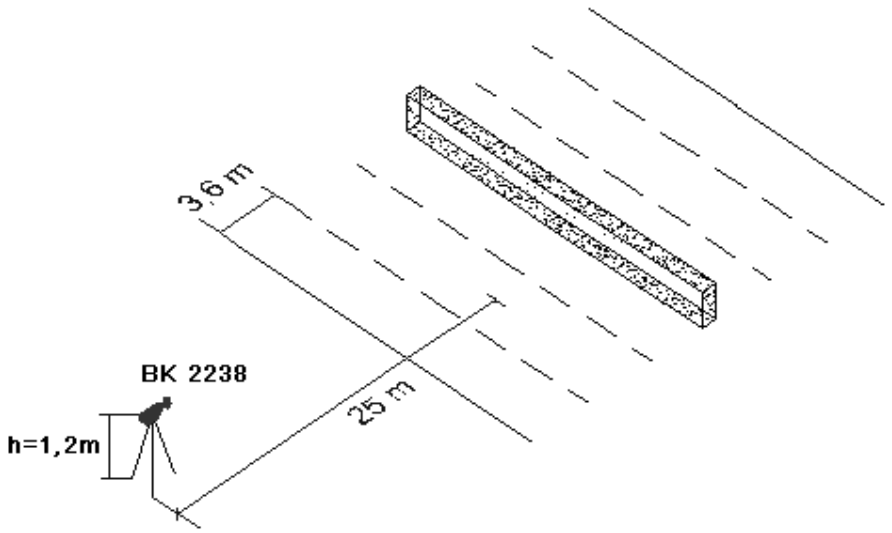


Figure 2. Monitoring scheme.

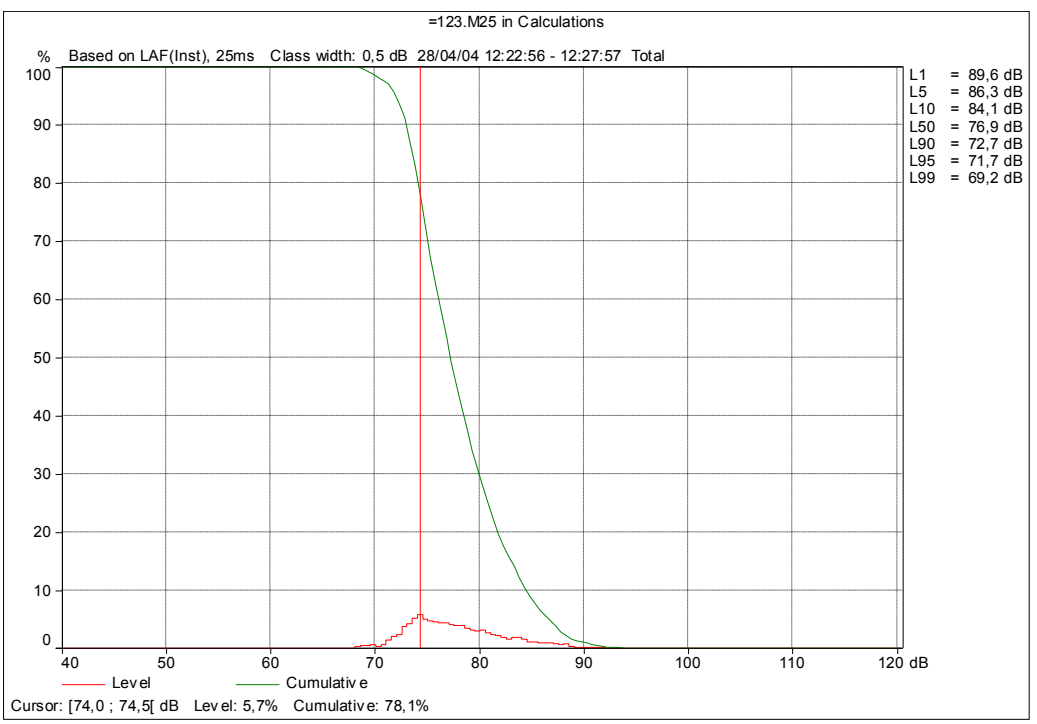


Figure 3. Cumulative Analysis of Statistical Levels for Point 1 – daytime.

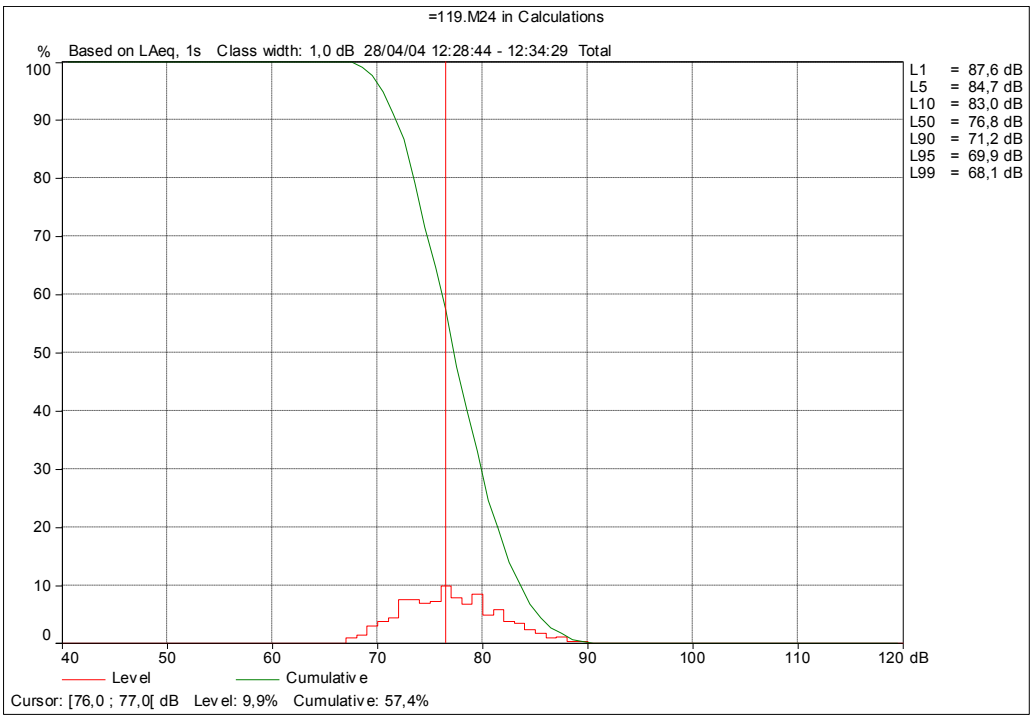


Figure 4. Cumulative Analysis of Statistical Levels for Point 1 – nighttime.

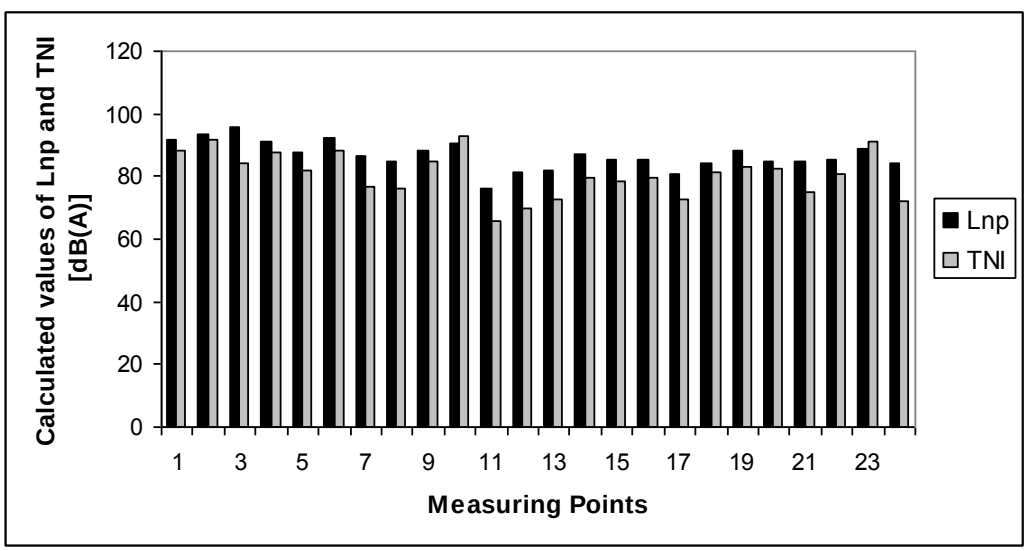


Figure 5. Calculated $L_{np}$ and *TNI* – daytime.

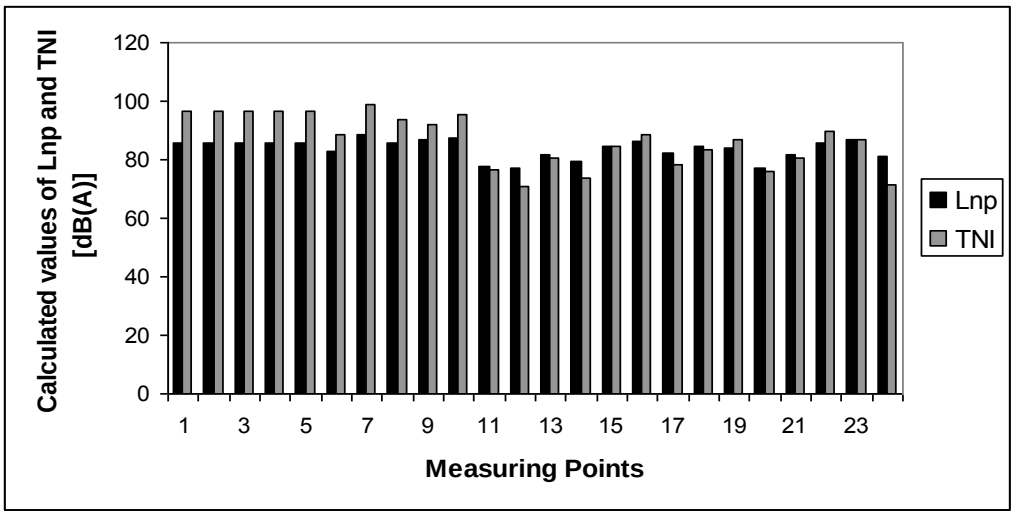


Figure 6. Calculated $L_{np}$ and *TNI* – nighttime.

A comparative analysis was made of daytime and nighttime $L_{np}$ and *TNI*, using the limit values recommended by Schultz, the WHO, Curitiba's municipal law No. 10625, and the Brazilian standard NBR 10151, using the mixed area as the object of study. The graphs below show this evaluation (Figures 7 to 10).

The comparative analysis of the $L_{np}$ graphs indicated that all the calculated values exceeded the limit values recommended by the adopted criteria, by an average of 13 dB(A) for the daytime and by 11 dB(A) for nighttime, based on the more flexible Schultz criterion of 74 dB(A). Based on the most extreme criterion of the NBR-10151 standard, of 60 and 55 dB(A), the $L_{np}$ values were on average 27 dB(A) above the limit established for the daytime and 29 dB(A) higher for the nighttime.

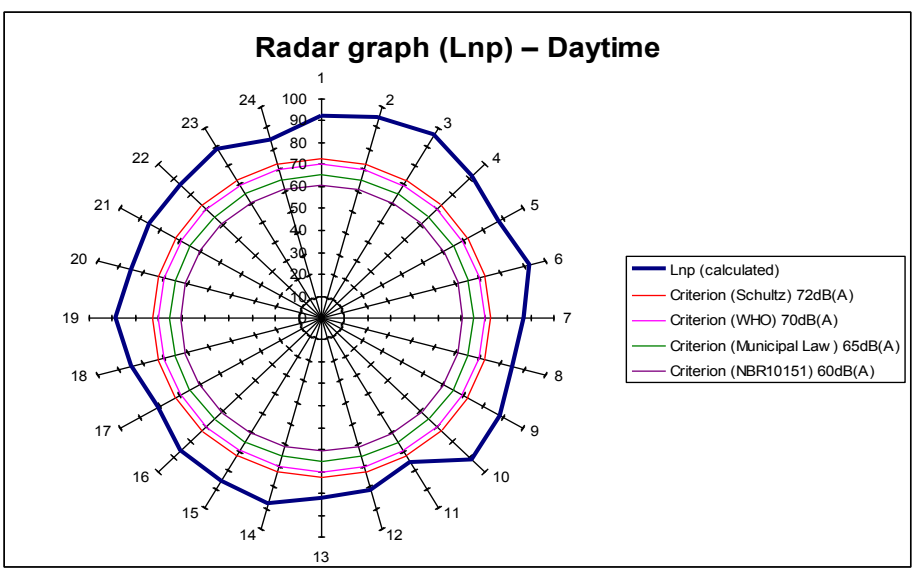


Figure 7. Comparative analysis of the calculated $L_{np}$, daytime.

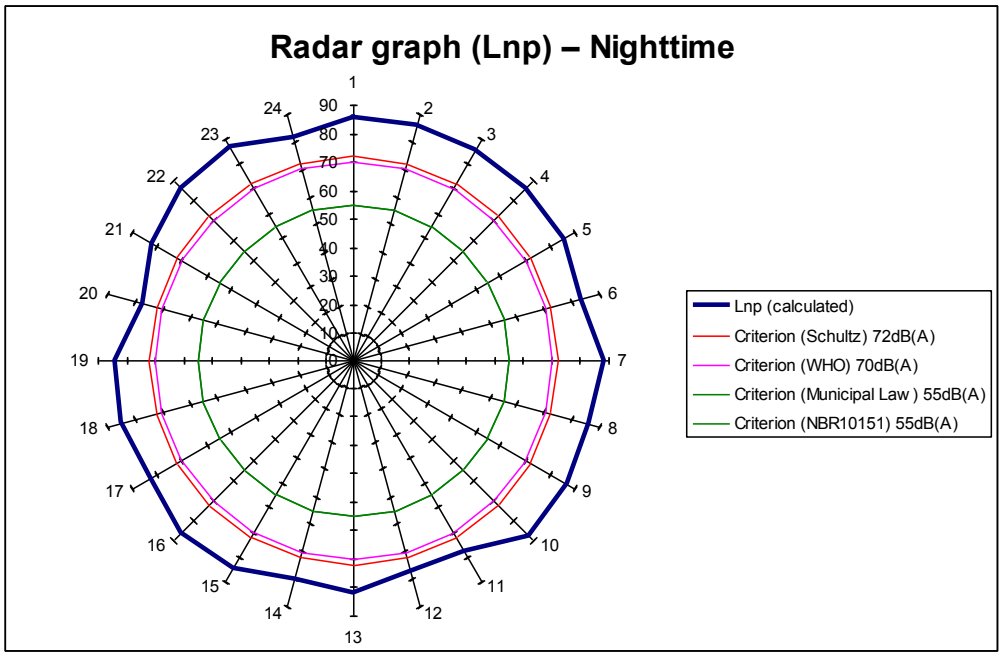


Figure 8. Comparative analysis of the calculated $L_{np}$, nighttime.

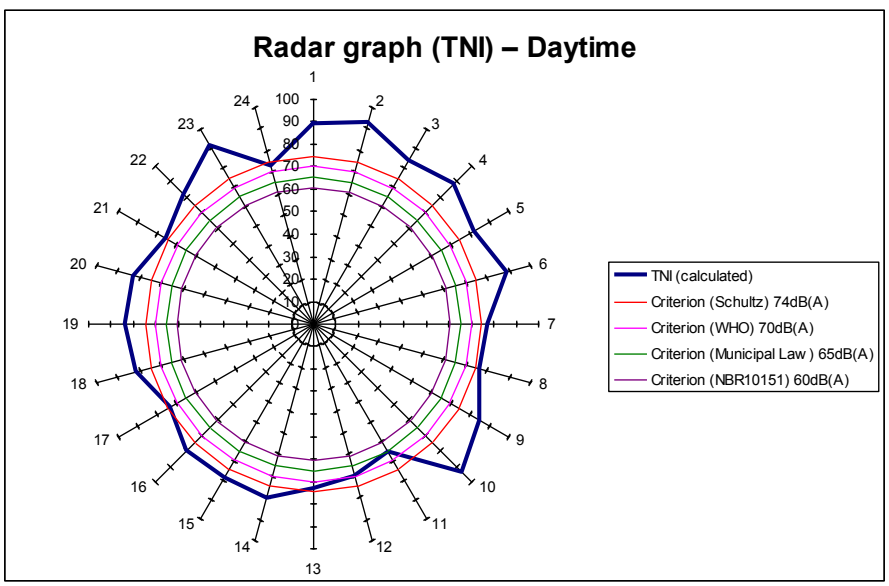


Figure 9. Comparative analysis of the calculated *TNI*, daytime.

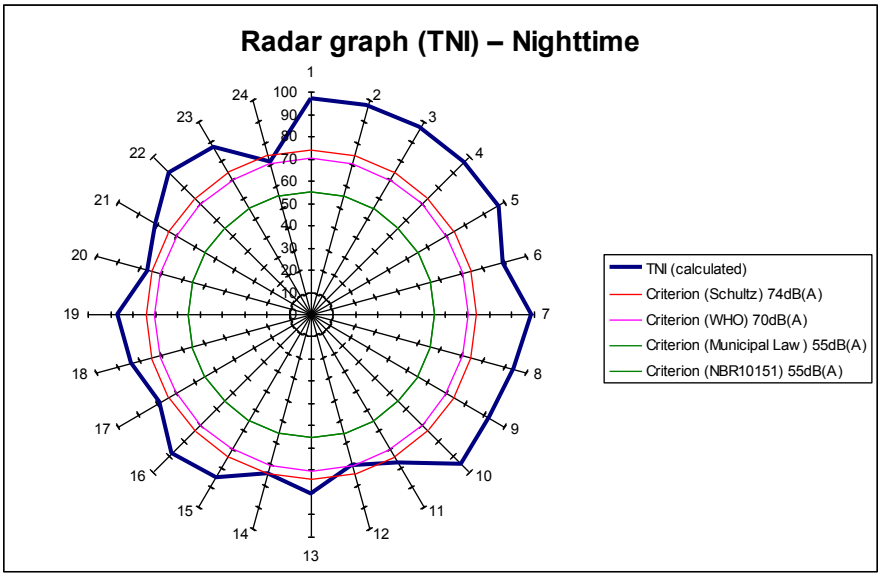


Figure 10. Comparative analysis of the calculated *TNI*, nighttime.

At point 24, where there is an educational building, an $L_{np}$ of 84 dB(A) was recorded in the daytime and of 81.4 dB(A) during the nighttime. Considering the WHO criterion that established 70 dB(A) as the health undermining level, the situation at this point is a cause of concern.

According to the Schultz criterion, the limit value for the noise traffic index is 74 dB(A). The comparative analysis of the *TNI* graphs revealed that, in the daytime, about 21% of the monitored points did not exceed the limit value of the Schultz criterion, while 46% of the points exceeded it by 4 dB(A) and 33% of the points exceeded this limit by an average of 14 dB(A).

During the nighttime, about 12% of the points did not exceed the limit value established by the Schultz criterion, 25% exceed it by an average of 5 dB(A) and 63% of the points exceeded the limit by an average of 17 dB(A). Based on the WHO daytime criterion, only 8% of the points did not exceed the established limit. According to the criteria of Curitiba's municipal law No. 10625 and the NBR-10151 standard, all the calculated values exceeded the limit values by an average of 19 dB(A) in the daytime and by 32 dB(A) in the nighttime.

An evaluation of the graphs showing the cumulative analysis of statistical levels indicated that the levels that occurred were exceeded during the measuring period, showing high values of 70 to 80 dB(A), with peaks up to 90 dB(A). Based on the comparison of the measured sound levels and the limit values established by the aforementioned criteria, it is clear that that current situation along the margins of the urban stretch of the highway under study is totally inadequate during both day and night, and is considered harmful in the daytime. Most of the sound levels monitored in this study exceeded 70 dB(A) which, according to the World Health Organization, is considered the level deleterious to human health. Therefore, this environment is highly sound polluted. The sound levels at nighttime were the ones that most exceeded the standard and legal limits.

Although this finding was expected, since the proposed limit levels for nighttime are always lower than those established for daytime, high nighttime values are of much greater

concern than daytime levels because, for residential buildings, this implies greater exposure to these levels since residents are inside those buildings for longer periods of time.

Because the $L_{np}$ and *TNI* are traffic noise descriptors that take into account the variability of noise in terms of percentile levels, it can be stated that there is a high occurrence, both day and night, of noises that are masked over time, but which have deleterious effects on the environment where they occur. In this context, it is clear that the structural and operational functionality of a major road (adequate grade, traffic signs, side roads, etc.) is not a synonym of environmental functionality, and that the road in question requires the immediate adoption of mitigating measures.

## 4. PREDICTION MODELS FOR ROAD TRAFFIC NOISE

### 4.1. Development of Prediction Models for the Daytime

Environmental noise in a city can be evaluated by various methods, such as: 1) measuring the noise levels at several points organized in an approximately regular grid, 2) measuring the noise levels according to a previous classification of urban noise according to the use of the area, demographic density or the importance of urban streets (Brown and Lam, 1977).

The results presented here were obtained using the second methodology described above, since the goal was to evaluate the traffic noise generated by a highway (BR-476) previously classified as the main road and used as a major avenue inside an urban setting (da da Paz, 2004, da Paz and Zannin, 2010). In order to evaluate the noise descriptors ($L_{eq}$, $L_{10}$ and $L_{90}$), several points along the road were chosen and analyzed (da Paz, 2004, Calixto et al., 2008; da Paz and Zannin, 2010).

The following parameters were assessed simultaneously: 1) the duration of each measurement; 2) the number of cars, motorcycles, trucks and buses passed by the observer during the time interval of each measurement; and 3) the equivalent and statistical levels in dB(A): $L_{eq}$, $L_{10}$ and $L_{90}$. BK 2238 and BK 2260 sound pressure level meters were used for the noise measurements (Calixto et al., 2008, da Paz and Zannin, 2010; Zannin et al., 2013).

In order to group the results of the several measurement points in a single matrix, some of the variables of the process were fixed. Sites with similar paving conditions, traffic characteristics, longitudinal inclination, and topographical parameters were selected, and considered unvariable. Each measurement site had the following characteristics: 1) Roads paved with smooth asphalt and in good conservation; 2) Approximately constant average speed of 55 km/h, weighted by a multiplying factor for the heavy vehicles; 3) Longitudinal inclination of less than 5%, which can be considered a flat stretch; 4) Straight stretch; and 5) Flat surrounding terrain characterizing an open field with no reflecting objects (Calixto et al., 2008; da Paz and Zannin, 2010; Zannin et al., 2013).

This simplification allowed the input data of the model to be reduced to vehicle flow and traffic composition, and its output data to sound pressure levels. Because traffic flow and composition cannot be controlled, the only way to consider variability in the input parameters adequately was to take measurements at different times and on weekdays. The duration of each measurement was also changed so that the sampled traffic conditions could approximate the conditions of regular traffic flow along the highway.

**Table 4. Description and mean values of the variables**

| Variables involved in the calculations | Variables involved in the calculations with their respective names | Average value for each variable |
|---|---|---|
| X1 | Vehicle flow [VF] | 2239.5 vehicles/h |
| X2 | 10 log VF<br>VF = vehicle flow | 33.3 |
| X3 | Percentage of heavy vehicles [HV] | 31.2 % |
| X4 | 10 log HV<br>HV = heavy vehicles | 14.7 |
| X5 | $L_{10}$ | 76.3 dB(A) |
| X6 | $L_{90}$ | 65.2 dB(A) |
| X7 | $L_{eq}$ | 73.1 dB(A) |

This procedure enabled significant variations in traffic parameters to be captured, with vehicle flow varying from 973 to 3,680 vehicles per hour, and the percentage of heavy vehicles varying from 6.9 to 76.9%. Heavy vehicles were considered those weighing more than 2,800 kg (RLS-90, 1990; da Paz, 2004; Calixto et al, 2008; da Paz and Zannin, 2010; Zannin et al., 2013). Table 4 lists the mean values of the main variables, while Table 5 describes the correlation coefficients among these variables.

As can be seen in Table 5, the correlation coefficients between the noise descriptors $L_{eq}$, $L_{10}$ and $L_{90}$ and the vehicle flow VF are r=0.6758, r=0.6295, and r=0.5324, respectively (Calixto, Pulsides, Zannin, 2008). This indicates that vehicle flow VF is the predominant parameter determining the equivalent and statistical noise levels generated by the road traffic under the considered conditions.

**Table 5. Correlation matrix for the variables in Table 4**

| | X1 | X2 | X3 | X4 | X5 | X6 | X7 |
|---|---|---|---|---|---|---|---|
| X1 | 1.0000 | 0.9555 | 0.2165 | 0.3017 | 0.6295 | 0.5324 | 0.6758 |
| X2 | 0.9555 | 1.0000 | 0.2324 | 0.3250 | 0.6119 | 0.5113 | 0.6607 |
| X3 | 0.2165 | 0.2324 | 1.0000 | 0.9281 | 0.5476 | 0.4564 | 0.5895 |
| X4 | 0.3017 | 0.3250 | 0.9281 | 1.0000 | 0.5988 | 0.4577 | 0.6420 |
| X5 | 0.6295 | 0.6119 | 0.5476 | 0.5988 | 1.0000 | 0.5864 | 0.9361 |
| X6 | 0.5324 | 0.5113 | 0.4564 | 0.4577 | 0.5864 | 1.0000 | 0.6790 |
| X7 | 0.6758 | 0.6607 | 0.5895 | 0.6420 | 0.9361 | 0.6790 | 1.0000 |

On the other hand, another variable shown in Table 5, the percentage of heavy vehicles HV, is also an important factor that influences the noise descriptors. The correlation coefficients between the noise descriptors $L_{eq}$, $L_{10}$ and $L_{90}$ and the percentage of heavy vehicle HV are r=0.5895, r=0.5476 and r=0.4564, respectively (Calixto, Pulsides, Zannin, 2008).

The variable of vehicle flow, VF, represents the sum of light and heavy vehicle flows on a road during a given time interval. Because heavy vehicles generate louder noise than light vehicles, particularly at the speeds considered in this survey, a weighting factor, *n*, was considered for such vehicles, resulting in an equivalent value for this traffic flow, $VF_{eq}$

(Calixto, Pulsides, Zannin, 2008). Considering VF as the real hourly vehicle flow, HV as the percentage of heavy vehicles, and *n* as the weighting factor, one has (Calixto, Pulsides, Zannin, 2008):

$$VF_{eq} = VF\ (1 + n\ HV/100) \quad (3)$$

Thus, the term [10 log ($VF_{eq}$)] in Table 4 will be transformed into [10.log (VF (1 + *n* HV/100))]. The weighting factor *n* will have a given value that results in the highest correlation coefficients between the noise level descriptors and the factor [10.log (VF(1 + *n* HV/ 100))].

By varying the weighting factor from 4 to 10, the highest correlation coefficients between $L_{eq}$ and $VF_{eq}$ are found when $n$ = 9.5 (r=0.8192). For the noise descriptor $L_{10}$, the highest correlation coefficient between $L_{eq}$ and $VF_{eq}$ is found when $n$ = 9.5 (r = 0.7692). On the other hand, because the percentage of heavy vehicles has a lower influence on $L_{90}$, the weighting factor is also lower, i.e., $n$ = 5.

In this case, the correlation coefficient between $L_{90}$ and the term [10.log (VF (1 + *n* HV/100))] is 0.6275 (Calixto, Pulsides, Zannin, 2008).

## 4.2. Mathematical Model of the Equivalent Noise Level $L_{eq}$

After measuring the vehicle flow VF, percentage of heavy vehicles HV, and equivalent noise levels $L_{eq}$, and determining the most adequate weighting factor, $n$ = 9.5, values for $L_{eq}$ and [10.log (VF (1 + 9.5 HV/100))] were plotted on a graph which is shown in Figure 11. Then, using the least-squares method, a curve was adjusted to the measured points. Mathematically, this curve can be represented by:

$$y = ax + k \quad (4)$$

Applying the variables to the straight line equation, one has (Calixto, Pulsides, Zannin, 2008):

$$L_{eq} = a\ 10 \log [VF\ (1 + 9.5\ HV / 100)] + k \quad (5)$$

The values of the constants "*a*" and "*k*" which were determined after applying the statistical methods of linear regression were: $a$ = 0.769 and $k$ = 42.964. Hence, the expression that mathematically represents the adjusted curve and can predict the equivalent levels for road noise is (Calixto, Pulsides, Zannin, 2008):

$$L_{eq} = 7.7 \log [VF\ (1 + 0.095\ HV)] + 43 \quad (6)$$

where: $L_{eq}$ is the equivalent noise level emitted by the road traffic, measured in dB(A) at a distance of 25 m; VF is the vehicle flow (vehicles per hour); and HV is the percentage of heavy vehicles of the total number of vehicles.

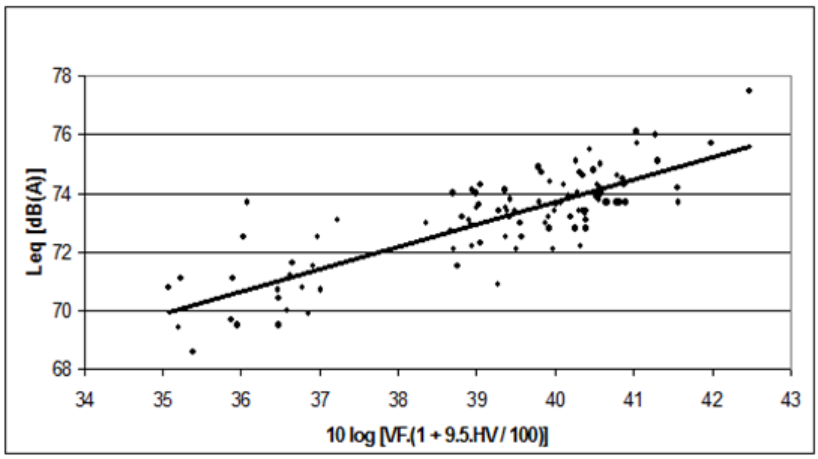


Figure 11. Adjusted curve for $L_{eq}$4.3 Mathematical models of $L_{10}$ and $L_{90}$.

Following the same procedure as that adopted for equivalent levels, mathematical expressions were obtained to determine the statistical levels $L_{10}$ and $L_{90}$, as indicated in equations (7) and (8) (Calixto, Pulsides, Zannin, 2008),

$$L_{10} = 6.2 \log [VF (1 + 0.095 HV)] \quad (7)$$

$$L_{90} = 10.2 \log [VF (1 + 0.050 HV)] + 27.1 \quad (8)$$

where: $L_{10}$ is the sound level exceeded in 10% of the measurement period and $L_{90}$ is the sound level exceeded in 90% of the measurement period, both measured in dB(A) at a distance of 25 m; VF is the vehicle flow (vehicles per hour); and HV is the percentage of heavy vehicles among the total number of vehicles.

## 5. Models for the Evaluation of Nighttime Urban Noise

Taking as a case study the urban stretch of the BR-116 highway in Curitiba (Brazil), a mathematical model was created of the main nighttime noise levels, i.e., the equivalent noise level ($L_{eq}$) and statistical noise levels $L_{10}$, $L_{50}$ and $L_{90}$. The acoustic environment was evaluated in several steps, as follows: a pilot study, measurements, and mathematical modeling.

### 5.1. Pilot Study

This step consisted of evaluating the construction aspects of the highway, its traffic logistics, the urban planning of the area, and a socioeconomic characterization of the area covered by the highway.

To control the variables of the highway under study, several stretches were selected presenting the following characteristics: a straight flat stretch without abrupt road grade variations; slopes of less than or equal to 5%; Class I - A highway (Brazilian classification) (Dantas, 1996); most of the surrounding region flat; presence of vehicle speed control and stopping devices; presence of level and unlevel traffic control sections; a stretch with three lanes, each 3.60 m wide; presence of a one-way marginal road along most of the westbound stretch; a highway shoulder with a mean width of 1.50 m; highway lane divider with variable widths of 0.50 to 20 m; presence of an efficient drainage system along the entire stretch; road surface without structural defects; paving of hot-rolled bituminous concrete; presence of functional vertical and horizontal traffic lights in good working order; mixed traffic; a zone of mixed land occupation, with a predominance of retail businesses and the presence of buildings for special purposes such as education and middle to high standard residences; fixed average traffic speed of 60 km/h; real measured average speed of 80 km/h for light vehicles and 70 km/h for heavy vehicles; and traffic of metropolitan public transport vehicles.

## 5.2. Measurements

Based on the characteristics predefined in the pilot study, 24 points were selected for the noise measurements along an 11.5 km stretch of the highway, spaced 500 m apart. These measurements were taken at each point during the nighttime (from 10:01 p.m. to 7:00 a.m.), with the total number of measurements at each point varying from 4 to 17, according to the variability of the traffic flow over time. The measurements were taken simultaneously in the two directions of the road.

The measurements were taken according to the criteria of the German standard RLS-90 (1990). The vehicle count was done manually, following the recommendations of the DNER (National Highways Authority), which characterizes light and heavy vehicles, with a count time of 15 minutes (Dantas, 1996).

The noise levels were measured with a BK 2238 Class I sound level meter set. Measuring time was fixed at 15 minutes, on the A-weighted curve. All the measurements were taken during good weather conditions (no rain or strong wind).

The following data were collected: number of heavy and light vehicles; equivalent noise level on the A-weighted curve ($L_{eq}$); statistical noise levels $L_{10}$, $L_{50}$ and $L_{90}$; and maximum and minimum noise levels ($L_{max}$, $L_{min}$).

## 5.3. Mathematical Modeling

The techniques used for the mathematical model were simple and multiple linear regressions.

The model's performance was evaluated based on the following statistical tests: 1) measures of the degrees of association between elements of the equation (linear correlation coefficient R and determination coefficient $R^2$); and 2) analyses of variance to verify the significance of regressors.

Mathematical models for the analysis of nighttime traffic noise were considered in the following two situations: 1) without class intervals, i.e., without constraints within the domain

of the independent variable; and 2) with class intervals, i.e., with a constraint in the domain of the independent variable, starting from the midpoint of sample data of the dependent variables. The sampling generated two data groups, one containing the measured values and the other containing the average calculated values.

Based on the descriptive statistical analysis of the groups, their position and dispersion measures were calculated. The correlation matrix was then calculated to determine which variables should be used in the construction of the mathematical model, according to their degree of correlation with the main noise levels.

The results were subjected to a graph analysis of normal probability density (Q-Q plot and box plot). The Q-Q plot graph analysis indicated that the distribution of collected and calculated data followed an approximately normal distribution. Using a box plot graph analysis, the symmetry of the data, their dispersion, and the presence or absence of data outliers was evaluated and a comparison was made of all the variables considered in the study.

The variables considered for the survey were: equivalent sound pressure level ($L_{eq}$); statistical sound pressure levels $L_{10}$, $L_{50}$ and $L_{90}$; maximum sound pressure level ($L_{max}$); minimum sound pressure level ($L_{min}$); number of light vehicles (LV); number of heavy vehicles (HV); total number of vehicles (TV); light vehicle flow per hour (LF); heavy vehicle flow per hour (HF); total vehicle flow per hour (TF); percentage of heavy vehicles (PHV); and percentage of light vehicles (PLV).

## 5.4. Results and Discussion

The box plot graph analysis which presents the values of the measures of position and quartiles (Figures 12 to 15) demonstrated that there was no difference in tendency between the characteristics of the measured samples and the samples of average values of each point, qualifying both samples for the mathematical modeling.

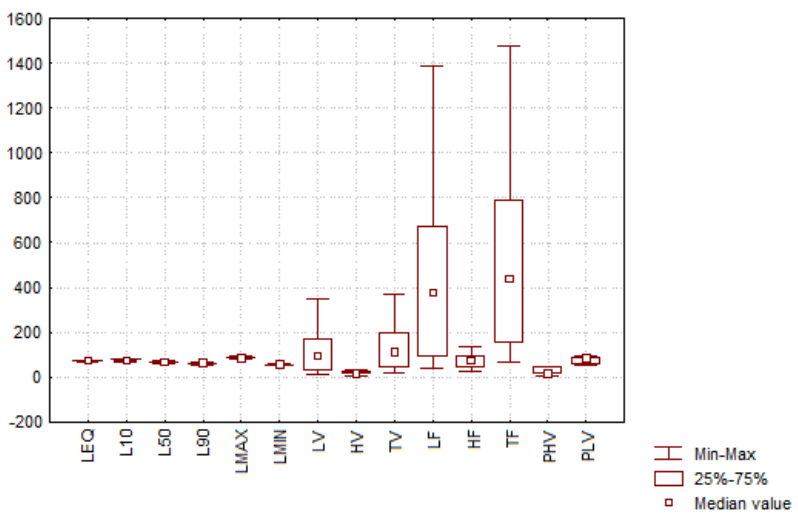


Figure 12. Box plot (Minimum and Maximum, Quartiles, Median), Measured nighttime sample.

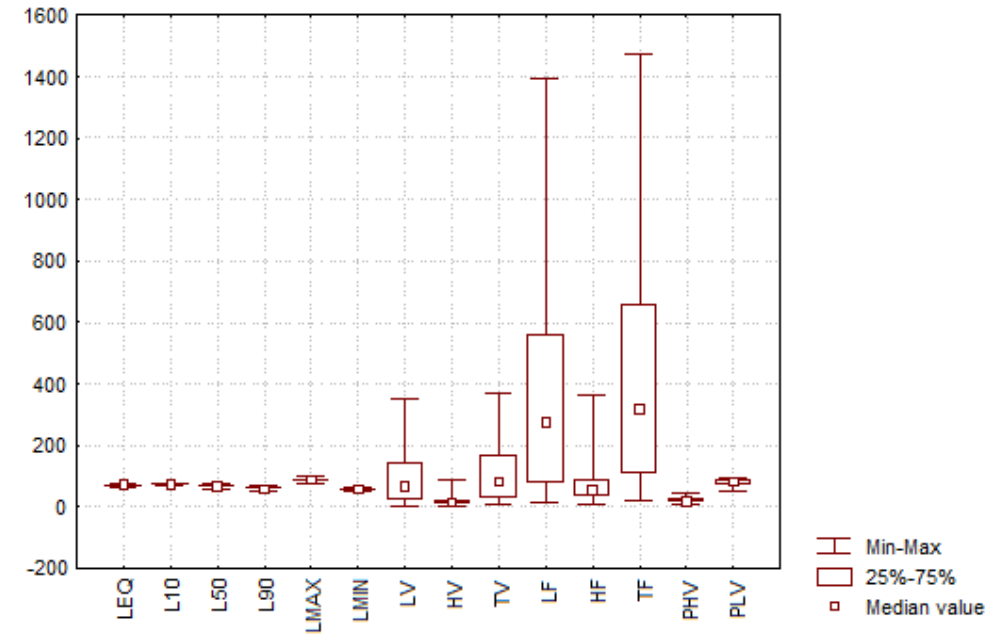


Figure 13. Box plot (Minimum and Maximum, Quartiles, Median), Average nighttime sample.

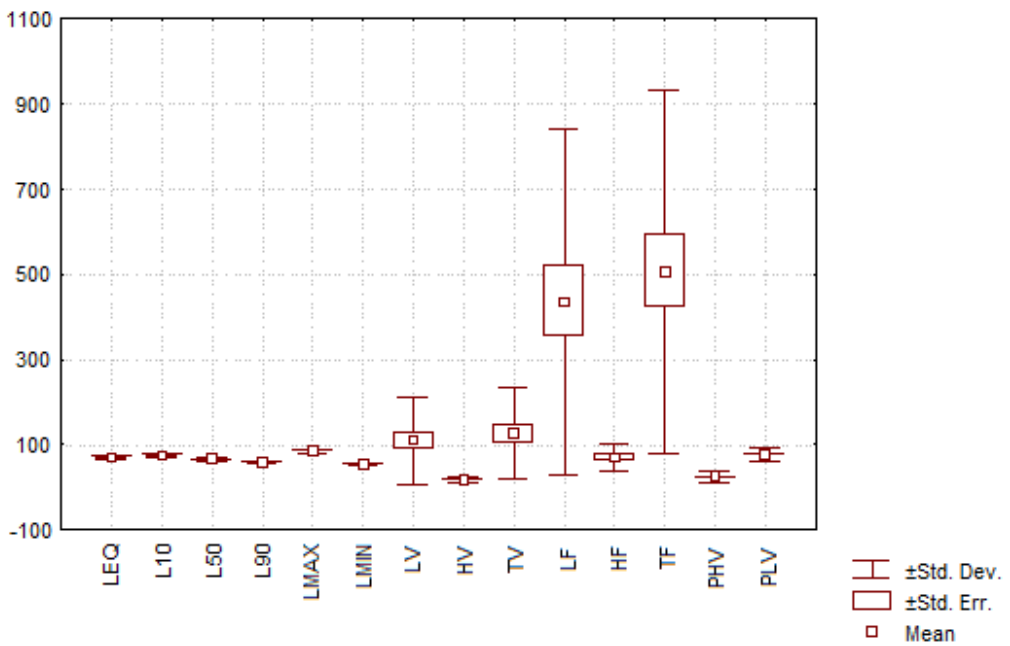


Figure 14. Box plot (Standard deviation, Standard error, Average), Measured nighttime sample.

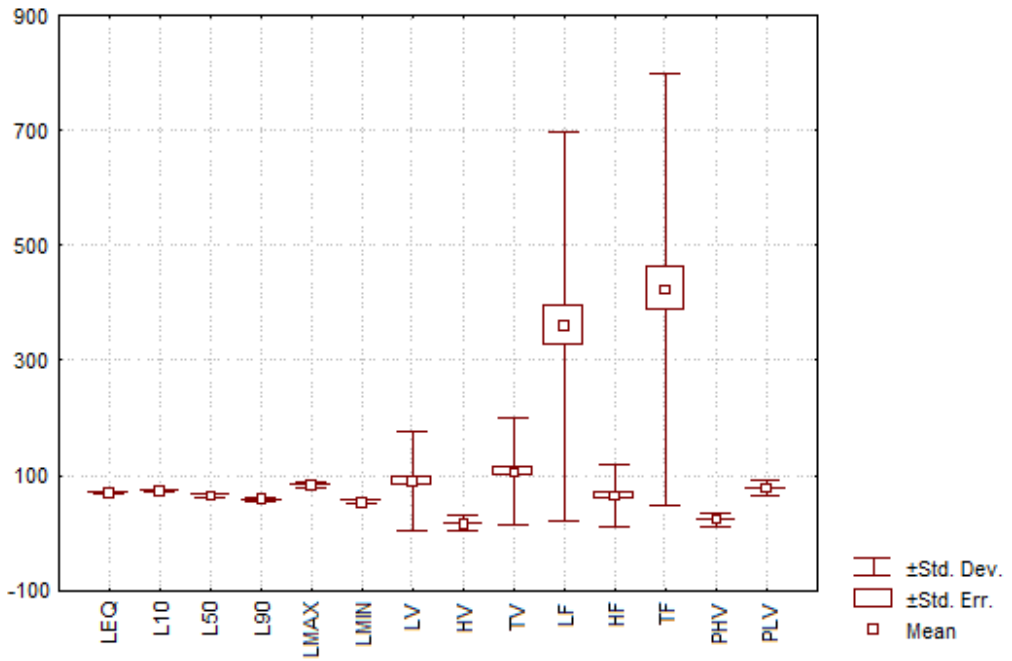


Figure 15. Box plot (Standard deviation, Standard error, Average), Average nighttime sample.

Tables 6 and 7 describe the results of the correlation of variables:

With respect to the noise levels, the two groups showed high correlations of $L_{eq}$ with $L_{10}$, $L_{50}$ and $L_{90}$.

As for the correlation between the variable $L_{eq}$ and the traffic variables, the highest correlations found were with the variables *HF* (heavy vehicle flow), *TF* (total vehicle flow) and *PHV* (percentage of heavy vehicles).

**Table 6. Correlation matrix for the average nighttime sample**

| | $L_{eq}$ | $L_{10}$ | $L_{50}$ | $L_{90}$ | $L_{MAX}$ | $L_{MIN}$ | LV | HV | TV | LF | HF | TF | PHV | PLV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $L_{eq}$ | 1.00 | 0.97 | 0.85 | 0.74 | 0.73 | 0.70 | 0.63 | 0.73 | 0.66 | 0.63 | 0.73 | 0.66 | -0.40 | 0,36 |
| $L_{10}$ | 0.97 | 1.00 | 0.76 | 0.63 | 0.71 | 0.60 | 0.46 | 0.66 | 0.49 | 0.46 | 0.66 | 0.49 | -0.18 | 0.18 |
| $L_{50}$ | 0.85 | 0.76 | 1.00 | 0.95 | 0.35 | 0.89 | 0.83 | 0.86 | 0.86 | 0.83 | 0.86 | 0.86 | -0.74 | 0.74 |
| $L_{90}$ | 0.74 | 0.63 | 0.95 | 1.00 | 0.26 | 0.97 | 0.76 | 0.84 | 0.79 | 0.76 | 0.84 | 0.79 | -0.76 | 0.76 |
| $L_{MAX}$ | 0.73 | 0.71 | 0.35 | 0.26 | 1.00 | 0.25 | 0.27 | 0.23 | 0.28 | 0.27 | 0.23 | 0.28 | 0.03 | -0.03 |
| $L_{MIN}$ | 0.70 | 0.60 | 0.89 | 0.97 | 0.25 | 1.00 | 0.70 | 0.76 | 0.72 | 0.70 | 0.76 | 0.72 | -0.71 | 0.71 |
| LV | 0.63 | 0.46 | 0.83 | 0.76 | 0.27 | 0.70 | 1.00 | 0.65 | 1.00 | 1.00 | 0.65 | 1.00 | -0.84 | 0.84 |
| HV | 0.73 | 0.66 | 0.86 | 0.84 | 0.23 | 0.76 | 0.65 | 1.00 | 0.70 | 0.65 | 1.00 | 0.70 | -0.56 | 0.56 |
| TV | 0.66 | 0.49 | 0.86 | 0.79 | 0.28 | 0.72 | 1.00 | 0.70 | 1.00 | 1.00 | 0.70 | 1.00 | -0.84 | 0.84 |
| LF | 0.63 | 0.46 | 0.83 | 0.76 | 0.27 | 0.70 | 1.00 | 0.65 | 1.00 | 1.00 | 0.65 | 1.00 | -0.84 | 0.84 |
| HF | 0.73 | 0.66 | 0.86 | 0.84 | 0.23 | 0.76 | 0.65 | 1.00 | 0.70 | 0.65 | 1.00 | 0.70 | -0.56 | 0.56 |
| TF | 0.66 | 0.49 | 0.86 | 0.79 | 0.28 | 0.72 | 1.00 | 0.70 | 1.00 | 1.00 | 0.70 | 1.00 | -0.84 | 0.84 |
| PHV | -0.40 | -0.18 | -0.74 | -0.76 | 0.03 | -0.71 | -0.84 | -0.56 | -0.84 | -0.84 | -0.56 | -0.84 | 1.00 | -1.00 |
| PLV | 0.36 | 0.18 | 0.74 | 0.76 | -0.03 | 0.71 | 0.84 | 0.56 | 0.84 | 0.84 | 0.56 | 0.84 | -1.00 | 1.00 |

**Table 7. Correlation matrix for the measured nighttime sample**

| | $L_{EQ}$ | $L_{10}$ | $L_{50}$ | $L_{90}$ | $L_{MAX}$ | $L_{MIN}$ | LV | HV | TV | LF | HF | TF | PHV | PLV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $L_{EQ}$ | 1.00 | 0.96 | 0.83 | 0.74 | 0.74 | 0.72 | 0.50 | 0.51 | 0.51 | 0.50 | 0.51 | 0.51 | -0.46 | 0.26 |
| $L_{10}$ | 0.96 | 1.00 | 0.75 | 0.64 | 0.67 | 0.63 | 0.36 | 0.36 | 0.38 | 0.36 | 0.36 | 0.38 | -0.13 | 0.13 |
| $L_{50}$ | 0.83 | 0.75 | 1.00 | 0.94 | 0.37 | 0.86 | 0.72 | 0.58 | 0.73 | 0.72 | 0.58 | 0.73 | -0.58 | 0.58 |
| $L_{90}$ | 0.74 | 0.64 | 0.94 | 1.00 | 0.29 | 0.94 | 0.67 | 0.61 | 0.69 | 0.67 | 0.61 | 0.69 | -0.58 | 0.58 |
| $L_{MAX}$ | 0.74 | 0.67 | 0.37 | 0.29 | 1.00 | 0.36 | 0.18 | 0.07 | 0.17 | 0.18 | 0.07 | 0.17 | -0.01 | 0.01 |
| $L_{MIN}$ | 0.72 | 0.63 | 0.86 | 0.94 | 0.36 | 1.00 | 0.59 | 0.57 | 0.61 | 0.59 | 0.57 | 0.61 | -0.48 | 0.48 |
| LV | 0.50 | 0.36 | 0.72 | 0.67 | 0.18 | 0.59 | 1.00 | 0.60 | 0.99 | 1.00 | 0.60 | 0.99 | -0.68 | 0.68 |
| HV | 0.51 | 0.36 | 0.58 | 0.61 | 0.07 | 0.57 | 0.60 | 1.00 | 0.69 | 0.60 | 1.00 | 0.69 | -0.17 | 0.17 |
| TV | 0.51 | 0.38 | 0.73 | 0.69 | 0.17 | 0.61 | 0.99 | 0.69 | 1.00 | 0.99 | 0.69 | 1.00 | -0.64 | 0.64 |
| LF | 0.50 | 0.36 | 0.72 | 0.67 | 0.18 | 0.59 | 1.00 | 0.60 | 0.99 | 1.00 | 0.60 | 0.99 | -0.68 | 0.68 |
| HF | 0.51 | 0.36 | 0.58 | 0.61 | 0.07 | 0.57 | 0.60 | 1.00 | 0.69 | 0.60 | 1.00 | 0.69 | -0.17 | 0.17 |
| TF | 0.51 | 0.38 | 0.73 | 0.69 | 0.17 | 0.61 | 0.99 | 0.69 | 1.00 | 0.99 | 0.69 | 1.00 | -0.64 | 0.64 |
| PHV | -0.46 | -0.13 | -0.58 | -0.58 | -0.01 | -0.48 | -0.68 | -0.17 | -0.64 | -0.68 | -0.17 | -0.64 | 1.00 | -1.00 |
| PLV | 0.26 | 0.13 | 0.58 | 0.58 | 0.01 | 0.48 | 0.68 | 0.17 | 0.64 | 0.68 | 0.17 | 0.64 | -1.00 | 1.00 |

Table 8 summarizes the correlation analysis of the variables selected for the mathematical modeling. The graph analysis of normal probability (Q-Q plot) of the variables considered for the modeling demonstrated that the data for all the variables followed an approximately normal distribution. This confirmed that linear regression could be applied satisfactorily in the development of the mathematical modeling, using simple linear regression to model the noise levels, and multiple linear regressions to model the $L_{eq}$ and traffic variables.

**Table 8. Summary of the linear correlation analysis**

| Measured Nighttime | Variables | Correlation Coefficient | Type of Correlation | Degree of Correlation |
|---|---|---|---|---|
| $L_{eq}$ | $L_{10}$ | 0.96 | Direct | Very strong |
| | $L_{50}$ | 0.83 | Direct | Very strong |
| | $L_{90}$ | 0.74 | Direct | Strong |
| | HF | 0.51 | Direct | Intermediate |
| | TF | 0.51 | Direct | Intermediate |
| | PHV | -0.46 | Inverse | Intermediate |
| Mean Nighttime | Variables | Correlation Coefficient | Type of Correlation | Degree of Correlation |
| $L_{eq}$ | $L_{10}$ | 0.97 | Direct | Very strong |
| | $L_{50}$ | 0.85 | Direct | Strong |
| | $L_{90}$ | 0.74 | Direct | Strong |
| | HF | 0.73 | Direct | Strong |
| | TF | 0.66 | Direct | Strong |
| | PHV | 0.40 | Direct | Intermediate |

Figures 16 to 29 present the Q-Q plot graphs.

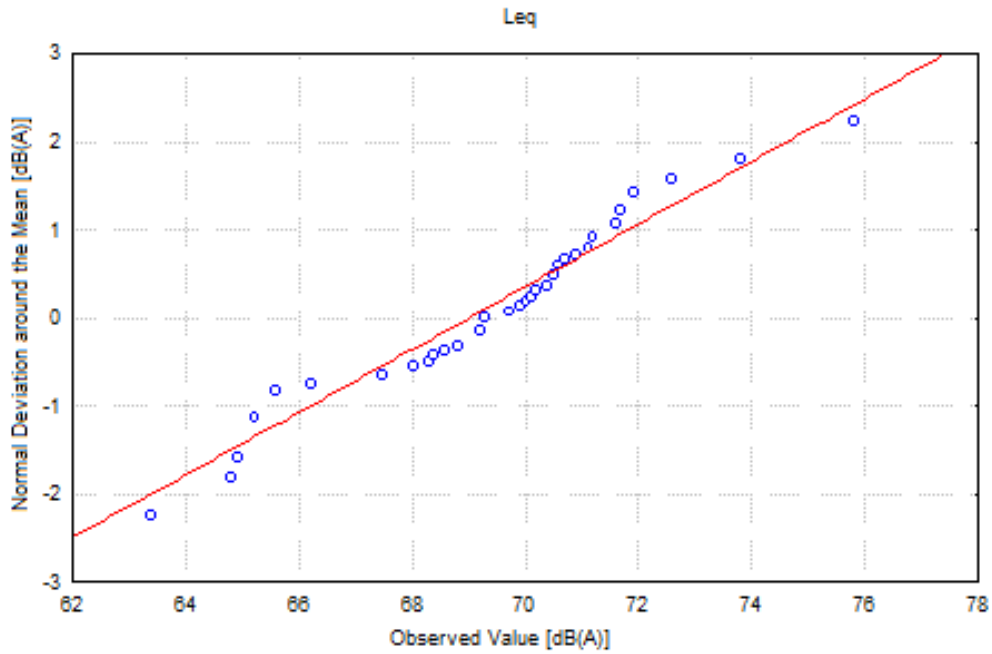


Figure 16. Q-Q Plot of measured nighttime $L_{eq.}$

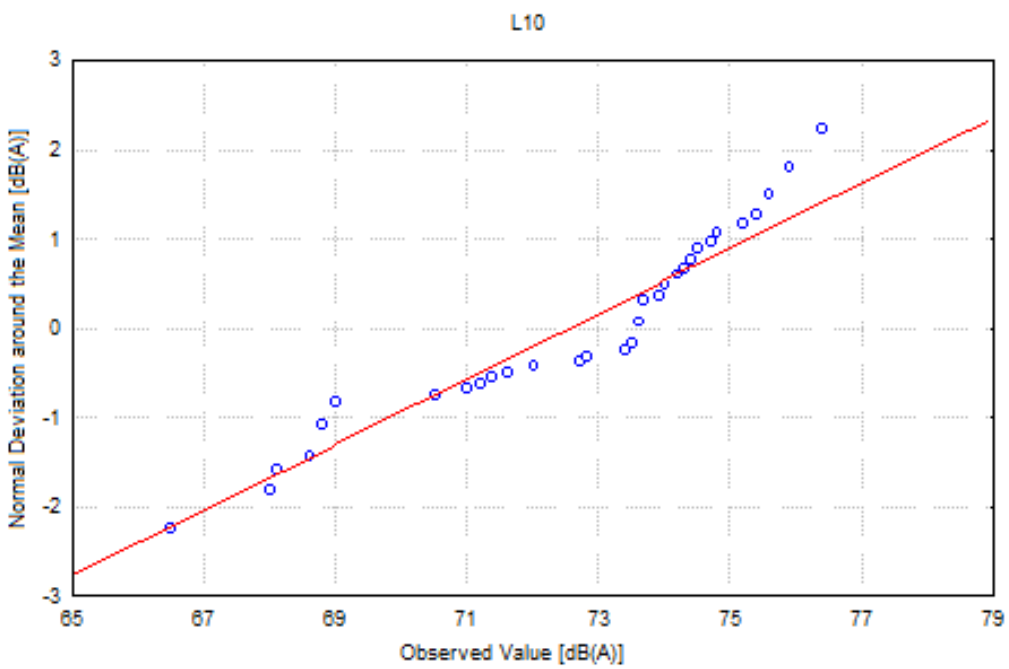


Figure 17. Q-Q Plot of measured nighttime $L_{10.}$

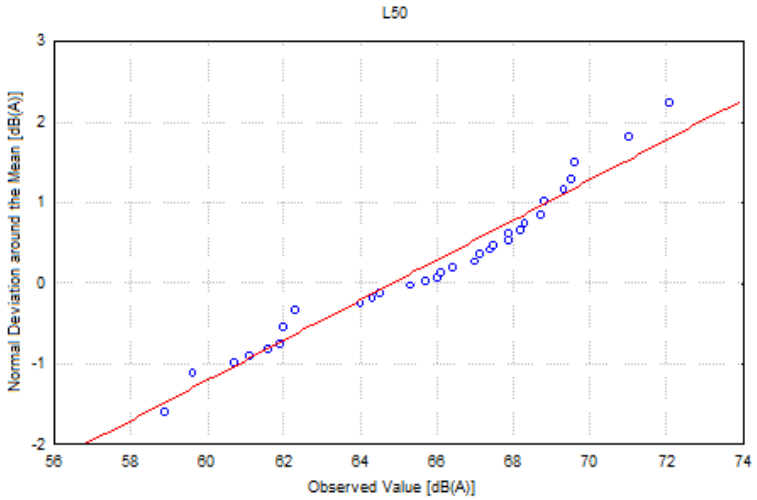


Figure 18. Q-Q Plot of measured nighttime $L_{50.}$.

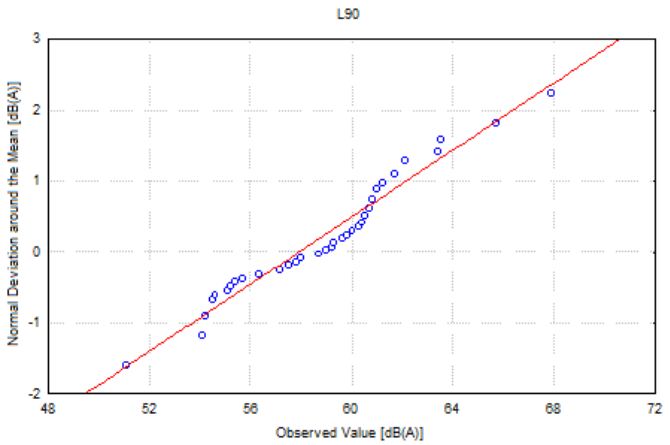


Figure 19. Q-Q Plot of measured nighttime $L_{90.}$

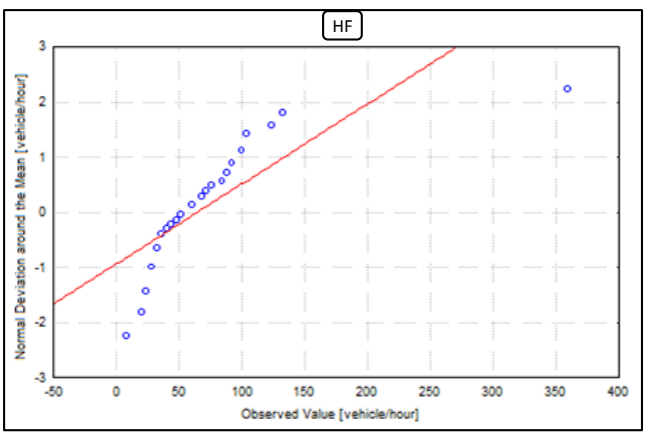


Figure 20. Q-Q Plot of measured nighttime *HF*.

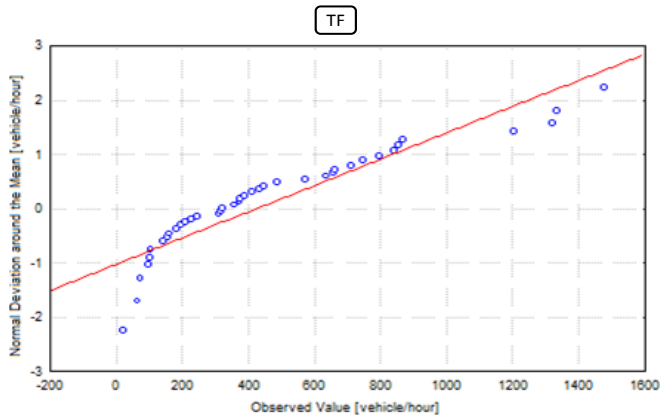


Figure 21. Q-Q Plot of measured nighttime *TF*.

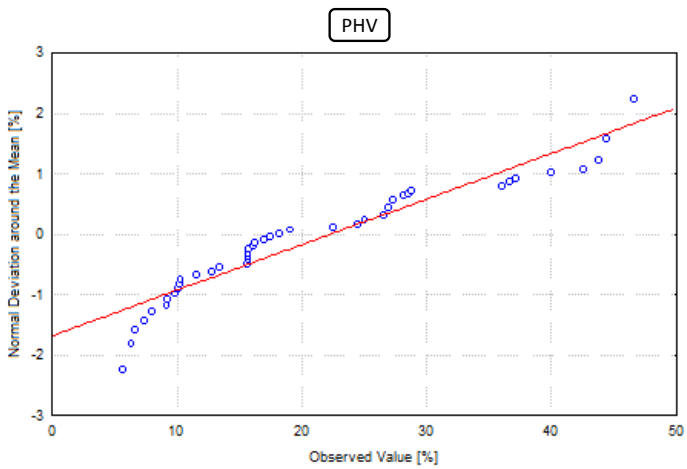


Figure 22. Q-Q Plot of measured nighttime PHV.

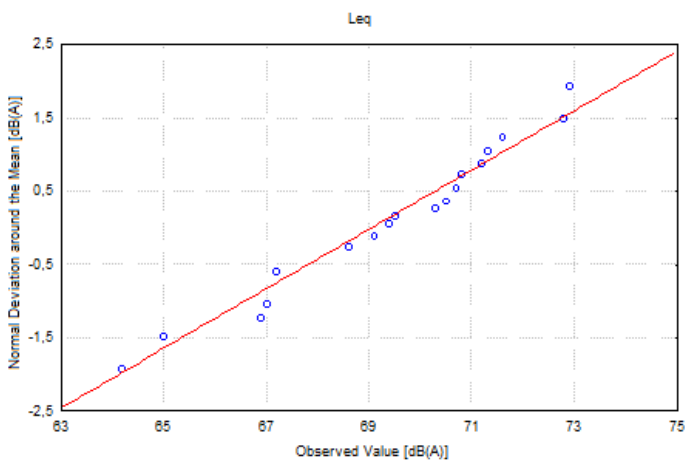


Figure 23. Q-Q Plot of average nighttime $L_{eq}$

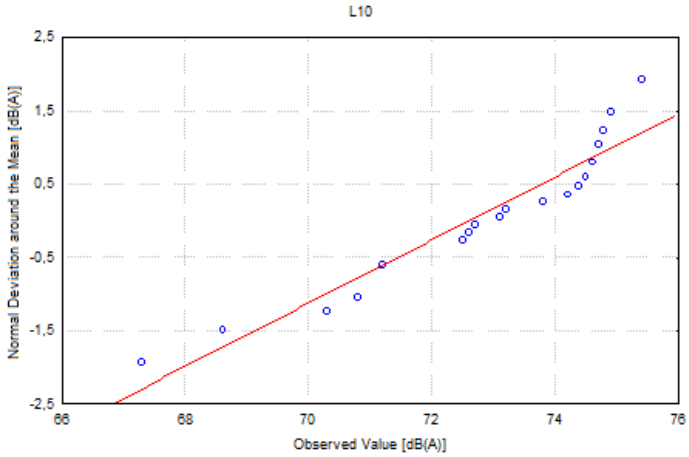


Figure 24. Q-Q Plot of average nighttime $L_{10.}$

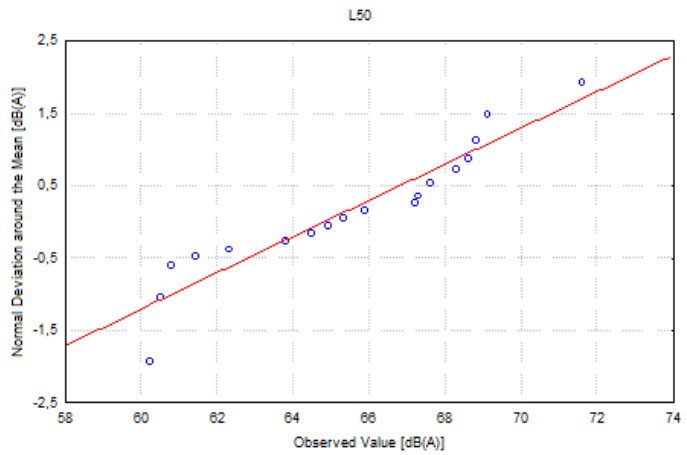


Figure 25. Q-Q Plot of average nighttime $L_{50.}$

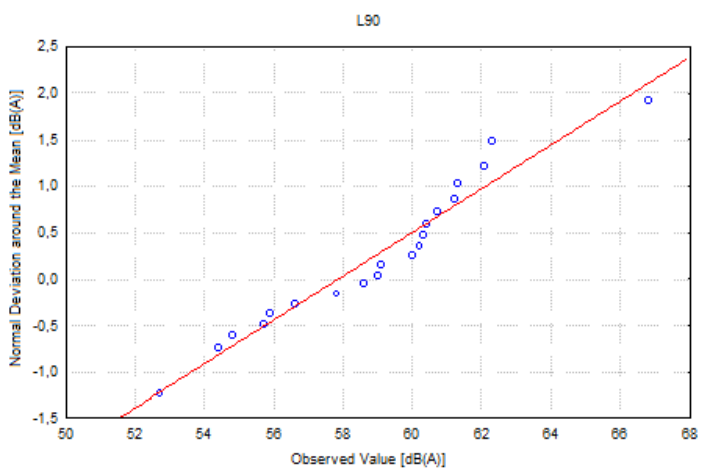


Figure 26. Q-Q Plot of average nighttime $L_{90.}$

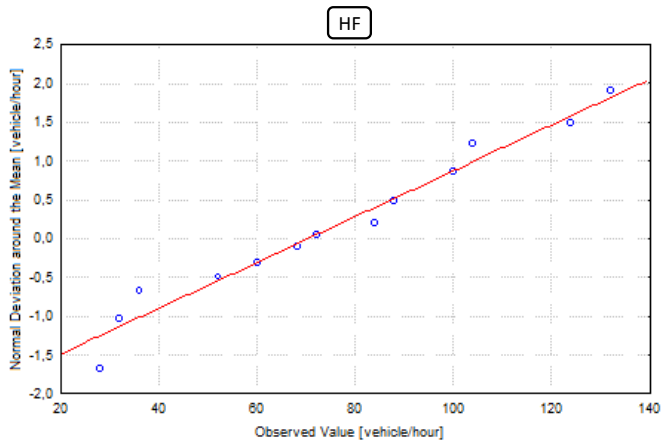


Figure 27. Q-Q Plot of average nighttime *HF*.

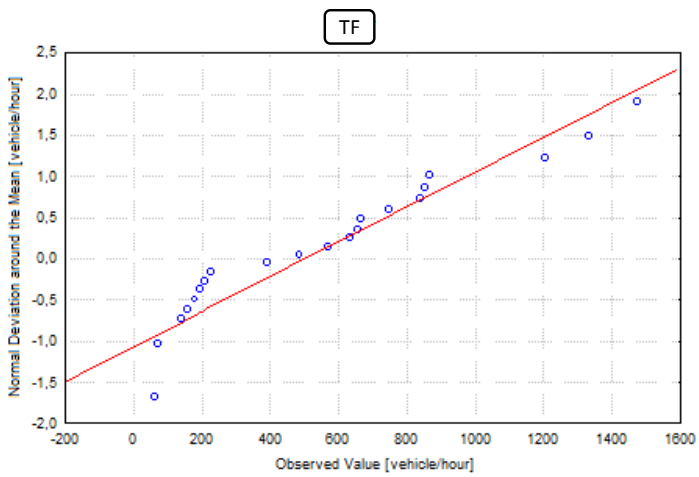


Figure 28. Q-Q Plot of average nighttime *TF*.

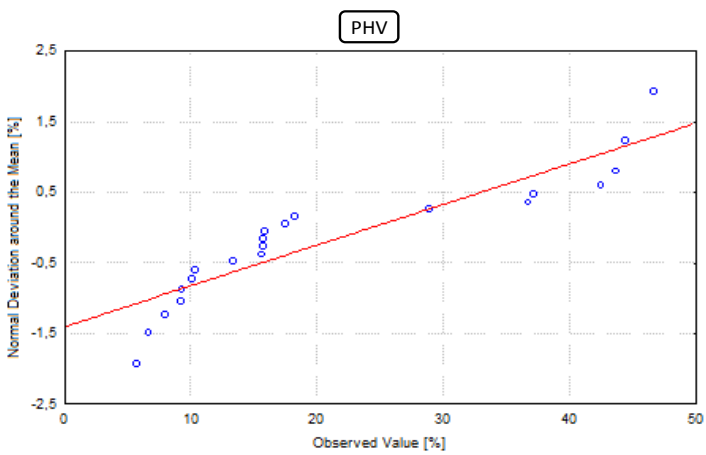


Figure 29. Q-Q Plot of average nighttime *PHVc*

The linear regression analysis considered the mathematical model in two situations: without class intervals and with class intervals. The variables $L_{10}$, $L_{50}$ and $L_{90}$ were called dependent variables and $L_{eq}$ was the independent variable. The mathematical models showed a reliability of 95%, since they were calculated at a 5% level of significance. The simple and multiple linear regression analyses without class intervals resulted in the following mathematical models:

Model 1
$L_{10} = (0.889L_{eq}) + 11.247$ (average values without class interval)

Model 2
$L_{10} = (0.903L_{eq}) + 10.004$ (measured values without class interval)

Model 3
$L_{50} = (1.323L_{eq}) – 26.508$ (average values without class interval)

Model 4
$L_{50} = (1.168L_{eq}) – 15.704$ (measured values without class interval)

Model 5
$L_{90} = (1.223L_{eq}) – 26.508$ (average values without class interval)

Model 6
$L_{90} = (1.092L_{eq}) – 17.402$ (measured values without class interval)

Model 7
$L_{eq} = (0.006TF) + (0.099PHV) + 63.312$ (average values without class interval)

Model 8
$L_{eq} = (0.039HF) + (0.001TF) + 65.493$ (average values without class interval)

Model 9
$L_{eq} = (0.004TF) + (0.027PHV) + 66.630$ (measured values without class interval)

Model 10
$L_{eq} = (0.007HF) + (0.003TF) + 67.303$ (measured values without class interval)

The tests of degrees of association of the models demonstrated that, for models 1 to 8, the variables of the equations presented satisfactory degrees of correlation (R); the calculated degrees of determination $R^2$ demonstrated that there is a satisfactory proportion of total variation that explains the dependent variable. Table 9 presents the degrees of association calculated for the models.

Models 9 and 10 did not present satisfactory degrees of association. This was due to the fact that the dispersion measures of the sample of measured values showed a higher variation than the sample of average values, whose data are adjusted to calculate the average value. Due to these results, the variables were subjected to a new regression analysis, but this time

with class intervals, dividing each sample into two classes at midpoint of the dependent variable.

**Table 9. Degrees of association, models 1 to 10**

| Model | R | Degree of R | $R^2$ | Degree of $R^2$ |
|---|---|---|---|---|
| 1 | 0.98 | Very strong | 0.94 | Very strong |
| 2 | 0.96 | Very strong | 0.92 | Very strong |
| 3 | 0.85 | Strong | 0.72 | Strong |
| 4 | 0.83 | Strong | 0.69 | Strong |
| 5 | 0.74 | Strong | 0.54 | Intermediate |
| 6 | 0.73 | Strong | 0.53 | Intermediate |
| 7 | 0.75 | Strong | 0.56 | Intermediate |
| 8 | 0.76 | Strong | 0.58 | Intermediate |
| 9 | 0.52 | Intermediate | 0.27 | Weak |
| 10 | 0.52 | Intermediate | 0.27 | Weak |

The mathematical models calculated with class intervals, with a 5% level of significance, are presented below.

Model 11

$L_{10} = (1.053L_{eq}) + 0.151$ (average values, $L_{10} \leq 72.62$)

$L_{10} = (0.529L_{eq}) + 36.787$ (average values, $L_{10} > 72.62$)

Model 12

$L_{10} = (1.037L_{eq}) + 1.064$ (measured values, $L_{10} \leq 72.56$)

$L_{10} = (0.497L_{eq}) + 39.092$ (measured values, $L_{10} > 72.56$)

Model 13

$L_{50} = (0.632L_{eq}) + 18.817$ (average values, $L_{50} \leq 64.85$)

$L_{50} = (0.779L_{eq}) + 12.838$ (average values, $L_{50} > 64.85$)

Model 14

$L_{50} = (0.595L_{eq}) + 21.507$ (measured values, $L_{50} \leq 64.89$)

$L_{50} = (0.561L_{eq}) + 28.352$ (measured values, $L_{50} > 64.89$)

Model 15

$L_{90} = (0.456L_{eq}) + 23.684$ (average values, $L_{90} \leq 57.95$)

$L_{90} = (0.512L_{eq}) + 24.816$ (average values, $L_{90} > 57.95$)

Model 16

$L_{90} = (0.508L_{eq}) + 20.159$ (measured values, $L_{90} \leq 57.97$)

$L_{90} = (0.433L_{eq}) + 30.478$ (measured values, $L_{90} > 57.97$)

Model 17

$L_{eq} = (0.007TF) + (0.140PHV) + 60.731$ (average values, $L_{eq} \leq 69.07$)

$L_{eq} = (0.003TF) + (0.076PHV) + 66.971$ (average values, $L_{eq} > 69.07$)

Model 18

$L_{eq} = (0.068HF) + (0.009TF) + 65.577$ (average values, $L_{eq} \leq 69.07$)

$L_{eq} = (0.014HF) + (0.001TF) + 65.659$ (average values, $L_{eq} > 69.07$)

Model 19

$L_{eq} = (0.005TF) + (0.052PHV) + 63.800$ (measured values, $L_{eq} \leq 69.02$)

$L_{eq} = (0.002TF) + (0.001PHV) + 69.863$ (measured values, $L_{eq} > 69.02$)

Model 20

$L_{eq} = (0.048HF) + (0.002TF) + 64.613$ (measured values, $L_{eq} \leq 69.02$)

$L_{eq} = (0.004HF) + (0.001TF) + 69.807$ (measured values, $L_{eq} > 69.02$)

For the models calculated with class intervals, the variables of the equations presented very satisfactory degrees of correlation R, with a significant increase in their values. The calculated degrees of determination $R^2$ demonstrated that there is a high proportion between the dependent and independent variables. Table 10 presents the degrees of association calculated for models 11 to 20, with class intervals.

**Table 10. Degrees of association, Models 11 to 20**

| Model | R | Degree of R | $R^2$ | Degree of $R^2$ |
|---|---|---|---|---|
| 11 | 0.98 | Very strong | 0.97 | Very strong |
| 12 | 0.98 | Very strong | 0.97 | Very strong |
| 13 | 0.95 | Very strong | 0.91 | Very strong |
| 14 | 0.93 | Very strong | 0.87 | Strong |
| 15 | 0.89 | Strong | 0.79 | Strong |
| 16 | 0.88 | Strong | 0.78 | Strong |
| 17 | 0.95 | Very strong | 0.90 | Strong |
| 18 | 0.93 | Very strong | 0.87 | Strong |
| 19 | 0.86 | Strong | 0.73 | Strong |
| 20 | 0.87 | Strong | 0.75 | Strong |

The models without class intervals were subjected to an analysis of variance statistical test by the normal Fisher-Snedecor F-distribution to verify the significance of their regressors, since they presented “Weak” and “Intermediate” degrees of association. This analysis demonstrated that the independent variables adopted contributed to the formation of the dependent variable and that their regressors are significant. Table 11 presents the results of the variance analysis, at a 5% level of significance, of models 1 to 10, where the model performance evaluation condition is Fcalc > Ftab.

**Table 11. Analysis of variance, models 1 to 10**

| Model | Fcalc | Ftab (5%) | Situation |
|---|---|---|---|
| 1 | 324.179 | 2.0283 | Fcalc > Ftab |
| 2 | 1052.739 | 1.4149 | Fcalc > Ftab |
| 3 | 56.203 | 2.0283 | Fcalc > Ftab |
| 4 | 196.531 | 1.4149 | Fcalc > Ftab |
| 5 | 26.401 | 2.0283 | Fcalc > Ftab |
| 6 | 103.403 | 1.4149 | Fcalc > Ftab |
| 7 | 13.234 | 2.0540 | Fcalc > Ftab |
| 8 | 14.349 | 2.0540 | Fcalc > Ftab |
| 9 | 16.711 | 1.4166 | Fcalc > Ftab |
| 10 | 16.831 | 1.4166 | Fcalc > Ftab |

### 5.5. Conclusion

The nighttime traffic composition can be considered equivalent, i.e., the light vehicle demand is similar to the heavy vehicle demand.

For samples with $n \leq 30$, without class intervals, on roads similar to the object of this research, models 1, 3, 5, 7 and 8 are statistically valid. With class intervals, models 11, 13, 15, 17 and 18 are statistically valid. For samples with $n > 30$, without class intervals, on roads similar to the object of this research, models 2, 4, 6, 9 and 10 are statistically valid. With class intervals, models 12, 14, 16, 19 and 20 are statistically valid. It was found that for large samples ($n > 30$) and for predicting the value of the equivalent sound pressure level ($L_{eq}$), the evaluation with class intervals is more suitable due to its higher variability. The models presented here for the evaluation of traffic noise differ from other models found in the literature, for two reasons:

Nighttime application – Most of the statistical models reported in the literature were developed for the daytime or for 24 hours without fractionation.

Application of class intervals – The majority of acoustic prediction models for traffic noise are formulated with a single equation. However, due to the considerable variability of traffic noise, these models are deficient in a given range of levels, which is not the case with models that use class intervals, as demonstrated by Prascevic et al. (1997).

## 6. Case Studies – Noise in an Urban Setting – Measurements, Noise Mapping, Citizens' Response to Noise

### 6.1. Evaluation of Noise in a Controlled Area and Comparison with a Noisy Area

Initially, an objective evaluation of urban noise (*in situ* measurement) was made to physically distinguish the sound levels in each urban zone, which were the focus of subjective evaluation, to determine whether they fit the situations of acoustic control: 1) acoustically controlled zone, and 2) noisy zone, identified in earlier studies by Zannin et al. (2002 and

2003). Like in the study of Zannin et al. (2003), 25 points were evaluated acoustically in the controlled zone and 97 in the non-controlled zone.

The *in situ* evaluations were based on equivalent sound levels measured in the daytime (from 7:01 a.m. to 10:00 p.m., during a period of 15 hours) on the main streets in each zone, on variable weekdays and times of day. Thus, a single value for each zone was generalized to a period of 16 hours, representative of any day of the week, from a total of 60 valid measurements taken with a BK 2260 real-time sound analyzer. The BK 7820 Evaluator software was used to obtain a single value for the equivalent noise level of each zone, by integrating the equivalent continuous sound level. Following the recommendation of the Brazilian NBR-10151 standard (2000), the measurements were taken in the absence of atypical sound sources such as rain and strong wind, in the following steps: 1) selection of different points of measurement based on an analysis of each site; 2) maximum measurement time of two minutes at each point; 3) device operating in fast mode.

The equivalent sound levels were 53.5 dB(A) in a controlled zone and 72.9 dB(A) in a noisy zone. The equivalent and calculated sound levels found in this study were compared with the daytime noise levels of 55 dB(A) for residential zones and 65 dB(A) for mixed zones permitted in the region under study by Curitiba Municipal Law No. 10625, which regulates noise emissions in the municipality of Curitiba, and with the level of 55 dB(A) for residential areas recommended by the World Health Organization (2003).

A subjective evaluation was made of the noise levels perceived by the population based on the answers of residents in each zone to a questionnaire developed by the authors, aiming to identify the main sources of urban noise they perceived, and their reaction to the acoustic noise levels to which they were exposed. Initially, an area (main roads) of each zone was selected for the random application of the questionnaire to residents of both sexes ranging in age from 17 to 69. The representative sample of residents in the controlled zone comprised 63% men and 37% women, making a total of 104 respondents, and in the noisy zone, 52% men and 48% women, making a total of 130 respondents.

The questionnaires were filled out in the presence of the researchers between 7:01 a.m. and 10 p.m. The quantitative perception of noise was based on the answers to multiple choice questions, using a Likert scale varying from 0 to 6, containing the following score criteria: (0) none, (1) very little, (2) a little, (3) intermediate, (4) a lot, (5) intense, and (6) extreme. For the quantitative perception of noise, like the respondents' information about their perception of urban noise, the identification of psychophysiological disturbances and the determination of which factor can cause the most inconvenience were based on "yes" or "no" questions, which represented the contingent variables of this study. The questionnaire included data on the respondents' identification.

The noise perception data were analyzed statistically using the *Statistica* version 5.0 software package. The data were analyzed statistically by multivariate factor analysis of the data as a function of the normality of the samples from both populations (controlled and noisy zones), tested at the 5% level of significance ($p \leq 0.005$). The extraction method used was principal components analysis (PCA), with normalized varimax rotation, and the selection criterion to determine the number of factors was the "Kaiser Criterion." An analysis was made to identify the quality of information provided by the respondents regarding the problem of urban noise, and the level of noise pollution was classified using univariate descriptive statistics. The next step included following stage included a multivariate factor analysis of this information.

The subjective evaluation of the noise levels perceived by the respondents involved 19 variables for the two groups of respondents. Using factor analysis, the variables were grouped in factors as a function of their linear correlation (Table 12).

**Table 12. Variables and factors**

| Variables | Attributes | Factors for the areas | Indicators |
|---|---|---|---|
| 1 | Perception of noise levels | 1 | Temporal Perception |
| 2 | Classification of daily noise | 1 | |
| 3 | Classification of daily noise intensity | 1 | |
| 4 | Classification of weekly noise | 1 | |
| 5 | Classification of weekly noise intensity | 1 | |
| 6 | Perception of annoying noise sources in other buildings | 2 | Perception of Atypical Noise |
| 7 | Perception of sporadic noise sources | 2 | |
| 8 | Perception of annoyance caused by noise | 3 | Source and Annoyance Indicator |
| 9 | Classification of annoyance caused by noise | 3 | |
| 10 | Perception of damage caused by noise | 3 | |
| 11 | Perception of noise inside the home | 4 | |
| 12 | Classification of noise intensity inside the home | 4 | |
| 13 | Classification of workplace noise | 4 | |
| 14 | Classification of workplace noise intensity | 4 | |
| 15 | Perception of the effects of noise | 5 | |
| 16 | Perception of annoying environmental noise sources | 6 | |
| 17 | Perception of annoying noise sources at home | 6 | |
| 18 | Response to external noise | 6 | |
| 19 | Response to noise at home | 6 | |

Six main factors were identified for the noisy zone and the controlled zone. These factors were grouped into three main statistical indicators according to their explained variability (Table 13).

**Table 13. Indicators**

| F1 | | F2 | F3 to F6 |
|---|---|---|---|
| Temporal Perception | | Atypical Noise Perception | Source and Annoyance Indicator |
| Acoustically controlled zone | | | |
| % Expl | 0.35 | 0.18 | 0.45 |
| Noisy zone | | | |
| % Expl | 0.27 | 0.16 | 0.38 |

These indicators were called: 1) Temporal Perception, i.e., perception of the daily or weekly occurrence of and insulation from noise; 2) Perception of Atypical Noise, i.e., perception of uncommon or infrequent noise in the zones in question; and 3) Source and

Annoyance Indicator, i.e., perception of the most frequent and annoying noise source, and perception of the annoyance caused by noise.

These indicators explained about 98% of the phenomenon in the different zones, while downtown they explained about 81%, indicating that the sample model would be representative for the analysis of the population under study.

### *6.1.1. Results*

The opinion of the respondents about the presence of urban noise became clear after analyzing the answers to the questionnaire, which indicated that 95.5% of the respondents in the noisy zone and 98% in the controlled zone claimed that noise can lead to health problems.

About 50.5% of the population in the controlled zone and 94% in the noisy zone reported being annoyed by noise.

In the two zones, the degree of annoyance resulting from this perception of noise ranged from the "absence of annoyance," which was found to a higher degree in the controlled zone, to "extreme annoyance," reported only by the residents of the noisy zone.

The difference in sensitivity to noise levels rose by 78.2% from "increased" to "extremely increased" in the city center, and by 71.7% from "somewhat increased" to "increased" in the zones, as indicated in Figure 30.

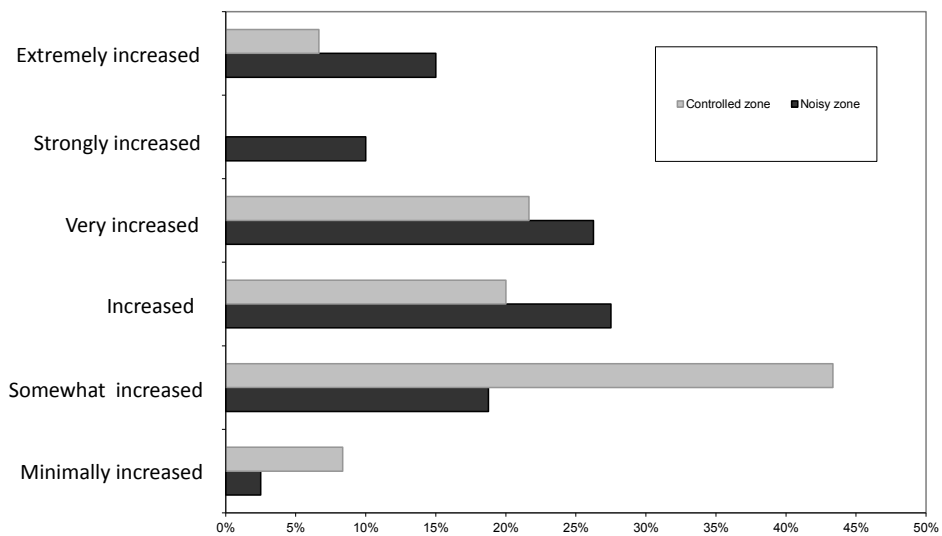


Figure 30. Perception of the increase in noise levels.

The statistical analysis of 'Temporal Perception' revealed that 61.5% of the residents in the noisy zone and 57.1% in the controlled zone reported an increase in noise levels, particularly during the morning and afternoon on in, and at night on weekends (Figure 31). The statistical analysis of 'Atypical Noise Perception' indicated that 70% of the respondents in the noisy zone and 30% in the controlled zone were annoyed by noise from atypical sources.

The 'Source and Annoyance Indicator' involved a larger number of variables, comprising information about existing or perceived noise sources in the urban environment, and the

psychophysiological annoyance caused by urban noise described by the respondents. In the two zones under study, the most frequently reported effects of noise pollution were irritation and low concentration (Figure 32).

Moreover, traffic noise was imputed as the most annoying, followed by car and home alarms, civil construction activities, etc. It should be noted that in the residential area, the second source of noise identified was from aircraft.

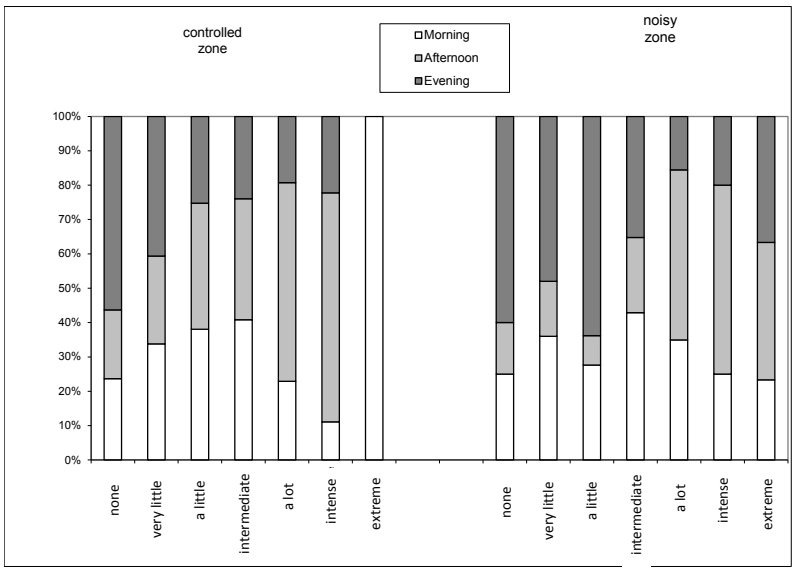


Figure 31. Temporal perception of noise.

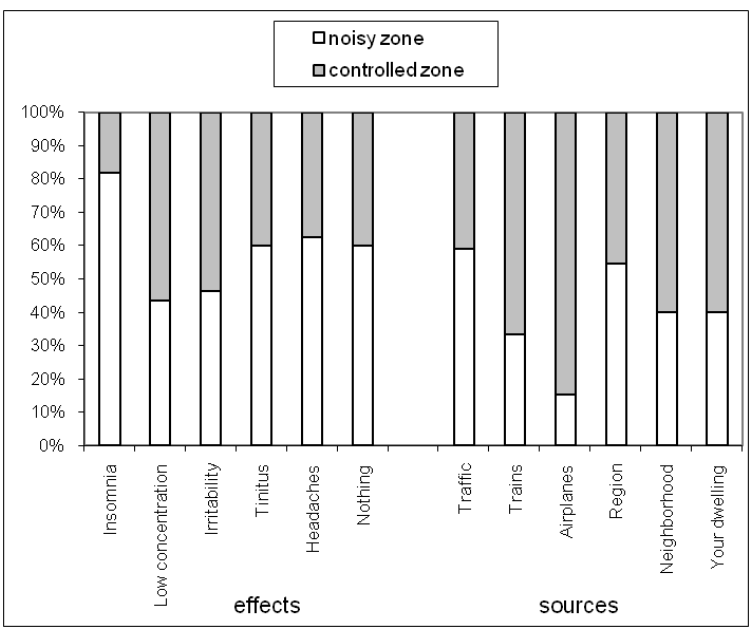


Figure 32. Effects and sources of noise perceived by the respondents.

### *6.1.2. Conclusion*

Elucidating the mechanisms of noise pollution is the first step in adapting them to control measures, according to Stansfeld and Matheson (2003). Initially, the subjective evaluation indicated that most of the respondents in this study are aware of the problems resulting from exposure to urban noise, and that this awareness was considered high in the two zones.

The subjective evaluation clearly indicated that the population in the controlled zone shows a heightened awareness of noise levels. This heightened awareness in the controlled area is corroborated by the noise measurements taken by Zannin et al. (2002). In the present study, a comparison was made of the noise levels measured in the controlled zone in 1992 and those taken in 2000, which indicated an increase in noise levels in the residential area, i.e., the controlled zone.

This increase is characterized by a larger number of points observed in the noisy area, i.e., $50 < L_{Aeq} \leq 55$ dB(A). In 1992, only 0.6% of a total of 25 points were observed in this area, while in 2000, 7.4% of the observed points were located in this area. In the present study, an equivalent noise level of $L_{Aeq} = 53.5$ dB(A) was measured.

In the noisy zone (city center), the measurements taken at 97 points in 2002 by Zannin et al. (2002), showed an equivalent sound level of $L_{Aeq} = 73.4$ dB(A). In the present study, the equivalent sound level was $L_{Aeq} = 72.9$ dB(A). This indicates that the health of the population living or working in the noisy zone is at permanent risk (Belojevic et al., 1997).

Moreover, Curitiba Municipal Law 10625 (2002) establishes a maximum sound immission level of 65 dB(A) for the city's central region in the daytime (from 7 a.m. to 7 p.m.). However, the sound level in this region has constantly exceeded the legal limit. Although the sound level here has remained constant, the subjective evaluation of the residents indicated that they have perceived an increase. This can be explained by the fact that Curitiba's city center today is one of the regions much sought after for residential purposes due to the low rents. However, when the residents compare the noise levels of the areas where they lived before and the one downtown, they perceive a significantly higher noise level in the central region. The findings of this survey indicate a $L_{Aeq}$ of 72.9 dB(A) in the downtown area and a $L_{Aeq}$ of 53.5 dB(A) in the residential areas.

According to Berglund et al. (1990), noise causes irritability in people and this effect continues even after the noise has gone or been reduced. Poor concentration and irritability are included in the group of secondary organic effects (physiology of attention). In the two zones under study, irritability and poor concentration were the organic effects of noise reported most frequently, which is consistent with the findings of Belojevic et al. (1997) in his study of exposure to traffic noise. Therefore, according to Muzet's classification (2007), this population is in a potential situation of risk. Traffic noise has been imputed as a type of noise that can cause great annoyance, and was the main reason for the organic effects identified by the surveyed population, which are characteristic of continuous noise exposure, according to Belojevic et al. (1997). According to Berglund et al. (1990) and Muzet (2007), traffic noise can be classified as a psychosocial stressor.

Guski (1999) classifies urban noise perception and annoyance analysis as a parameter for the evaluation of quality of life. Hence, it can be concluded that the indicators: Temporal Perception, Atypical Noise Perception, Source and Annoyance characterize the perception to continuous exposure to noise and also provide supporting evidence for the evaluation of quality of life of the people in this study, characterizing two distinct situations (an ideal

environment and a noise polluted one), which will be used as parameters for future evaluations in other urban zones.

## 6.2. Environmental Noise Impact Assessment of Road Traffic Based on Noise Mapping

Environmental impact, according to Resolution 001/86 of Brazil's National Environmental Council – CONAMA, is considered "…any alteration of the physical, chemical and biological properties of the environment, caused by any form of matter or energy resulting from human activities that directly or indirectly affect: I – the health, safety and well-being of the population; II – social and economic activities; III – the biota; IV – the esthetic and sanitary conditions of the environment; and V – the quality of environmental resources…" (CONAMA, 1986).

According to Carvalho (1999), "Environmental Noise Impact Assessment is a multidisciplinary technical and scientific instrument for defining, measuring, monitoring, mitigating, and correcting the possible causes and effects of a particular activity that produces excessive noise levels in a given environment." [our translation]

In view of the above, the noise generated by vehicle traffic can be considered a causer of negative impacts. These impacts not only affect human health directly, since heavy traffic in urban areas causes traffic jams, the release of pollutants into the air, and increased environmental noise (WHO, 2003), but also leads to socioeconomic consequences such as real estate devaluation, etc. (Lake et al., 1998; Taylor et al., 1982). Therefore, traffic noise should be a factor considered in studies on environmental impacts and human health (Sordia and Días, 1999).

The urban stretch of highway BR 476 which passes through the city of Curitiba, south Brazil, fits the aforementioned context. This stretch is known as a "highway-major avenue" because it is an access route for arrival, departure and passage through the city, and of access to work and homes, since the areas along the sides of the aforementioned highway have been transformed into densely populated neighborhoods.

Due to the augmented flow of traffic on this stretch, a beltway encircling the city was built and began operating in September 2002. This led to a substantial reduction (13.53%) in the flow of heavy traffic in relation to the total flow of traffic along the stretch of road under study. Table 14 depicts the situation of the stretch of road in question in terms of traffic and noise immission in the region before and after the construction of the aforementioned beltway.

As can be seen in Table 14, this stretch of road is noise polluted, according to the definition set forth in Curitiba Municipal Law No. 10625 (PMC, 2002). This law regulates noise immissions in the city, establishing a maximum equivalent sound level of 65 dB(A) for the daytime in the urban zones surrounding highway BR 476, as indicated in Table 3. To integrate the road network of the zones adjacent to the urban stretch of highway BR 476, this stretch is to be transformed into an urban avenue. This project includes the construction of bus shelters and a surface metro system. The project also includes a gradual elimination of heavy vehicles on this new "urban avenue," allowing only the circulation of urban buses.

This study made a prediction of noise levels generated during the development of the project to urbanize highway BR 476.

**Table 14. Traffic flow on highway BR 476**

| Year | Traffic Variables | Noise immission limits Curitiba Municipal Law 10625 (see Table 3) | Situation of the site in terms of noise pollution |
|---|---|---|---|
| 2001 | Percentage of heavy vehicles in total vehicle flow [%] = 31.38 | 65 dB(A) | Noise polluted |
| | Mean equivalent sound immission level $L_{eq}$ = 73.1 dB(A) | | |
| 2002 | Percentage of heavy vehicles in total vehicle flow [%] = 17.85 | 65 dB(A) | Noise polluted |
| | Mean equivalent sound immission level $L_{eq}$ = 66.8 dB(A) | | |

### *6.2.1. Materials and Methods*

An urban stretch of highway BR 476 was selected as the study area, and its characteristics were measured *in situ* for the preparation of noise maps.

The area selected for this study presents the following characteristics: straight and flat in most of its longitudinal direction, i.e., without abrupt variations in grade; ramps lower than or equal to 5%; Class 1-A highway; surrounding region mostly flat along this particular stretch of the highway; roadway with 3 lanes [in each direction], each 3.60 meters wide; existence of a one-way marginal road along most of the western extent; 1.5 m wide hard shoulder; highway lane dividers with average widths of 0.50 m between the main lanes and 20 m between them and the marginal road; efficient drainage system along the entire stretch; paving considered acceptable for traffic, with a minimum of structural defects due to various factors; hot-milled bituminous concrete surface; functional vertical and horizontal road signs in good condition; mixed traffic; zone considered a mixed location, with predominance of commercial establishments and buildings for special uses, such as education, and middle to upper class residences; average traffic cruising speed set at 60 km/h; real recorded speed of 80 km/h for light vehicles and 70 km/h for heavy vehicles; and metropolitan bus traffic.

Within the region selected for analysis, an area of evaluation was chosen, called a "noise-sensitive area" i.e., an area with educational buildings, where the environmental noise impact assessments were conducted. Analyses and calculations were made in preparation for noise mapping in the following situations of the highway urbanization project: 1) Current, 2) Implementation, and 3) Operationalization of the urbanized highway. SoundPlan version 6.0 software was used for the calculations.

To map the noise in the current situation, field measurements of the equivalent sound pressure levels were taken and vehicle counts were made. The physical data of the area were obtained photogrammetrically and through on site evaluations.

To map noise levels in the implementation situation, on site measurements were taken of the equivalent sound pressure levels generated by two common types of earthmoving equipment, a CAT 12H standard motor grader and a CASE 580H backhoe, both on pneumatic

wheels. These machines showed an equivalent sound pressure level ($L_{eq}$) in operation of 91 dB(A) and 92 dB(A), respectively. The simulation of the implementation of the works also considered the "whistle signal" produced by earthmoving equipment when operating in reverse, which generated an $L_{eq}$ of 90.2 dB(A) (Figure 33).

A flow of 780 vehicles per hour was considered, with 8.5% of heavy vehicles, in the situations of implementation and operationalization of the project. The speedconsidered for light and heavy vehicles during the implementation phase of the project was 40 km/h.

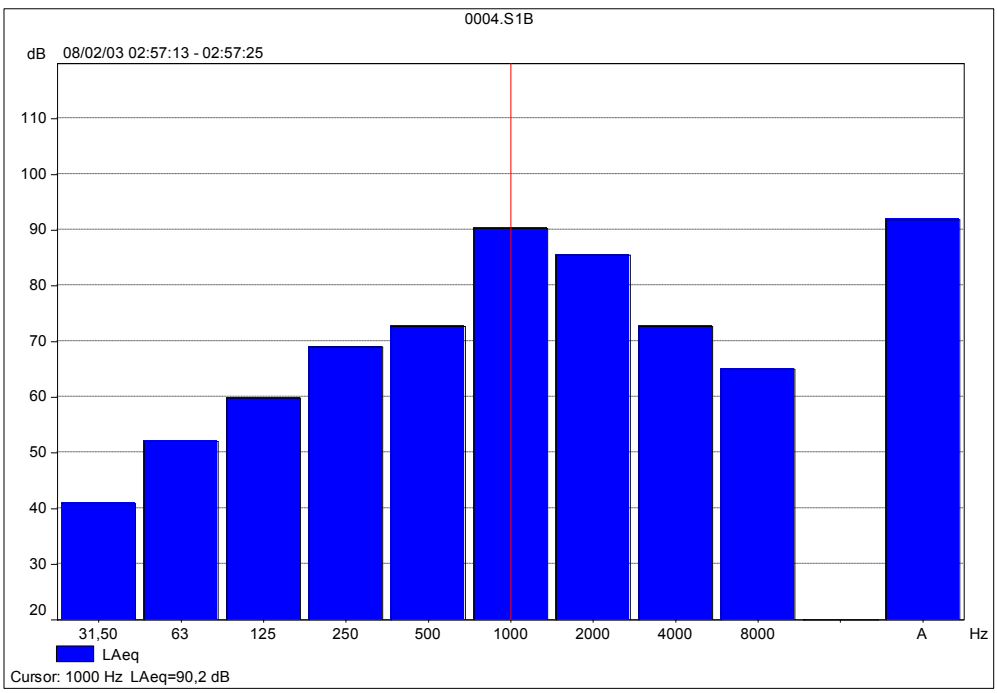


Figure 33. Noise frequency spectrum generated by the whistle signal of a grader, $L_{eq}$ = 90.2 dB(A) at 1,000 Hz.

The noise maps for the situation of operationalization were prepared considering the basic project for the Metropolitan Axis of Curitiba's Integrated Transport Network. This project includes: 1) the prioritization of public transport, with the implementation of exclusive express bus lanes; 2) marginal roads for the circulation of traffic between different neighborhoods of Curitiba and of metropolitan municipalities; 3) local access roads to reach neighboring activities; and 4) implementation and remodeling of bike paths and green areas. Double and triple-articulated buses were also considered, at 3-minute intervals.

To determine the environmental impact, an assessment was made of the impact attributes, i.e., classification of the qualitative characteristics of the activity based on the calculated noise maps. Table 15 lists the attributes in question.

### *6.2.3. Results and Discussion*

The noise maps generated by computer simulation for the various phases of the project, i.e., current, implementation, and operationalization, are shown below. The maps are presented sequentially, preceded by information about their main identified features. The

classification of noise pollution was formulated for a mixed area of approximately 20 km², according to Curitiba Municipal Law No. 10625 and the Brazilian standard NBR-10151 Noise Assessment in Communities, in terms of acceptable percentages:

from 0% to 20% – clearly polluted
from 21% to 50% – partially polluted
from 51% to 70% – slightly polluted
from 71% to 100% – ideal

**Table 15. Environmental impact attributes due to noise emissions and immissions**

| Attribute | Qualification |
|---|---|
| Phase of occurrence | Implementation (work phase)<br>Operationalization |
| Area of coverage | Local<br>Regional |
| Nature | Positive<br>Negative |
| Order | First order (direct source)<br>Second order (indirect source) |
| Probability of occurrence | Uncertain<br>Certain |
| Beginning | Short and medium term<br>Long term<br>Immediate |
| Duration | Temporary<br>Permanent |
| Importance | Minor<br>Intermediate<br>Major |
| Possibility of reversal | Reversible<br>Irreversible |
| Synergy with other impacts* | Existent<br>Nonexistent |

*specify when “existent”.

### 6.2.3.1. Current Situation

Noise levels in the surroundings of the highway of 74-76 dB(A). Existence of concentrated areas along the highway in the range of 76-78 dB(A) due to the reduction of the highway lane divider between main roads. Existence of a potentiated zone of 72-74 dB(A) between the main lanes of the highway due to the existence of an unpaved embankment dividing these lanes. Noise levels of 66-68 dB(A) at the facades of buildings situated along the road, and of 62-64 dB(A) at the facades of buildings situated further back from the road. Presence of an educational establishment with noise levels of 66-68 dB(A) at its main facade (see Figure 34). Most of this stretch of the highway is not in compliance with the legal requirements for acceptable daytime noise levels, as indicated in Table 16.

**Table 16. Comparison of maximum acceptable values, current situation, daytime**

| Legislation and Standards | Period | Maximum value [dB(A)] | % Compliance | Acoustic Situation |
|---|---|---|---|---|
| Law No. 10625 (ZE-BR-476 – special zone of BR-476) | Daytime | 65 | 16 | Clearly polluted |
| Law No. 10625 (ZE-E – special educational zone) | Daytime | 60 | 0 | Clearly polluted |
| NBR-10151 standard (mixed zone) | Daytime | 65 | 16 | Clearly polluted |
| NBR-10151 (with special buildings) | Daytime | 55 | 0 | Clearly polluted |

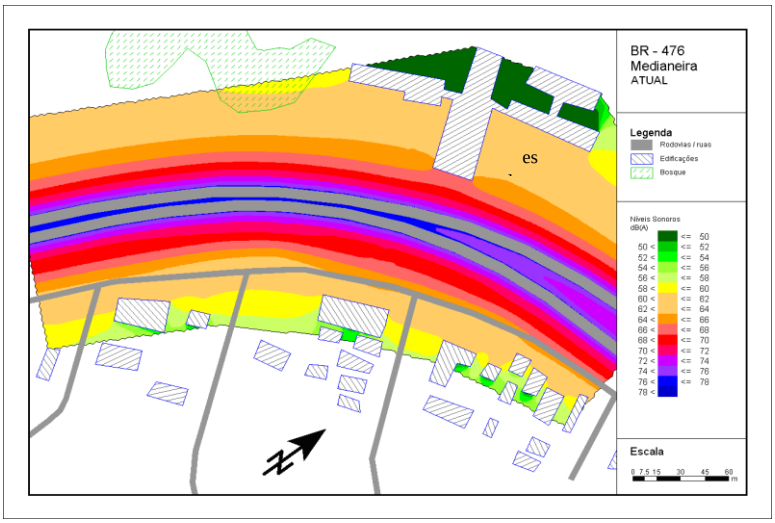


Figure 34. Noise map of highway BR-476 in the current situation: surroundings of the educational establishment – School Medianeira. Legend: rodovias = road; níveis sonoros = sound pressure levels; edificações = buildings; bosque = forest.

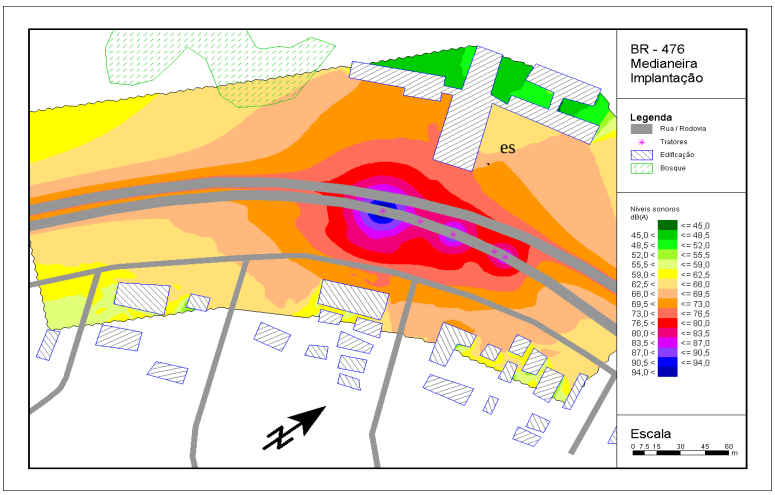


Figure 35. Simulation of noise levels in the implementation phase of the highway urbanization project: earthmoving works in the surroundings of the educational establishment – School Medianeira. Legend: rodovias = road; níveis sonoros = sound pressure levels; edificações = buildings; bosque = forest; tratores = tractors.

### 6.2.3.2. Implementation Phase (Works)

Noise levels in the order of 90.5 dB(A) to 94 dB(A) in the vicinity of the points representing earthmoving equipment (graders and backhoes), with one concentrated area. Job site noise levels range from 76.5 dB(A) to 94 dB(A). Noise levels in the range of 73-76.5 dB(A) at the facades of buildings along the highway, and of 66-73 dB(A) at the facades of buildings further back from the highway. Presence of an educational establishment with noise levels in the range of 73-76.5 dB(A) at its front façade (Figure 35).

Most of this stretch of the highway is not in compliance with the legal requirements for acceptable daytime noise levels, as indicated in Table 17.

**Table 17. Comparison of maximum acceptable values, implementation phase, daytime**

| Legislation and Standards | Period | Maximum value [dB(A)] | % Compliance | Acoustic Situation |
|---|---|---|---|---|
| Law No. 10625 (ZE-BR-476 – special zone of BR-476) | Daytime | 65 | 13 | Clearly polluted |
| Law No. 10625 (ZE-E – special educational zone) | Daytime | 60 | 0 | Clearly polluted |
| NBR-10151 standard (mixed zone) | Daytime | 65 | 13 | Clearly polluted |
| NBR-10151 (with special buildings) | Daytime | 55 | 0 | Clearly polluted |

### 6.2.3.3. Operationalization Phase

For this phase, only the limit values for zones with buildings for special uses were considered, because after the project is completed, this urban stretch of highway but will become a municipal road, and will fit the category of a special educational zone (ZE-E, see Table 3).

Continuous noise levels in the range of 72-74 dB(A) in the proximities of the urban avenue. Noise levels in the range of 68-70 dB(A) at the facades of buildings along the avenue, and of 62-64 dB (A) at the facades of buildings further back from it. Existence of an educational establishment with sound levels in its front facade in the range of 68-70 dB (A) (Figure 36). Presence of an educational establishment with noise levels in the range of 68-70 dB (A) at its front façade (Figure 36).

This stretch of the highway is not in compliance with the legal requirements for acceptable daytime noise levels, as indicated in Table 18. The operationalization of the road urbanization project will intensify the existing noise pollution levels.

**Table 18. Comparison of maximum acceptable values, operationalization phase, daytime**

| Legislation and Standards | Period | Maximum value [dB(A)] | % Compliance | Acoustic Situation |
|---|---|---|---|---|
| Curitiba Law No. 10625 (ZE-E) | Daytime | 60 | 0 | Clearly polluted |
| NBR-10151 standard (with special building) | Daytime | 55 | 0 | Clearly polluted |

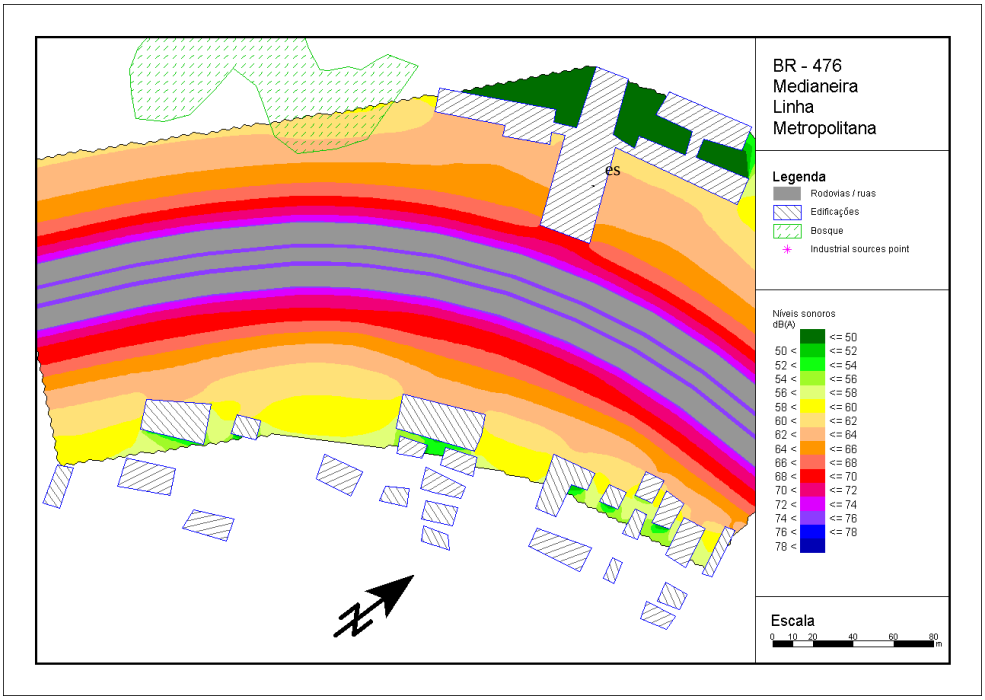


Figure 36. Simulation of the operationalization phase of the highway urbanization project: surroundings of the educational establishment – School Medianeira. Legend: rodovias = road; níveis sonoros = sound pressure levels; edificações = buildings; bosque = forest.

### *6.2.4. Environmental Impact Matrix*

Tables 19 and 20 describe the Environmental Impact Matrices of the implementation and operationalization phases of the project in terms of measured and simulated noise levels.

**Table 19. Environmental Impact Matrix of the Implementation phase**

| Attribute | Qualification |
|---|---|
| Phase of occurrence | Implementation |
| Area of coverage | Local |
| Nature | Negative |
| Order | First order |
| Probability of occurrence | Certain |
| Begining | Immediate |
| Duration | Temporary |
| Importance | Major |
| Possibility of reversal | Reversible |
| Synergy with other impacts | Higher local air pollution due to increased emission of nonmetallic dust, dust containing metals, and exhaust gases |

**Table 20. Environmental Impact Matrix of the Operationalization phase**

| Attribute | Qualification |
|---|---|
| Phase of occurrence | Operationalization |
| Area of coverage | Local |
| Nature | Negative |
| Order | First order |
| Probability of occurrence | Certain |
| Beginning | In the short term |
| Duration | Permanent |
| Importance | Major |
| Possibility of reversal | Reversible |
| Synergy with other impacts | Higher local air pollution due to increased emission of nonmetallic dust, dust containing metals, and exhaust gases from continuous vehicle traffic.<br>Higher thermal pollution due to the increase in thermal sensation caused by air pollution and reduced permeable area.<br>Economic impact due to possible real estate devaluation of middle class and upscale housing. |

### *6.2.5. Conclusion*

The implementation and operationalization of the road urbanization project will intensify the existing noise pollution, resulting in negative local environmental noise impact in synergy with impacts of other orders of magnitude.

The magnitude of this impact in terms of increased noise level is expected to be on average 48%, representing an unhealthy condition for the population living or working on or in the proximities of this avenue. Therefore, for a region that already has noise levels exceeding the regulatory and legal limits, this increase is considered to pose a risk, requiring the immediate adoption of mitigating measures, which should already be defined in the project's design phase. Some noise control measures that can be applied are: 1) reduction of sound levels from the noise source by controlling vehicle noise emission; 2) use of pavements with low roughness and with sound absorption characteristics; 3) control of traffic speed; 4) pavement maintenance; 5) control of the quality of the private and public vehicle fleet; 6) limitation of noise transmission by natural means, using the topographic conditions and existing vegetation, or by artificial means, e.g., acoustic barriers with noise absorbing materials, since noise propagation on the operationalized avenue will increase continuously. The choice of control measures will depend on the effectiveness of the economic factor and on the acceptance of the population.

## 6.3. Assessment of Railway Noise in an Urban Setting

A 20 kilometer stretch of railway track runs through the city of Curitiba, crossing urban thoroughfares and passing through residential neighborhoods. As a safety measure, trains blow their horn before they reach a railroad crossing. The trains pass through 40 crossings and blow their horn at least three times as they approach a crossing, thus blowing their horns

at least 120 times as they pass through the city. Since an average of ten trains pass through the city each day, their horns are blown at least 1200 times per day. This section describes the assessment of annoyance caused by railway noise in an urban setting, based on noise measurements, noise mapping, and subjective perceptions.

## 6.4. Materials and Methods

The environmental impact generated by railway noise was characterized based on several parameters: 1) noise level measurements at railroad crossings with the train horn blowing; 2) noise level measurements at railroad crossings without the train horn blowing; 3) noise maps showing the situation of noise pollution generated by train horn blowing; 4) noise maps without train horn blowing; 5) noise measurement at the receiver, i.e., inside the home of a resident in a neighborhood affected by railroad noise; and 6) interviews with the population of a district through which the railway runs. The equivalent sound pressure levels $L_{eq}$ were measured according to the Brazilian standard for noise assessment in urban environments, NBR 10151, at various points along the railway line. Noise measurements were taken using four Type 1 integrating sound pressure level meters (B&K 2270, B&K 2260, B&K 2250 and B&K 2238), while the simulations were done using SoundPlan, version 6.2 software. To evaluate the population's perception of railway noise, a questionnaire was prepared and distributed to residents in the neighborhoods surrounding the railroad tracks. One hundred and fifty questionnaires were distributed and the residents were given a week to answer the questions, after which the researchers collected 130 completed questionnaires.

## 6.5. Results and Discussion

The trains passing though the city follow a pattern that is repeated at each railroad crossing. Shortly before reaching each crossing, the train blows its horn three times. Five railroad crossings were evaluated, and noise measurements were taken at each of them in two different situations: A) Train passing with horn blowing, B) Train passing without horn blowing. Table 21 shows the noise level measured at various points along the railway line.

The railroad crossings listed in Table 21 are located in Urban Residential Areas, for which Curitiba Municipal Law 10625 establishes maximum acceptable daytime noise levels (7:01 a.m. to 7:00 p.m.) of 55 dB(A). Thus, it is evident that the noise generated by passing trains exceeds the limits established by municipal legislation, resulting in "noise pollution."

To analyze the noise generated by rail traffic based not only on measurements, SoundPLAN software was used to calculate noise maps for two situations: 1) Train passing with horn blowing, 2) Train passing without horn blowing. The results obtained from these simulations indicate how high the noise levels are (Zannin and Bunn, 2013). Figures 37 and 38 show the train passes with its horn blowing.

The noise map in Figure 37 indicates that the passage of trains blowing their horns generates noise levels of 80 to 92 dB(A) at the facades of the homes closest to the railway line. In addition, it shows that the noise levels that reach the more distant homes range from 68 to 80 dB(A).

**Table 21. Noise levels along the railroad**

| Measurement point/ Measurement situation | Characterization of the measurement | $L_{eq}$ dB(A) |
|---|---|---|
| Point 1 - A | Train passing with horn blowing | 108.3 |
| Point 1 - B | Train passing without horn blowing | 79.8 |
| Point 2 - A | Train passing with horn blowing | 101.0 |
| Point 2 - B | Train passing without horn blowing | 79.9 |
| Point 3 - A | Train passing with horn blowing | 109.8 |
| Point 3 - B | Train passing without horn blowing | 80.0 |
| Point 4 - A | Train passing with horn blowing | 102.7 |
| Point 4 - B | Train passing without horn blowing | 87.4 |
| Point 5 - A | Train passing with horn blowing | 108.9 |
| Point 5 - B | Train passing without horn blowing | 84.3 |

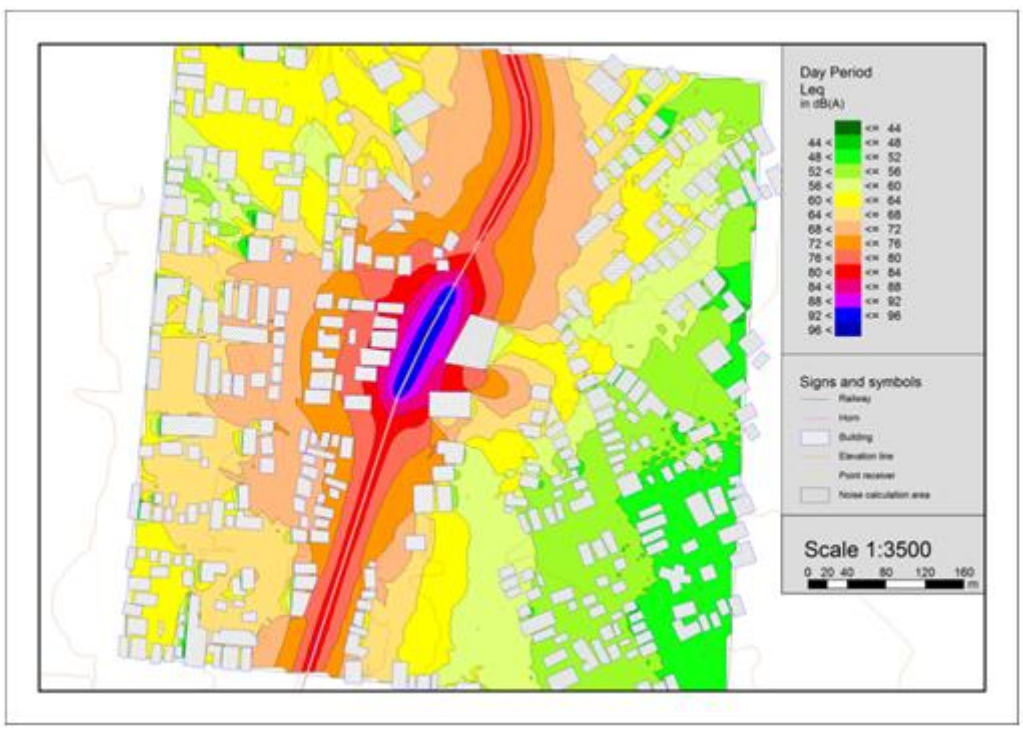


Figure 37. 2D noise map of the acoustic scenario when the train is blowing its horn.

Figure 37-a also indicates that, when a train passes with its horn blowing, the noise levels at the centerline of the noise map exceed 96 dB(A). Therefore, the situation is clearly one of "noise pollution," since the noise levels generated far exceed the legally established limit of 55 dB(A) for daytime.

The noise map in Figure 38 represents the acoustic scenario when the train does not blow its horn. The noise emission level decreases significantly without the blowing horn. The noise levels in the proximities of the rail line vary from 68 to 80 dB(A), in contrast with the situation with the horn blowing, when the levels varied from 80 to 92 dB(A). Although the noise levels declined considerably without the blowing train horn, they still far exceeded the limit of 55 dB(A) for the daytime established by Curitiba's municipal law for residential areas.


Figure 38. 2D noise map of the acoustic scenario of the train passing without blowing its horn.

Residents were asked whether – *they find the noise irritating*, to which 92% answered *YES* and 8% *NO*. The residents were asked whether noise leads to – *poor concentration*, to which 86% said *YES*, 13% answered *NO*, and 1% did not respond.

Residents were asked whether the noise causes – *headache*, to which 59% responded *YES*, 39% answered *NO*, and 2% did not respond.

The residents were asked what time of the day they consider the most bothersome in terms of noise. The great majority, 88%, stated that the most bothersome time is the nighttime. Asked if the noise causes them – *insomnia*, 73% of the respondents answered *YES*, and 27% *NO*.

The interviewees were asked how frequently – *their sleep is disrupted by noise*, to which 58% answered *Often*, 32% *Sometimes*, 9% *Never*, and 1% did not answer. They were then asked whether – *sleep is interrupted by the noise of the train*, with 70% claiming that their sleep is *Interrupted Frequently*, 21% *Sometimes* 8% *Rarely or Never*, and 1% did not answer.

Table 22 lists the times of the day when, according to the residents, the noise of the train is the most frequent nuisance.

**Table 22. Time of day when train noise is the most annoying, and percentage of respondents affected by it**

| Time when *sleep* is interrupted by train noise | Percentage of respondents |
|---|---|
| 12 – 2 a.m. | 18% |
| 2 – 4 a.m. | 18% |
| *4 – 6* a.m. | *37%* |
| *6 – 8* a.m. | *43%* |
| 8 – 10 a.m. | 19% |
| 10 a.m. – 12 p.m. | 2% |
| 12 – 2 p.m. | 1% |
| 2 – 4 p.m. | 0% |
| 4 – 6 p.m. | 0% |
| 6 - 8 p.m. | 3% |
| 8 – 10 p.m. | 9% |
| *10 p.m. – 12 a.m.* | *35%* |

As reported above, 88% of the interviewees indicated that the noise of the train causes the greatest annoyance in the nighttime. In view of this finding, measurements were taken of the nighttime noise generated by passing trains. To this end, a sound level meter was installed in a sound receiving location – the home of a resident. The distance from the railway tracks to the receiver site (the resident's home) is about 200 meters. As Figure 38 shows, the measurements started before 10 p.m. and ended after 6 a.m. A B&K 2238 sound level meter was used and the measurements were taken with a datalog module (noise levels vs. time of measurement), with measurements recorded at 10 minute intervals.

Figure 39 indicates that two trains passed by the measurement location between 10 p.m. and 6:30 a.m., one at 10:10 p.m. and the other at 6:20 a.m. Both trains blew their horn, as evidenced by the high values of maximum sound level, $L_{max}$, and equivalent sound level, $L_{eq}$. Figure 38 shows how high the noise level is when a train passes with its horn blowing, since the maximum sound levels reached nearly 80 dB(A) at the railroad crossing at 10:10 p.m. and 78 dB(A) at 6:20 a.m. The equivalent sound pressure level reached $L_{eq}$ = 60 dB(A) at 10:10 p.m. and $L_{eq}$ = 58 dB(A) at 6:20 a.m.

Curitiba's Municipal Law 10625, which regulates noise in communities, establishes that the noise levels, $L_{eq}$, from 10 p.m. to 7 a.m. cannot exceed 45 dB(A) in the region where the nighttime measurements were taken. Therefore, this is a clear violation of this law during the nighttime.

The measurement shown in Figure 39 proves what the residents claimed, as indicated in Table 8, i.e., the daytime periods from 4 to 6 a.m. and 6 to 8 a.m., and the nighttime period from 10 p.m. to midnight are the periods of greatest annoyance due to train noise. 37% of the

respondents stated that the noise between 4 and 6 a.m. was the most annoying, while 43% stated it was between 6 and 8 a.m., and 35% claimed that the noise between 10 p.m. and midnight was the most disruptive.

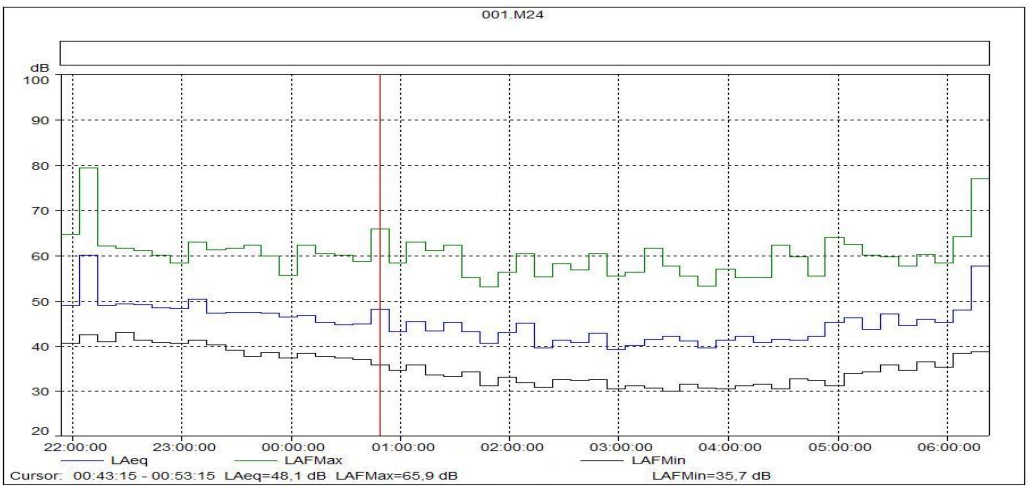


Figure 39. Noise levels as a function of the time of day.

Lastly, the residents were asked whether they believe that local noise can devalue their home, to which 69% responded *YES*, 28% *NO*, and 3% did not answer the question. According to the World Health Organization (2000), noise pollution generates not only health problems but also economic impacts. This economic impact identified by WHO (2000) involves the following factors: 1) Use of drugs prescribed for insomnia and other sleep disorders. According to WHO, such drugs contribute to the social cost of noise since they would be unnecessary in the absence of noise. 2) Desertion of city centers due to numerous and diverse noise sources. 3) Depreciation of the value of homes.

The World Health Organization cites studies conducted in Canada, the United Kingdom and the United States of America about the correlation between aircraft noise and real estate values. According to WHO (2000), these studies cite a depreciation factor of 0.75% per dB(A) for low and moderate priced housing, and of 1.0% per dB(A) for upscale housing. These real estate depreciation factors are applied to sound pressure levels of 60 to 80 dB(A) (2000).

Evaluating the effect of aircraft noise on home value depreciation, Espey and Lopez [49] showed that the value of homes located in areas close to an airport, where noise levels were 65 dB(A) or higher, was about $ 2400 lower than similar homes located in areas not considered noisy. Railway noise also has an impact on the value of homes. The train horn is considered a major cause of high noise levels near railway lines. Bellinger (2006) evaluated the cost of noise generated by blowing train horns in a small town in Pennsylvania. According to him, real estate market values depreciate by 4.1% for every 10 dB above the background noise level. Considering the 256 homes affected, the losses represented a total of about $ 4 million in 2004 market values. According to Schwieterman and Baden (2001), in the region of Illinois, USA, if quiet zones – areas where the trains are not allowed to blow

their horns – had not been created, depreciation in real estate values would probably have been in the order of 616 million dollars, and possibly even as much as 1 billion dollars.

## CONCLUSION

This study evaluated the noise impact generated by railway noise in an urban setting. The residents were found to feel strongly affected by noise generated by passing trains. This finding is confirmed by the measured noise levels and also demonstrated in the sound maps. Train noise causes *irritation and annoyance*, *headache*s, *poor concentration* and *insomnia*. In terms of noise pollution, 88% of the respondents cited nighttime as the most critical time of the day. Moreover, most of the residents fear that the value of their residential properties is depreciated by the presence of train noise.

The measurements indicated that the noise levels generated as the train passes with its horn blowing are extremely high, clearly violating Curitiba's noise legislation. Noise mapping showed that a simple solution to control noise would be for the trains to pass through the city without blowing their horns. However, although the noise levels are significantly lower, they still exceed the levels established by municipal legislation. The solution to the problem would be to remove the railway line passing through the city. However, lack of resources and of political will are two obstacles to the removal of the trains passing through residential areas within the city.

With respect to noise generated by rail traffic, one should not forget the words of Fields and Walker (1982): "*Noise is rated to the most serious environmental nuisance caused by railways*"

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*Chapter 8*

# BATTLING URBAN PRIMACY: CHANGING PATTERNS OF INTERNAL MIGRATION IN VENEZUELA, 1950-2001

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## ABSTRACT

Urban primacy was a concern for many developing countries around the middle of the twentieth century. Venezuela spent billions of dollars of its oil revenue in an attempt to redirect population away from the Capital Region. This paper examines changes in life-time migration patterns for 1950, 1971, and 2001. Migration efficiency ratios were used to determine which states became more efficient in the exchange of migrants over the fifty years. As of 1950, the Federal District gained migrants from all states illustrating the draw of the Capital City. States on the periphery of the country lost population to not only the Capital but to those that served as intervening opportunities on the way to the Capital. By 1971, migrant gains expanded to include contiguous states to the Capital. Bolivar State on the periphery switched from a net exporter to net importer of migrants by 1971 largely as a result of a planned industrial city. The Capital lost to all of the surrounding states as of 2001.

Through an analysis of the system efficiency it was noted that Venezuelan migration flows were instrumental in moving migrants from overpopulated areas such as the Capital Region to less populated areas.

While migration to the Capital was reduced during the timeframe, it is uncertain to what extent Venezuela's urban planning policies affected these changes. It is likely that disamenities associated with the Capital led to outmigration while simultaneously repelling potential inmigrants.

**Keywords:** Urban primacy, deconcentration, internal migration, migration efficiency

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## INTRODUCTION

High rates of population growth due to the rapid declines in death rates began after the 1950s in much of the developing world (Kojima, 1996). Soon thereafter, rapid urbanization began as individuals flocked from rural to urban areas. The Capital City of the country often received the bulk of individuals who came in pursuit of the country's best economic opportunities, educational facilities, and cultural amenities (Jefferson, 1939). Not only did capital cities grow through migration but migrants tended to be in their prime child-bearing years which led to high natural increase rates (Gilbert, 1996). This growth was thought to be beneficial to the country in its economic development process.

Migration and economic development are intricately related processes. Theoretically, migrants move from low income to high income regions (Borts and Stein, 1964). Migrants are considered as rational economic individuals who seek out destinations with the greatest economic benefit. The problem is that urban areas in developing countries have been unable to provide jobs for all migrants, but this has not stopped the rural to urban flow. Harris and Todaro (1980) found that migrants came in expectation that a higher wage job would be found in urban areas. Migration is assumed to slow when the income levels of high and low regions converge as populations redistribute themselves throughout the country and migrants drive wages down in the destination and raise them in the origin (Borts and Stein, 1964). Given that rural areas had a less diversified economy than urban areas much of the initial flow during the development process is from rural to urban areas (Zelinsky, 1971). Neoclassical migration theory (Stark and Bloom, 1985) has been advanced to explain that migration is not an individual but a family decision and that some individuals in a household will remain in the origin and send a member or members to a destination to diversify risk and to remit money to the origin. This process effectively creates a system that serves to interconnect the origin and destination and is likely to stimulate a countercurrent of migration between origin and destination.

This paper focuses on the redistribution of Venezuela's population from 1950 to 2001 as a result of the process of internal migration. Venezuela is an interesting case study because internal distribution of population through migration was already well advanced by the 1920s as a result of oil discovered in the Maracaibo Basin in the Northwestern part of the country (Suarez and Torrealba, 1980). This directly led to rapid industrialization and urbanization by the 1950s, which stimulated migration from the Western Region of Venezuela to Zulia (Chen, 1968), the origin of the oil resources. More importantly, the wealth from the resources was funneled into the development of Caracas which spurred an additional migrational movement to the Capital city from the rest of Venezuela. Although Caracas dominated the urban hierarchy of Venezuela at mid-century, a much more even distribution in city size and population distribution throughout the country was apparent by the end of the twentieth century (United Nations, 2008). It is uncertain what brought about this change. Some scholars (MacKellar and Vining, 1995) claimed that deconcentration in advanced developing countries was a result of negative externalities associated with the Capital City. However, part of this deconcentration could have been a result of Venezuela's attempt to redirect the migrant flows to the peripheral region of the country to halt the overconcentration of population in the Capital Region. Unfortunately, while migration and population redistribution within Venezuela was a prime topic of interest from the 1950s to the 1970s (Chen, 1968; Suarez and

Torrealba, 1980; Brown and Goetz, 1987; Lawson and Brown, 1985), the academic community has been less interested in recent patterns of internal migration, leaving two decades of movements largely unexplored. This paper hopes to fill this lacuna in the research on recent Venezuelan internal migration and how these flows have contributed to the overall redistribution of the Venezuelan population. More importantly, this study provides a point of departure for future population redistribution in Venezuela during the 21st century. Hugo Chavez's administration embarked upon a redistribution policy in 2001 designed to more effectively integrate the country spatially by developing three regions for deconcentration, illustrating that population distribution was still a concern for the future (Plan Nacional de Desarrollo Regional, 2001; Barrios, 2000).

The paper begins with an overview of urban primacy. The second section examines the population characteristics of Venezuela in the twentieth century and categorizes the 23 states of Venezuela according to the socioeconomic and demographic characteristics of the population. Sections three, four, and five examine net migration exchanges, migration efficiency indices, and Hoover indices, to determine if Venezuela's population had become more evenly distributed by the beginning of the twenty-first century. Net migration and efficiency ratios are examined for 23 Venezuelan States between 1950 (the beginning of concentration of population in the Federal District), 1971 (a time of high population growth and urbanization) and 2001, the latest census. The paper concludes with suggestions for future research.

## Urban Primacy

Jefferson (1939) proposed the law of the primate city which stated that once a country captured a certain percentage of the nation's economic resources and population that it would continue to perpetuate its growth and thus obscure the growth of all other cities in the urban system of that nation. Economists believed that this agglomeration of population and economic resources was necessary to the development process given that the labor force, market, and infrastructure needed to support the industrialization process could only be realized after a certain threshold of population was attained (Alonso, 1971).

El-Shahks (1972) illustrated that development is a condition more often seen in the form of an inverted U-shaped pattern. Those countries very low on the economic development continuum and those very high on the continuum had the lowest levels of primacy while those in the intermediate stages of economic development showed the highest degrees of primacy. Alperovich (1992) supported El-Shahks conclusions finding low levels of primacy in Europe, the United States, and the Soviet Union as well as many countries in Africa, while countries in Asia, the Middle East, and Latin America, mostly in intermediate stages of economic development illustrated the highest levels of primacy. The urban primacy associated with Asian, African, and Latin American countries is thought to be a result of colonialism in which the economic and political power was concentrated in the capital city (Lyman, 1992).

As countries develop, improvements in transportation and communication systems between different regions allow a more dispersed urban system to develop. MacKellar and Vining (1995) found that developing countries in Latin America well along the economic development process had experienced deconcentration of their populations from the capital region by the 1970s. Further studies on developing countries noted that large cities had

experienced deconcentration to the surrounding areas during the 1980s (Villa and Rodriquez, 1996; Gilbert, 1996). Unfortunately these studies postdated the attempts by many countries to artificially redirect population and economic resources away from the Capital City that began in earnest in the 1950s. Many countries experimented with planned growth poles and the development of secondary cities in which the government redirected population flows from the Capital Region to peripheral regions to affect a more balanced population distribution and to aid in economic development. These projects were carried out in such diverse countries as Thailand (Glassman and Sneddon, 2003), Taiwan (Williams, 2003), Egypt (Stewart, 1996), South Africa (Dewar and Watson, 1986), Peru (Jameson, 1979), Venezuela (Friedmann, 1969), and Brazil (Townroe and Keen, 1983) to name a few. The results of these efforts were largely disappointing in that they failed to attract either the quality or quantity of migrants needed to fulfill expectations. Parr (1999) summarized the problems experienced by numerous countries in their attempts with growth poles. Many times the long-term feasibility of the projects was questionable while in some cases the development strategy was ill-advised focusing on industrial ventures instead of rural development. Irazabel's (2009) examination of planning ventures that redirected migrant flows in Latin America questioned the feasibility of the state's role in preempting migratory flows and suggested that policies focus instead on integrating migrants into their desired destinations.

## The Study Area-Venezuela

As of 2001, Venezuela was divided into 24 states. In the 1990s, Vargas was carved out of the Federal District, but since it did not exist prior to this period, no disaggregation takes place in this study. There are five major regions in Venezuela (See Figure 1). The Capital Region consists of the Federal District which contains Caracas and the surrounding states of Miranda, Aragua, and Carabobo. These states contain several of the country's largest cities and have the highest per capita incomes. The Northeast States consist of Monagas, Delta Amacuro, Anzoategui, Sucre, and Nueva Esparta. They were largely rural states, experienced high fertility levels during the 1950s to 1970s, and had low per capita incomes. The Frontier States of Bolivar and Amazonas are located in the Southeast and continue to be lightly populated, although much less so than in 1950. The Interior States of Guarico, Apure, and Barinas are large land areas with poor, rural populations. The Western Highland States of Portuguesa, Trujillo, Cojedes, Lara, Falcon, and Yaracuy have traditionally been densely populated, overwhelmingly rural, and poor. However, they contain several large cities. Tachira, Merida, and Zulia are in the far West. The State of Zulia surrounds the Maracaibo Basin and houses Venezuela's second largest city.

Morse (1971) indicated that Venezuela had already become primate by 1900 and that this was to further intensify throughout the first half of the 1900s (Browning, 1989). By 1950, the country was already 47.9 percent urban and was the most rapidly urbanizing country in Latin America during the middle of the twentieth century largely a result of rural outmigration and economic development in Venezuela induced by the oil industry. The 1950s and 1960s witnessed Venezuela's highest population growth during the twentieth century (4.03 percent per year) as a result of decline in death rates and the continuation of high birth rates. In an attempt to reap the rewards of the country's development potential, the Venezuelan government redirected economic resources to Southeastern Venezuela and built a city along

the Orinoco and Caroni Rivers in the State of Bolivar (MacDonald, 1969). The planners took advantage of the natural resources in the area and produced aluminum and steel which was fundamental to the industrialization process. By the 1970s, fertility rates and population growth had declined from their highs of the 1950s and 1960s but migration was still an important redistributor of population (Chackiel and Plaut, 1996). Venezuela began the twenty-first century with 89.7 percent of the population living in an urban area and fertility levels of only 1.82 (United Nations, 2010). While rural to urban migration declined substantially by 2000, the government still continued to redistribute the population away from the cities of the Capital Region.

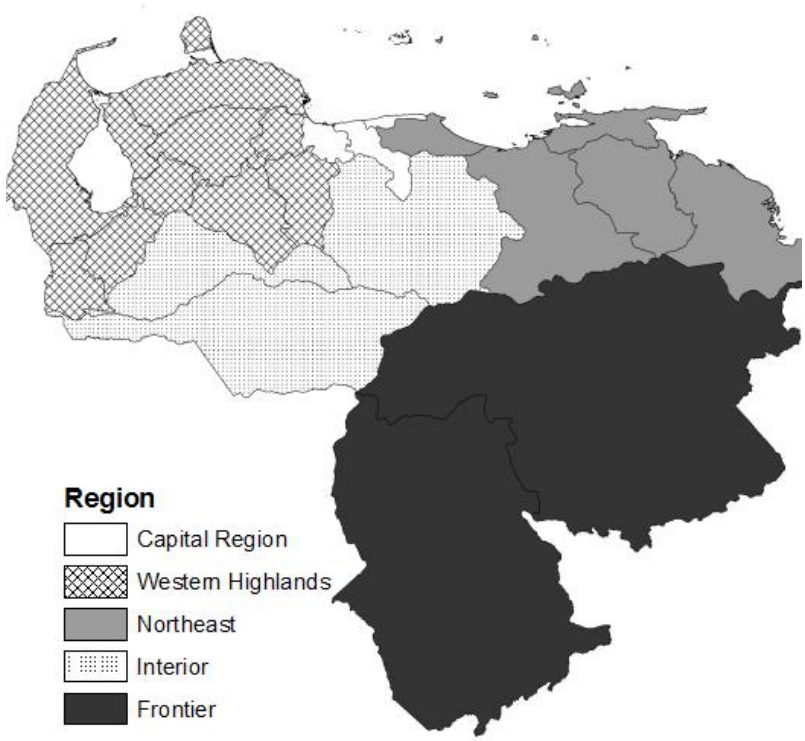


Figure 1. The regions of Venezuela.

## Data and Methodology

The Venezuela life-time migration figures produced by the Censuses of 1950, 1971, and 2001 are used for the analysis. Life-time migration is not the best indicator of migration behavior because of the large number of years that the measure covers and may not adequately illuminate the social, demographic, economic, and environmental factors important for different time periods and different units of analyses. In addition, life-time migration does not examine whether the migrant came directly from the state of birth or made additional moves before arriving in the state of enumeration for that census. Recent migration, often migration that has occurred in the past five years, is a better measure, but

neither the 1950, 1971, nor 2001 censuses contain such information, making that comparison impossible. Varela (2008) used a data technique to extract five year migration exchanges for the 2001 Venezuelan census and his results will be compared with the general life-time trends in migration for 2001. Actual net life-time migration flows between states are examined. However, this unfairly highlights states with larger populations and it makes a comparison between 1950, 1971, and 2001 equally problematic because the population of the country was many times larger in 2001 than in 1950. Even within the same year, total numbers of net migrants can be misleading given the major differences in size of population and size of land area of the states. To combat this problem migrant efficiency ratios are used. Longitudinally, two or more years of migrant exchange ratios can be examined to indicate whether states have become more or less efficient in migrant exchanges. Plane (1984) used migration efficiency ratios to examine exchanges between U.S. States. The advantage of this method is that it is not influenced by the actual number of migrants exchanged, allowing states with very large and very small populations to be more fairly compared. These ratios range from -100 to 100 with 0 indicating that one state sent the same number of migrants to another state as it received from that state. A ratio of -100 indicates a one way flow of migrants from state i to j, whereas 100 indicates a one way flow of migrants from state j to i. A migrant efficiency ratio of 0 indicates an equal exchange between the state and other states. Spatially, the ratios can be examined to detect states which are the most and least efficient in the exchange of migrants within a particular country. The migration efficiency ratio is somewhat misleading given that higher numbers in one direction indicate redistribution of the population. Given that Venezuelan migration flows were focused on the Capital Region by 1950, for the purposes of this paper, lower numbers would be considered better in that the system was becoming more effective at providing equitable exchanges of migrants and providing a corrective measure to overconcentration in the Capital Region.

Two further measures are used to determine if the entire system has been affected by exchanges in migration from 1950 to 2001. While migration efficiency as discussed above examines the flows of migrants between the other states in the country, system efficiency examines how effective migration has been in redistributing the population within the country as a whole. System efficiency is measured by taking the absolute value of the migration efficiency ratios for each state, summing these measures, and dividing by the total number of states. The closer the number is to 0, the more efficient the system has been in redistributing migrants. The Hoover Index (Hoover, 1941) is used to determine how spatially concentrated the entire population is by examining land area and population. The closer to 0 the more equitably distributed the country's population. Whereas net migration and migration efficiency ratios only examine migration, the Hoover Index factors in natural increase.

## Results-Numerical Net Migrant Exchanges

In 1950, ten states gained migrants from other states in Venezuela (See table 1). Not surprisingly, in total numbers, the Federal District gained the most net migrants (213,532). The Federal District also gained from every state. Aragua and Carabobo, two states contiguous to the Federal District, had minimal gains from other states, only 10,419 and 8,088, respectively. Zulia gained 104,800 migrants, a result of the increase in employment opportunities created by the oil industry.

**Table 1. Net Migration and Migration Efficiency Ratios for the States of Venezuela, 1950, 1971, and 20001**

| | 1950 | | | |
|---|---|---|---|---|
| | IN | OUT | NET | M.E. |
| Amazonas | 1671 | 810 | 861 | 34.7 |
| Anzoategui | 57323 | 30325 | 26998 | 30.8 |
| Apure | 8662 | 16669 | -8007 | -31.6 |
| Aragua | 52103 | 41684 | 10419 | 11.1 |
| Barinas | 18301 | 11601 | 6700 | 22.4 |
| Bolivar | 15467 | 25750 | -10283 | -24.9 |
| Carabobo | 53306 | 45218 | 8088 | 8.2 |
| Cojedes | 7153 | 14655 | -7502 | -34.4 |
| Delta Amacuro | 7612 | 7312 | 300 | 0.2 |
| Falcon | 10881 | 64675 | -53794 | -71.2 |
| Guarico | 18433 | 36471 | -18038 | -32.9 |
| Lara | 24067 | 84233 | -60166 | -55.6 |
| Merida | 13027 | 45138 | -32111 | -55.2 |
| Miranda | 48443 | 89263 | -40820 | -29.6 |
| Monagas | 43881 | 26747 | 17134 | 24.3 |
| Nueva Esparta | 3209 | 38100 | -34891 | -84.5 |
| Portuguesa | 41732 | 9319 | 32413 | 63.5 |
| Sucre | 14495 | 75958 | -61463 | -68.0 |
| Tachira | 12365 | 46074 | -33709 | -57.7 |
| Trujillo | 10583 | 84850 | -74267 | -77.8 |
| Yaracuy | 14924 | 45240 | -30316 | -50.4 |
| Zulia | 128202 | 23402 | 104800 | 69.1 |
| Federal District | 257485 | 43953 | 213532 | 70. 8 |
| | 1971 | | | |
| | IN | OUT | NET | M.E. |
| Amazonas | 3292 | 2368 | 921 | 16.3 |
| Anzoategui | 99661 | 106309 | -6648 | -3.2 |
| Apure | 13408 | 48011 | -34603 | -56.3 |
| Aragua | 189551 | 70625 | 118926 | 45.7 |
| Barinas | 64159 | 31656 | 32503 | 33.9 |
| Bolivar | 103918 | 47611 | 56307 | 37.2 |
| Carabobo | 203450 | 74985 | 128465 | 46.1 |
| Cojedes | 14316 | 28116 | -13800 | -32.5 |
| Delta Amacuro | 6666 | 17881 | -11215 | -45.7 |
| Falcon | 18778 | 148742 | -129964 | -77.6 |
| Guarico | 39349 | 84746 | -45397 | -36.6 |

**Table 1. (Continued)**

| | IN | OUT | NET | M.E. |
|---|---|---|---|---|
| Lara | 66920 | 149959 | -83039 | -38.3 |
| Merida | 39279 | 104680 | -65401 | -45.4 |
| Miranda | 375102 | 123147 | 251955 | 50.6 |
| Monagas | 54391 | 99984 | -45593 | -29.5 |
| Nueva Esparta | 7716 | 50287 | -42571 | -73.4 |
| Portuguesa | 78663 | 34294 | 44369 | 39.3 |
| Sucre | 18820 | 207129 | -188309 | -83.3 |
| Tachira | 26659 | 182329 | -155670 | 74.5 |
| Trujillo | 21094 | 158334 | -137240 | 76.5 |
| Yaracuy | 34790 | 81514 | -46724 | 40.2 |
| Zulia | 185368 | 114041 | 71327 | 23.8 |
| Federal District | 641418 | 338009 | 303409 | 31.0 |
| | **2001** | | | |
| | IN | OUT | NET | M.E. |
| Amazonas | 18252 | 11392 | 6860 | 23.1 |
| Anzoategui | 307278 | 174527 | 132751 | 27.6 |
| Apure | 42571 | 125570 | -82999 | -49.4 |
| Aragua | 627254 | 189662 | 437587 | 53.6 |
| Barinas | 163886 | 110893 | 52993 | 19.3 |
| Bolivar | 281079 | 139074 | 142005 | 33.8 |
| Carabobo | 65124 | 393793 | 393793 | 50.9 |
| Cojedes | 583599 | 16480 | 16480 | 14.9 |
| Delta Amacuro | 25279 | 31978 | -6699 | -11.7 |
| Falcon | 104615 | 215577 | -110962 | -34.7 |
| Guarico | 102553 | 200990 | -98437 | -32.4 |
| Lara | 211322 | 238634 | -27312 | -6.1 |
| Merida | 124716 | 205108 | -80392 | -24.4 |
| Miranda | 1098812 | 142475 | 956337 | 77.0 |
| Monagas | 162172 | 164783 | -2611 | -.1 |
| Nueva Esparta | 99450 | 49030 | 50420 | 34.0 |
| Portuguesa | 128750 | 125122 | 3628 | 1.4 |
| Sucre | 63051 | 344653 | -281602 | -69.1 |
| Tachira | 105430 | 316086 | -210656 | -49.9 |
| Trujillo | 66339 | 256542 | -190203 | -58.9 |
| Yaracuy | 108318 | 121790 | -13472 | -5.9 |
| Zulia | 265018 | 301901 | | -6.5 |
| Federal District | 449495 | 1312092 | -862597 | -49.0 |

Three other states, Monagas, Anzoategui, and Delta Amacuro in the Northeast gained migrants. These states acted as intervening opportunities to migrants from other states on their way to the Capital Region. Portuguesa and Barinas also gained migrants. Their locations between the Western Highlands and the Capital Region act as intervening opportunities for outmigrants from Apure, Trujillo, and Tachira. As stated in classic migration theory (Ravenstein, 1886), step-wise migration is likely to occur as migrants relocate close to the origin and then after they become more familiar with the migration process, move onward to a larger town or city. It is likely that individuals residing in the urban areas of these intervening states proceeded to the capital region while rural migrants took their places. Although Venezuela was highly urbanized by 1950, it was only beginning the rapid population growth that would further spawn migration. In all cases except the transfer of migrants to the Federal District, the greatest beneficiaries of net migrants accrued to contiguous states to the exporting state.

All of the Western Highland States (except Portuguesa) lost migrants as of 1950. Three states had net migration losses exceeding 50,000 (Falcon, Lara, and Trujillo). The migrants ended up in Zulia, the Federal District and the states surrounding the Capital Region. Miranda received inmigrants from other states in Venezuela and in turn sent migrants to the Federal District contributing to the concentration of population in the Federal District and resulting in a net loss of 40,820 from Miranda. The heaviest losses in 1950 occurred in peripheral states which were unable to provide intervening opportunities for migrants on their way to the Capital Region.

Nine states gained life-time migrants according to the 1971 census. (See table 1) Aragua, Carabobo, Miranda, and the Federal District all had gains of at least 100,000. The biggest surprise was Miranda's 251,955 net migrant gain after its loss in 1950. It would appear that urban growth spilled over from the Federal District into the state of Miranda. Anzoategui, Delta Amacuro, and Monagas switched to net losers of life-time migrants while Bolivar switched to a net gainer. The development of the planned industrial city in Bolivar largely explains this reversal. Tens of thousands of poor migrants from the neighboring states of Anzoategui, Delta Amacuro, and Monagas migrated to Bolivar during the 1960s (MacDonald, 1969). Falcon, Sucre, Tachira, and Trujillo had net migrant losses exceeding 100,000. The incredible gain in numbers either negative or positive is not surprising given that migration chains are self-reinforcing.

As of 2001, ten states benefitted from life-time net inmigration (See table 1). Five of the states (Amazonas, Aragua, Barinas, Carabobo, and Portuguesa) also had gained in 1950 and 1971. Bolivar continued to gain life-time migrants from surrounding states and undoubtedly the new industrial city depressed outmigration from Bolivar. Anzoategui once again switched to a net importer of migrants largely a result of discoveries in oil deposits which strengthened urban areas (Plan Nacional de Desarrollo Regional, 2001), but Delta Amacuro and Monagas continued to lose life-time migrants as in 1971. Cojedes experienced a gain in migrants and given its proximity to the Capital Region may have become a part of the agglomeration. Miranda not only continued as a net importer of migrants, but gained the greatest number of migrants, largely as a result of its changed relationship with the Federal District which effectively had spread eastward. The rapid population growth and migration that occurred after the 1950s heavily affected the Northeast and many migrants from these states likely encountered Miranda before the Federal District. Excluding the island state of Nueva Esparta, Venezuela's gaining states as of 2001 formed a contiguous path stretching from

Bolivar/Amazonas and Monagas in the east to swing around to states surrounding the Capital Region to Barinas in the West. By 2001, Zulia was a net loser of migrants, a result of the decline in the importance of the oil industry (Plan Nacional de Desarollo, 2001). Other states that lost migrants included the majority of the states of the Western Highlands and Sucre which were on the periphery of the migration system. Zulia's changed fortunes by 2001 undoubtedly explain the decline in life-time net migrant loss for Falcon, Yaracuy, and Trujillo in close proximity to Zulia.

A major difference between 1950 and 2001 concerns the more equitable distribution of migrants from the Western Highlands. These states were relatively small in territorial size and thus population increase and migration are more likely to cross a state border and be more inflated for 1950 given the high fertility levels of this time period. The large territorial size of Anzoategui, Bolivar, and Monagas, may explain in part why they were able to more effectively accommodate growth of population and that migration may occur within state instead of cross boundaries in effect lowering migration exchanges with other states. As stated previously, the Western Highlands were already a major source of outmigrants prior to 1950. This outmigration was selective in terms of age, favoring younger individuals. Assuming that this process went on for decades, it is not surprising that child-bearing behavior would be transferred to other states. As migrants settled into destinations network connections would be put in place allowing chain migration to occur. Nueva Esparta, a major exporter of migrants in 1950, became an importer of migrants by 2001. The development of tourism (Desarrollo, 2001) has not provided employment opportunities for potential outmigrants but it may be that return migration to the state has occurred. The Federal District displayed rapid reversal from net in to net out migration between 1950 and 2001. The demise of the Import Substitution Policies and the interconnection to the global economy was a misfortune for many of the primate cities in the developing world (McKay, 2004). This made living in a large city a liability during the 1980s and 1990s (Venables, 2005; World Bank, 2009).

## Migrant Exchange Ratios

Figures 2A, B, and C display migrant exchange ratios between the 23 states for 1950, 1971, and 2001. States with migrant exchange ratios exceeding 50.0 or -50.0 indicate a very inefficient flow of migrants. The Federal District, Zulia, and Portuguesa exceeded 50.0 and received many more migrants from other states than what they sent to other states. Eight states (Falcon, Lara, Merida, Nueva Esparta, Sucre, Tachira, Trujillo, and Yaracuy) had migration efficiency ratios that exceeded -50.0. This indicates that these states sent many more migrants to other states than they received from the other states. Spatially, these states are found in the Western Highlands and the Northeast. These states had high population growth rates, were highly rural, and had low per capita incomes which pushed many of these individuals out of these states after the 1950s.

Individuals from other regions of the country would not be interested in these states given the underdeveloped status of the majority of them. The most equitable exchange of migrants occurred between Aragua, Carabobo and Miranda in the Capital Region and Delta Amacuro. All of these states are redistributors of migrants in that they attract from peripheral states of Venezuela and then send their own migrants to the Capital Region.

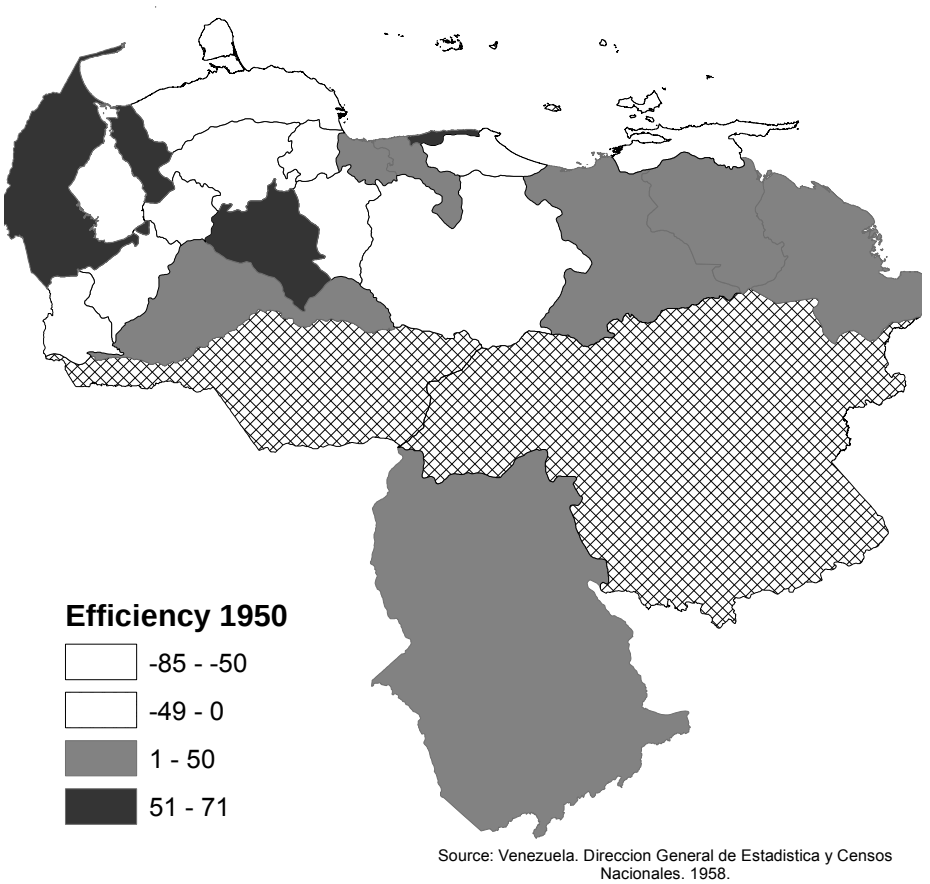


Figure 2A. Migration efficiency ratios for states of Venezuela, 1950.

The states of the Capital Region attract migrants from all over Venezuela and send migrants to other states in the Capital Region and the Federal District. Delta Amacuro attracted migrants from peripheral Northeast States and sent migrants to contiguous states of the Capital Region.

Migrant efficiency ratios for 1971 showed a major difference from 1950. Only Miranda had a migration efficiency ratio exceeding 50.0. However, Aragua, Carabobo, and Miranda became less efficient (increased efficiency ratios in 1971 in comparison to 1950) at affecting equitable population distribution given that they ceased to send large numbers of migrants to the Federal District. Several of the states in the Western Highlands (Cojedes, Yaracuy, and Merida) became more equitable in redistribution (declining ratios between 1950 and 1971), a likely result of interconnections between the capital region due mostly to their proximity to this Region. Six states exceeded -50.0 (Apure, Falcon, Nueva Esparta, Sucre, Tachira, and Trujillo), and are all located on the periphery. The more equitable distribution of net migrants for Lara, Merida, and Yaracuy in comparison to 1950 is likely a result of their locations between the states on the periphery and the states of the Capital Region.

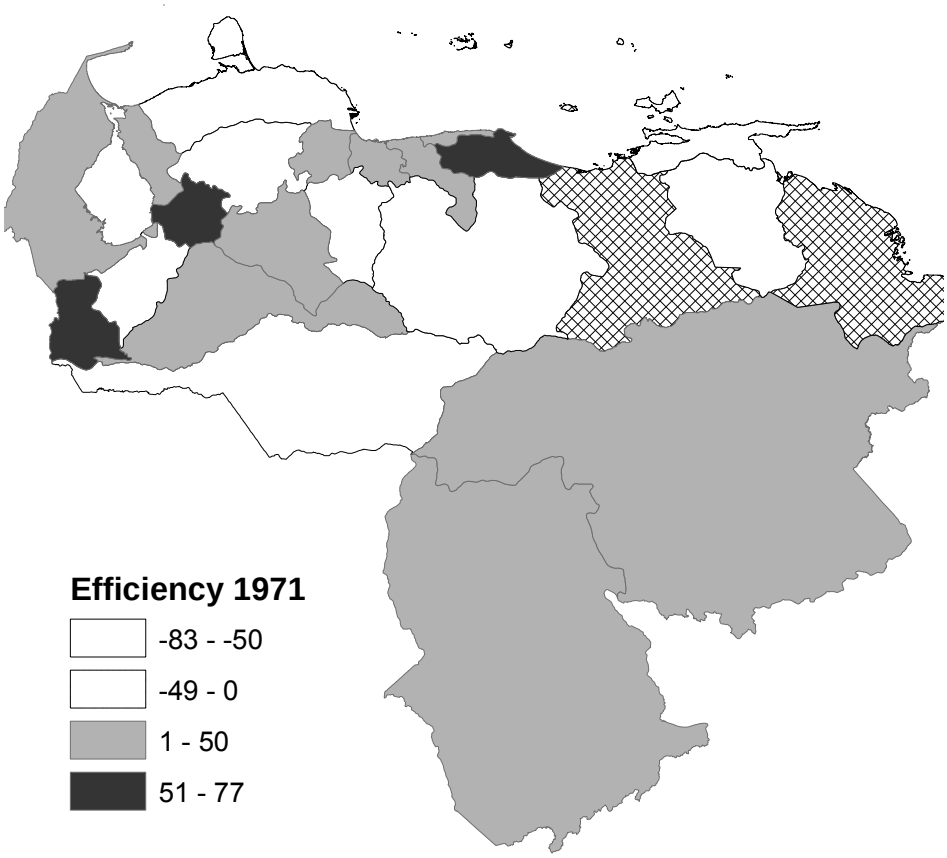


Figure 2B. Migration efficiency ratios for states of Venezuela, 1971.

As of 2001, the three states exceeding 50.0 (least equitable exchanges) were Aragua, Carabobo, and Miranda. These three became less efficient at moving outmigrants through the system. The role that these states played was to absorb migrants from other states of Venezuela, and to then send their migrants to the Federal District and the surrounding states. Not only did these three continue to absorb migrants from the periphery of Venezuela but also absorbed them from the Federal District which by the last two decades of the twentieth century was in a process of deconcentration. Only Sucre and Trujillo had migration efficiency ratios exceeding -50.0. Thus, these data suggest that migrant exchanges between states were more efficient in 2001 than they were in 1950 (the system efficiency index will discuss that below).

The most equitable migration efficiency ratios were found in the Western Highlands suggesting that these states had finally stopped the exodus of migrants to other states. As stated previously, the Western Highlands became much more efficient in moving individuals through the system. There are likely several reasons for why these states became more equitable. First, decades of outmigration would have suppressed the population growth of these states from not only the outmigrants themselves but as these migrants transferred their child-bearing behavior to other states. Secondly, these states may have become more

successful in retaining potential outmigrants. Thirdly, migrants who left may have returned to state of origin as a result of unrealized opportunities at the destination, upon retirement, or because of enhanced opportunities in the origin state. As Venezuela became more integrated, it would be less necessary for individuals to reside in the Capital Region. Fourth, it is also necessary to keep in mind that return migrants who found their mate or completed child-bearing behavior at the destination may have returned with these individuals by 2001.

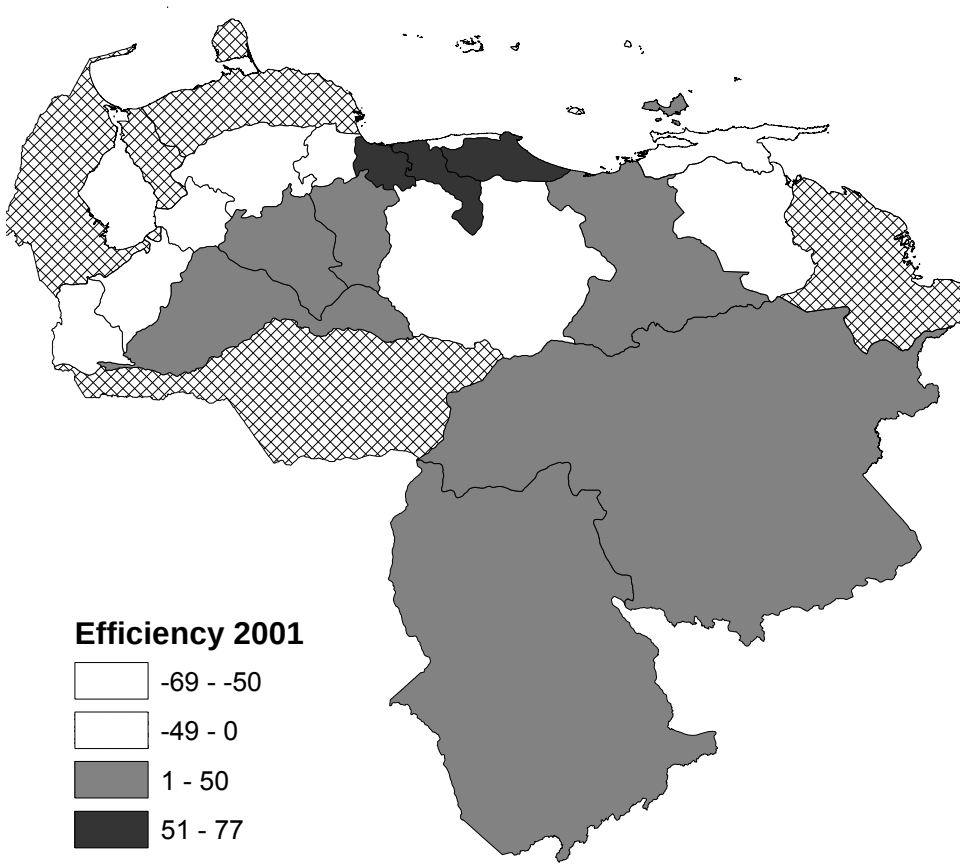


Figure 2C. Migration efficiency ratios for states of Venezuela, 2001.

A calculation of the system efficiency index indicated that Venezuela's migration streams had become more balanced with a ratio of 43.9 for 1950 and 31.9 for 2001. As of 1971, the system efficiency index rose to 45.1, likely a result of rapid population growth and urbanization that occurred during the 1950s and 1960s. Thus it can be concluded that the migration process allowed Venezuela's migration streams to more effectively redistribute population. However, did these migration streams bring about a more equitable distribution of the entire population? If migrants to and from different states have vastly different characteristics in terms of age structure and child-bearing behavior the migration streams may have had less of an effect on population redistribution. One method of combating this issue is to examine the Hoover Index which displays the level of concentration of a country's

population. Given the population and land area of each state this figure can easily be computed. This is only a rough estimate of redistributive processes given that many of Venezuelan States are extremely large.

A calculation of the Hoover indices in 1950 and 2001 revealed very little difference in the population distribution by state with Hoover indices of 60.2 and 58.2 in 1950 and 2001, respectively. Although the migrational flows changed dramatically over the fifty years, population distribution, at least as measured by the state, was little affected. However, it must be remembered that Venezuela's population increased from about five million in 1950 to over 23 million in 2001 (Venezuela, 2001). It was not until the 1990s that Venezuela's population growth rates began to decline dramatically. The high movement rates of the 1960s likely transferred numerous individuals in the 15 to 35 age group to the Capital Region, given that this age group would have the highest mobility levels.

These individuals would have still been in the labor force by 2001 and also would have been subjected to the high fertility levels of the time and were young enough to not have experienced high levels of attrition through age-related mortality. The upcoming censuses of 2011 and beyond will likely illustrate different life-time migrational flows and different population distribution patterns given the decline in fertility levels and the mortality processes associated with aging. Although this analysis concludes that the population had become slightly more evenly distributed in Venezuela by 2001, it is likely that within individual states that population had become more concentrated as individuals moved from rural to urban areas within their states.

## CONCLUSION

Lee's (1966) theory of migration largely explains migration in Venezuela for the 1950 and 1971 censuses. Push factors at the origin such as unequal land distribution, lower incomes, and unemployment expelled individuals from poorer mostly rural states while higher incomes, food subsidies, and educational/cultural opportunities pulled migrants to the major urban areas. The Western Highlands contained very high population densities around the mid twentieth century and effectively pushed poor rural migrants to nearby cities and also to Caracas as they were pulled to these areas for actual or potential employment opportunities (Chen, 1968). By the latter part of the twentieth century, urban to urban migration was more prominent. Between 1950 and 1960, rural to urban net transfer of migrants resulted in a gain of 56.9 percent of urban growth while this rural to urban transference between 1990 and 2000 was only 13.7 percent (Cerrutti and Bertoncello, 2003). Furthermore, whereas rural to urban income in 1976 was 2.07, by 1993 it was 1.74 making the difference between rural and urban migration more comparable with Venezuela mostly having completed its absorption of migrants into the nonagricultural sector (Butzer, Larson, and Mundlak, 2002). Since approximately ninety percent of Venezuela's population was urbanized (as of 2001), and migrant efficiency ratios have demonstrated that migrant streams have become more efficient between 1950 and 2001, then it can be assumed that Venezuelans have found smaller cities/towns more attractive than they were in 1950 or 1971.

It would appear that the negative externalities of pollution, crime, congestion, and the high cost of living in Caracas expelled many individuals to the areas surrounding the Capital

Region. Caracas has expanded not only in population but also in area and has resulted in deconcentration of population within the Capital Region. Rodriquez (2008) found in his study of population distribution patterns in several developing countries that the deconcentration was a result of suburbanization in nearby urban areas, and was only mildly indicative of larger redistribution trends. In regards to Latin America, Vasquez (2000) and Ollino and Vignoli (2006) also found this to be the case for Mexico City and Santiago, respectively. The positive net migration to Carabobo, Miranda, and Aragua suggests this may be the dominant process in Venezuela. However, the overall transition to a largely urbanized country by the close of the twentieth century and the concomitant innovations in transport and communications probably did much to even the distribution of migrants among the states (Lattes, Rodriquez and Villa, 2002). Many cities in Venezuela grew to a size that would provide opportunities to individuals within that state as well as perhaps attract individuals who left to return. The cost in terms of time and money would have depreciated over the fifty year period while knowledge concerning alternative locations would have increased. Many states expelled individuals in the child-bearing years during the 1960s and 1970s and would have depressed population increase at the origin while transferring natural increase to the destination (the Federal District). It is suggested that this outpouring of young adults may have been instrumental in checking outmigration rates from the Western Highlands by the latter decades of the twentieth century.

The results from this study are comparable to other studies on Venezuelan migration. Ramos (1999) examined states of attraction and repulsion from 1920 to 1990 and found that by 1950 the Federal District was the major pole of attraction for migrants. It was hardly conceivable at this time that migrants would find better opportunities than those available in the Federal District. By 1961, migrant selectivity had become more bipolar with Zulia and the Federal District the main attractors. By 1971, the Federal District shared attraction with the surrounding federal entities. By 1990, Bolivar had arisen as a secondary pole of attraction. While analyses using life-time migration likely includes migration behavior undertaken decades previously, Varela's (2008) study of recent internal migration patterns between 1996-2001 concurs with the overall patterns of life-time migrants as of 2001. The Federal District and Sucre were the largest losers while Miranda, Carabobo, and Aragua were the largest gainers. Anzoategui's changed fortune is more illuminated in recent migration patterns. My results concerning the system efficiency index of migration (31.9) is relatively close to Bell and Muhidin's (2009) calculation of system efficiency using IPUMS data for Venezuela (39.8). Venezuela's population and economic development plans for 2001-2007 illustrated an attempt to continue to deconcentrate the population to growth poles in peripheral regions. Whether this process is successful will not be determined until the next analysis of migration trends after the 2011 census.

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*Chapter 9*

# THE PUBLIC PARTICIPATION IN URBAN PLANNING – PORTUGUESE SMALL TOWN CASE

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## ABSTRACT

Public participation has become, in recent decades, a centerpiece of the decision making process in urban and environmental planning. This process had been faulted by a lack of efficiency and poor outcomes for most of the 20th century. With the advent of sustainable development, public participation has been enshrined as a key factor towards the building of a sustainable future. Future cities need to be designed according to sustainable methods and principles and participation strengthens the outcomes by involving all actors in the decision process. In this work we review the evolution of Public Participation, its integration in the broader concepts of urban and environmental planning, as well as its objectives and potential benefits. A case study was developed in the Portuguese municipality of Cascais, specifically the *Zambujeiro and Murches* district, a small town located inside a Natural Park which was integrated within a sustainable planning process. The outcomes and benefits of the process are presented and discussed within the broader framework of Public Participation in environmental decision making.

**Keywords**: Protected landscape, public participation, sustainable development, urban planning

## INTRODUCTION

In recent years, public participation in environmental decision-making has become the center attention due to fact that the traditional decision making process has been perceived as often failing. This perceived lack of efficiency in decision making has led to public

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participation being integrated into the current legal instruments in both the European Union and Portugal (Moore 1996; Moote, Mcclaran, and Chickering 1997; Webler, Seth Tuler 1999; Lauber and Bruice 1999; Reed 2008; Shmueli, Kaufman, and Ozawa 2008; Rauschmayer, Paavola, and Wittmer 2009).

Public participation is a complex concept but may be defined as any of several "mechanisms" intentionally instituted to involve the lay public or their representatives in administrative decision-making (Beierle and Cayford 2002). Moreover (Public) Participation is defined as a process where individuals, groups or organizations choose to take an active role in making decisions that affect them.

Public participation is fundamental in the context of sustainable development. The 10$^{th}$ Principle of the Rio Declaration 1992 on Environment Development articulates public participation in environmental decision-making as one of the key principles of environmental governance. This principle is developed in the Aarhus Convention in June of 1998 to include improving public participation in decisions relating to the environment as one of its three key pillars (articles 6 to 8). It establishes that sustainable development can be achieved only through the involvement of all stakeholders (Aarhus Convention 1998). Furthermore the European Union's White Paper on governance identifies participation as one of five principles of good governance, together with openness, accountability, effectiveness and coherence (EC 2001).

The benefits of community involvement in planning are widely documented; they include enhancing the capacity of citizens to create a stronger sense of commitment, which increases user satisfaction and their confidence in the decisions or outcomes of planning (Sanoff 1999; Towers 1995) (McClure, 1997). Public participation increases the acceptance of planning decisions and thus improves agreement and implementation on the field (Graham, Phillips, and Canada 1998a; Macnaghten and Jacobs 1997; Chess and Purcell 1999; Abelson et al. 2003; Schenk, Hunziker, and Kienast 2007).

With public participation, the population is actively involved in the development process; Sanoff (2000) noted that the main purposes of public participation are:

- To involve people in the design of the decision-making process and in this way increase their trust in organizations, making it more likely they will accept decisions and plans within the established systems;
- To provide people with a voice in design and decision-making in order to improve plans and decisions;
- To promote a sense of community by bringing together people who share common goals.

Appelstrand (2002) stated that (public) *participation is not just a means but also a model for involving those concerned*; it is a proactive approach to create better understanding of the objectives and problems and the possible alternatives to solve them.

There are several and diverse techniques for public participation, like public hearings, citizen surveys, focus groups, charrette, comments period, consensus conferences, citizen advisory boards, citizen's panels, neighborhood and community meetings (Fiorino 1990; Beierle 1999; Sanoff 1999; Rowe and Frewer 2004; Carr and Halvorsen, K 2001; Abelson et al. 2003).

Nevertheless, public participation is usually sought to satisfy legal requirements and is not intended to establish a connection with the community (Francis 1999; Innes and Booher 2004). Innes and Booher (2004) stated that public participation must be collaborative and it should incorporate not only citizens, but also organized interests, profit-making and non-profit organizations, planners and public administrators in a common framework where all interact and influence one another. (Public) *Participation should be seen as multi-way interaction in which citizens and other players work formal and informal ways to influence action in the public arena before it is virtually a foregone conclusion* (Innes and Booher 2004).

Beierle (1999) identifies the five social goals of any evaluation of public participation: (1) educating and informing the public; (2) incorporating public values into decisions; (3) improving the substantive quality of decisions; (4) building trust in institutions and (5) resolving conflict among competing interests.

And there are many studies with an effective evaluation of public participation or criteria for the process evaluation (Fiorino 1990; Laird 1993; Renn, Webler, and Wiedemann 1995; Chess and Purcell 1999; Carr and Halvorsen, K 2001; Bickerstaff and Walker 2001; Halvorsen 2001; Rowe and Frewer 2000; Beierle and Konisky 2000; Rowe and Frewer 2004; Tippett, Handley, and Ravetz 2007).

Public participation, which is a legal requirement in most countries, was perceived and implemented in different ways and with varying degrees of success. In Portugal, the democratic culture is somewhat recent, and the population doesn´t show much interest in public participation processes. But the increased requirements of both the European and National law of a greater involvement from the citizens in several public policy contexts are forcing a more active participation.

Participatory planning provides a broader basis and more comprehensive framework for analysis and evaluation (Richard Warren Smith 1973). Communities can identify the relevancy of problems, support goals, and contribute with alternatives. It's important to seek inputs from the population at all stages of the planning process.

The timing of consultation in the planning process will often determine the outcome. For instance, if people are consulted in preparation of a new project, their opinions are more likely to be incorporated than if they are asked to participate on an already identified and designed project. In Portugal most consultation processes use techniques like meetings to announce decisions rather than to seek opinions.

Webler, Tuler, and Krueger (2001) said the public should be involved in environmental decision-making. The public participation addresses the inclusion of local knowledge in the decision-making process (Renn et al. 1993; Webler, Kastenholz, and Renn 1995; Beierle 1999). Taking into account the interests and local particularities in the initial phase, makes it possible to feed the project designers with a variety of perspectives, and thereby increase the likelihood that local needs and priorities are successfully met. It is often discussed that participatory processes should lead to higher quality decisions, as they should be based on more complete information, and anticipate and mitigate unexpected negative outcomes before they occur (Graham, Phillips, and Canada 1998b; Beierle 2002; Reed 2008).

The multicultural diversity of the cities is expanding quickly. This diversity demands to understand what kind of services different communities' value and how people are most comfortable interacting with state institutions.

Taking the opportunity to embrace cultural and social diversity that characterizes the population of the cities today, the development of an operative planning process also implies the inclusion of ecology and public participation as active factors in the process of sustainable development (Slocombe 1993).

This attitude would strengthen the value of the planning process itself, promoting an easier acceptance and implementation on the cities' development procedures indeed *the best technical solution cannot be implemented if the process of decision making is perceived as unfair or biased. Social acceptance of any policy is closely linked with the perception of a fair procedure in making the decision (Renn et al, 1993)*. A required approach to an intercultural city should be able to provide a combination of different aspects, such as:

- Ethnical, cultural, and natural diversity, as potential values of urban life;
- Socio-cultural integration policies without local loss of identity;
- Pluralism in community participation.

Public participation, supporting the population's commitment and guidance to urban planning actions, is therefore of utmost importance in the development process and transformation of the cities for the future.

Multiculturalism is essential to the sustainable city (Landry & Wood, 2008), as well as creativity (Landry, 2008), both as vital features of urban societies. Culture, in its various demonstrations and styles, becomes a valuable resource to assure social cohesion and economic advantage. In the city often co-exist diverse music styles, sounds, shows and festivals, which, as social features, result from the mix of cultures with creativity, contributing to local identity.

Besides its clear environmental benefits, the protection of urban ecology and biodiversity also embodies a guarantee to preserve, in the city, its singular values, and the possibility to safeguard the existence of its distinguishable features that identify, value and characterize the spaces we dwell, both individually and collectively.

This approach to a *new city* requires a different operative planning process, ruled by different kinds of specific indicators to be incorporated in the planning process by the municipalities and local administration. In this methodological frame, it's absolutely essential that the *strategy* to apply in urban areas is accepted, and decided, by the population. Only after that, is it possible to define and set the efficient indicators to the execution of the planning process.

Although there is not a unique way to define possible strategies and indicators, in most cases these can be structured over eight principles (Jennings & Newman, 2008):

1. Vision
2. Biodiversity
3. Economy and partnerships
4. Society and culture
5. Sense of belonging and local identity
6. Empowerment
7. Sustainable production and consumption
8. Governance and participation

These eight principles allow a clear and objective strategy definition, from which it is possible to apply the sustainable planning process (Amado, 2005a) to the different actions of urban transformation, with permanent inputs of public participation.

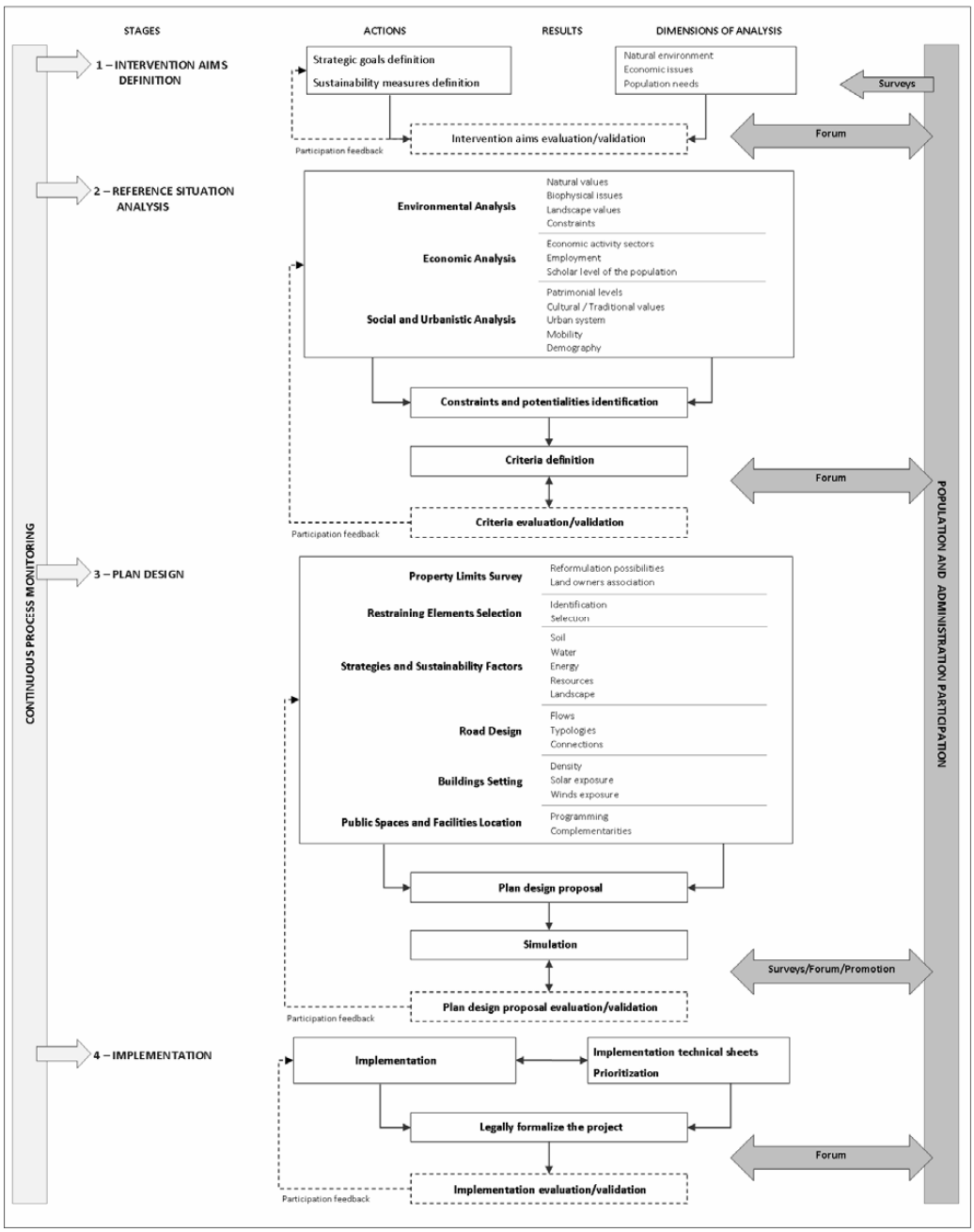


Figure 1. Structure of Urban Planning Process methodology (adapted Amado 2005).

## SUSTAINABLE URBAN PLANNING PROCESS

The methodology used in the sustainable urban planning action consists of a process of four sequential stages (Amado 2005), as seen in Fig. 1. These stages are developed sequentially, and each dependent of the one before, so that the next stage only begins after the evaluation/validation of the previous one. For this evaluation/validation it is crucial that the population is involved in the planning process, giving decision makers their knowledge of the area and their specific needs.

During all its stages – from *conception* to *implementation* – the process must have both the population and the administration's participation, through constant evaluation and validation, in order to ensure that the community can relate to the final urban proposal and a faster implementation of this proposal. It is important to mention that the population's involvement and participation, as well those of other interested parties, is a decisive factor for the success of the Sustainable Urban Planning Process.

Public participation accompanies the process in all its stages, either through providing information or through the creation of plan monitoring commissions. However, as seen in Fig. 1, there are some formal moments of public participation during the process development, for presenting participation inputs and outputs of each stage. These formal participation moments are intended to assess the population's main needs and expectations, to show the work done so far, and to gather information about its adaptability to the intervention priorities.

The phases' evaluation/validation, combining the actions developed with public participation, should allow for a better adequacy of each stage's final result to the needs and expectations of both the population and the administration, as it generates "feedback" that can lead to reformulations, preventing cases of inadequacy towards those expectations. This monitoring process, along all stages, helps the planners in assessing and validating the plan's development against the established goals.

The effective participation of both the population and the local administration during the entire process is a major factor for its efficiency, since increasing the partaking of the intervening actors prevents the occurrence of potential conflicts, guaranteeing a faster acceptance of the new ideas for urban structure. Another major factor for the efficiency of the Sustainable Urban Planning Process is the implementation stage, during which the project's execution is permanently evaluated and monitored, and implementation technical sheets are defined with the aim to provide efficiency profits to all levels of Sustainability.

## METHODOLOGY TO PUBLIC PARTICIPATION IN "ZAMBUJEIRO AND MURCHES" URBAN PLANNING PROCESS

Territorial management, in particular in protected landscape areas, should ensure the dialogue between the design team and local population, given the need to preserve the landscape values and natural resources of the Natural Park, and promoting conformity between stakeholders and socio-economic development. On such sites, the requirement for the natural environment to be managed as part of a universal public heritage, leads to an

increasing role of public participation within the frame of the planning process, as a framework to land use and natural environment transformations.

Zambujeiro and Murches constitute two formerly rural communities, located in the southwest of Europe at the municipality of Cascais. The Zambujeiro and Murches Plan covers an area of 83,4ha, 2,6% of the area of the Sintra-Cascais Natural Park (P.N.S.C.) inserted in Cascais municipality. Zambujeiro and Murches are two villages with 804 inhabitants, representing 13,3% of the population of the Sintra-Cascais Natural Park in Cascais.

The development of urban planning actions within Protected Landscape areas, as the Sintra-Cascais Natural Park, should perform a methodological process that is structured over distinct sequential stages. These stages enable the development of a continuous, interactive, integrated and participative planning process.

The defined planning process methodology allows the introduction of sustainability principles, while guaranteeing appropriate answers to the foremost challenges in Protected Landscape areas, where a co-decision procedure is essential to a successful territorial planning.

Community participation processes result in a shared responsibility on decision making (Sanoff 2000). From this point of view, it was thought that it would be advantageous to include the participation of the population right from the first stages of the planning process, thus ensuring greater dynamism throughout the design development, but also a larger and broader public awareness of the planning process.

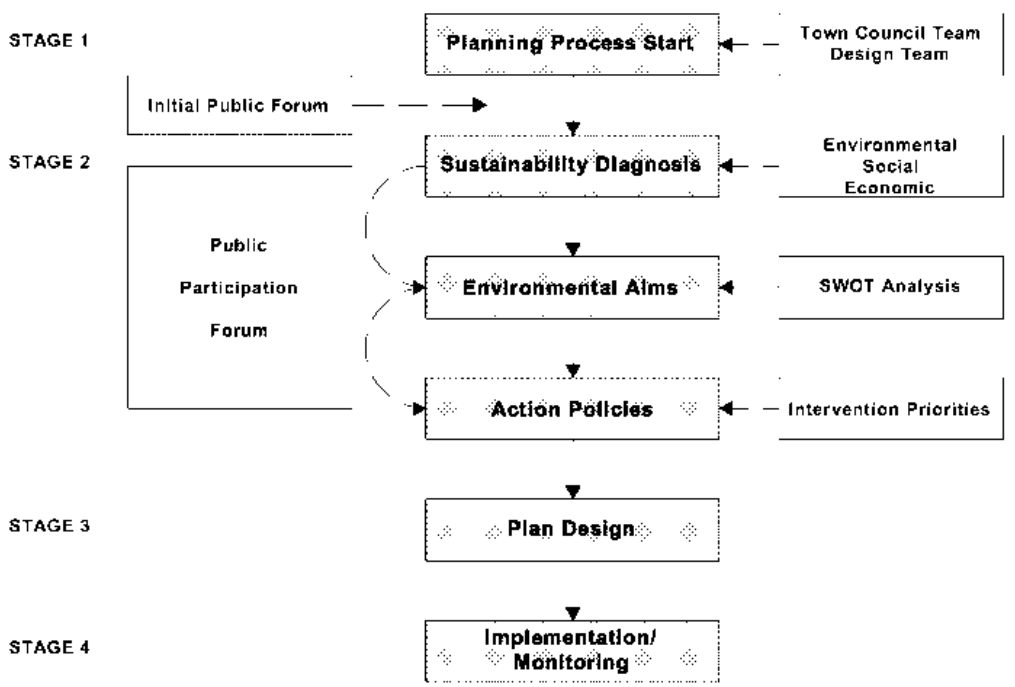


Figure 2. Public Participation Methodological Process (adaopted of Sanoff 2000).

From the start of *Zambujeiro and Murches Plan* process, several public participation actions and *charrettes* were promoted, involving the local community, municipalities (Câmara Municipal and Junta de Freguesia), NGOs and various public and private entities.

The actions mentioned in the present paper, were carried out at stage 1 - Intervention aims definition, and stage 2 – Reference situation analysis (Fig. 2). These actions enrolled a significant number of participants partaking in the decision-making process. The latest public participation action held within *Zambujeiro and Murches Plan* was the evaluation of its Terms of Reference.

ZAMBUJEIRO AND MURCHES PLAN REFERENCE TERMS

| | |
|---|---|
| Programming of structured urban settlement expansion and **restraining of dispersed construction** and diffuse urbanization. | 1 |
| Promotion of **building capacity in urban space, according to sustainability criteria**. | 2 |
| Promotion of **reconstruction and restoration of existing buildings**, rather than building new ones. | 3 |
| Development of **housing programs** targeted to specific needs and areas, including the **improvement of public space** (squares, sidewalks) **and road network**. | 4 |
| Improving the quality of life, **strengthening local rural characteristics**, and **refurbishing built heritage**, particularly in the historic center. | 5 |
| Development of an integrative transformation of the built environment, in order to promote **protection of the ecological structure**, ecosystems renewal and the expansion of naturalized spaces through their **connection to the Natural Park**. | 6 |
| An urban design inductor of a **greater use of public space**, taking advantage of local biophysical environment. | 7 |
| Definition, quantification and location of basic infrastructures required for future development, ensuring equity in **access to infrastructures and services** of general interest, in particular **sewer systems**. | 8 |
| Planning and **location of community public facilities**, particularly regarding health, education, sports, culture and leisure facilities. | 9 |
| Promotion of properly supported answers for mobility, accessibility and car parking, giving **solution to accessibility and public transport problems**, and the promotion of non-motorized transport. | 10 |
| **Inclusive design of public spaces**, contributing to the "National Cities and Towns Network Mobility for All". | 11 |

Figure 3. Reference Terms of Plan.

In the development of Zambujeiro and Murches urban planning, municipality determined that the territorial management within the Sintra-Cascais Natural Park should pursue the following guidelines:

Perception of the Natural Park as a whole, in respect of the principles of balanced and sustainable development;

A growth development model, with polycentric emphasis, providing the connection between urban system, road and transportation, water, telecommunications and energy networks, information, communication and knowledge, social structure, tourism activities, and nature conservation, particularly in classified areas with special protection levels.

Measures of positive discrimination in the context of rural and urban development policies, attention being given to areas with low development potential, or with serious structural problems, at economic and urban levels, as well as areas with environmental conservation high pressure;

Rational and consistent territorial supply of infrastructure networks and public facilities, supporting the structure of economic and social activities and needs.

Moreover, taking into account the legal framework of the ongoing urban planning process, the benchmarks for the Plan's proposal development and design were approved. These benchmarks already pointed out an integrative approach, with relief to public spaces arranged in a continuous urban structure, the proposal of required new facilities, as well as the construction of required wastewater, communications and road networks, coherent with land use options.

These benchmarks constitute the Terms of Reference of Zambujeiro and Murches Plan, approved by the town council as 11 strategic aims (Fig. 3). These strategic terms are expected to ensure the surveillance of all components of sustainable development, providing a balanced treatment between environmental, economic, social and urban planning actions.

## DISCUSSION ON PUBLIC FORUM RESULTS

A public forum on the Plan's Terms of Reference has taken place, in order to involve the local community in the decision of specific local key issues and define the appropriate priorities within the goals and strategies previously settled. This public forum was attended by professionals from the town council technical board, the design team, the official authorities, local stakeholders, along with local residents, providing a better understanding and clarification of local expectations and their future satisfaction through the planning development.

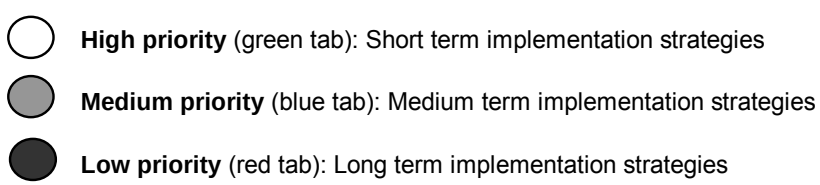


Figure 4. Reference Terms and priority evaluation tabs.

The aim of this event was to allow each participant to select sequential and hierarchical priority levels on the terms of reference strategic aims. The session included a slideshow presentation, with an explanation of the methodology procedure, also supported by posters. The procedure for the selection activity was to provide each participant with 3 colored tabs (1

green, 1 blue, and 1 red), corresponding to high, medium and low priority values (Fig. 4). Participants were free to independently select the strategic targets they found relevant to comment, and then fasten the appropriate colored tab next to that Term of Reference aims.

The results of the public forum (Fig. 5, Fig. 6, and Fig. 7), determined as high priority relevancy Terms of Reference aim 1 and, with less votes, aim 5; as medium priority relevancy aims 1 and 6; and as low priority relevancy aims 5, 8 and 9.

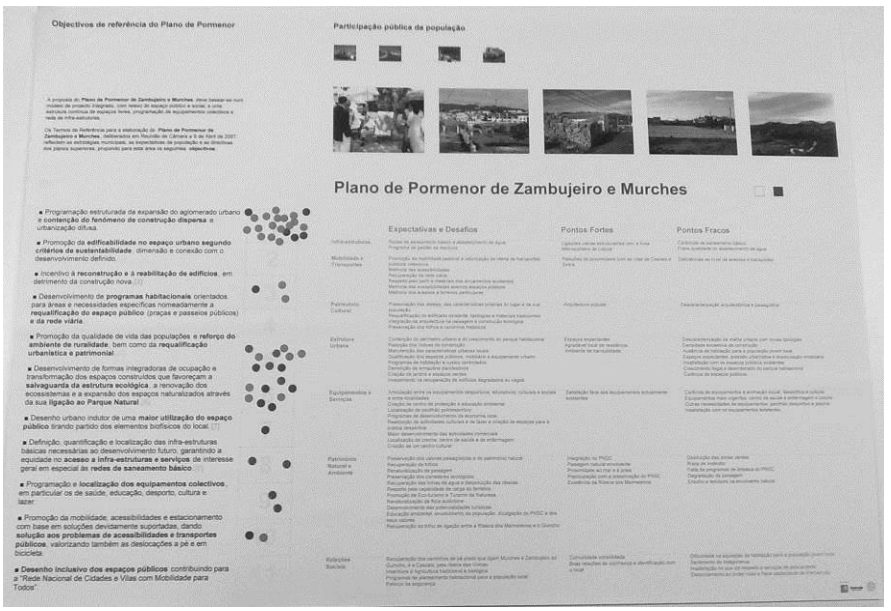


Figure 5. Terms of Reference poster priority evaluation results.

Primarily, the results reflect the importance given by the population to limit the dispersion of the construction and qualify the existing urban core.

On the other hand, the same aim was the most selected with medium priority relevancy, although in this category the results were not so clear with less total votes. The second most voted aim, with medium priority, was promotion of protection to ecological structure, ecosystems renewal and the expansion of naturalized spaces through the connection to the Natural Park.

Globally, there was a smaller number of answers in the category of low priority, in comparison to the total number of answers. This result is probably due to the fact that present participants were more concerned with immediate needs, not wanting to give importance to not so critical actions, as were the objectives of previous categories.

The process of involving the public makes the results more relevant to the population's needs. In fact, participation provides local knowledge and thus makes the planner decisions more appropriate to local specificities. Results were later inputted at Stage 2, on SWOT analysis, contributing to the reference situation's characterization, and discussed on plan design proposal, at Stage 3.

REFERENCE TERMS - PRIORITY RESULTS TOTAL ANSWERS AND PERCENTAGE

| Terms of Reference Aims | Zambujeiro and Murches | | |
|---|---|---|---|
| Priority values | □ | ▒ | ■ |
| 1 | 17 | 5 | 0 |
| 2 | 0 | 0 | 0 |
| 3 | 2 | 1 | 0 |
| 4 | 0 | 0 | 0 |
| 5 | 4 | 2 | 3 |
| 6 | 3 | 4 | 1 |
| 7 | 0 | 1 | 0 |
| 8 | 0 | 0 | 2 |
| 9 | 0 | 0 | 2 |
| 10 | 1 | 1 | 0 |
| 11 | 0 | 0 | 0 |
| Total answers | 27 | 11 | 8 |
| Priority values | □ | ▒ | ■ |
| 1 | 35 % | 10 % | - |
| 2 | - | - | - |
| 3 | 4 % | 2 % | - |
| 4 | - | - | - |
| 5 | 8 % | 4 % | 6 % |
| 6 | 6 % | 8 % | 2% |
| 7 | - | 2 % | - |
| 8 | - | - | 4 % |
| 9 | - | - | 4 % |
| 10 | 2 % | 2 % | - |
| 11 | - | - | - |

Figure 6. Terms of Reference answers and percentage results.

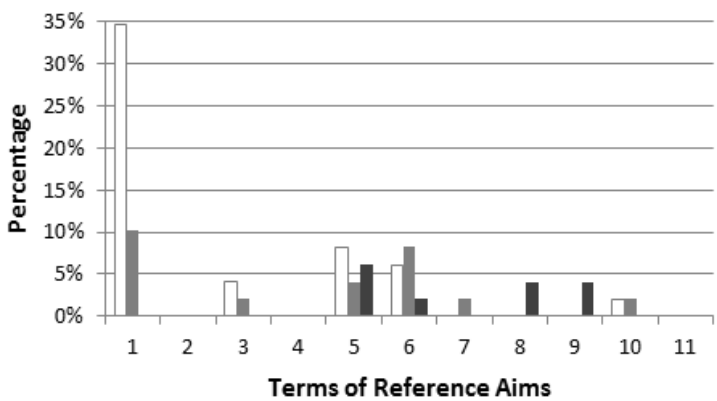


Figure 7. Graphic Distribution of priority level votes on strategic aims of the Reference Terms.

Thus, high priority action policies should focus on planning structured urban expansion with limitation of the dispersal construction. As such, the planning should apply design principles that respect the visual quality and rural history of the area; protect and restore the natural areas and ecological processes that are important to the people and to the connection to the Natural Park, and preserve a clean and natural flow in the area streams.

## CONCLUSION

Given the diversity and specificity of the natural and urban environment, planning solutions must always be adapted to each case. Therefore, a sustainable urban planning process has to show an open and flexible methodology, always guided by the principles and strategic goals leading to sustainable development.

Only through a new planning process approach is it possible to walk in the path of Sustainable Development. The presented sustainable urban planning process, given its open and flexible structure, permits interventions on different realities and site dimensions, allowing to analyze the characteristics of each case, its potential, weaknesses and opportunities, guiding the project's planning process.

The implemented public participation process allowed the intervention of the population, occurring from the first stage of urban planning, contributing to the definition and determination of its terms of reference.

Furthermore, community participation enabled that intervention area resources (human, natural, economic and cultural) are valued by the local agents and thus constitute the basis for the creation of proposed new sustainable activities, developing employment and wealth, preserving natural values and promoting an appropriation of public space with greater social sensitivity and responsibility.

## ACKNOWLEDGMENT

We want to express our acknowledgment to the Municipality of Cascais in Portugal and to GEOTPU FCT for the important collaboration to implement the developed operative planning process, and to all the population who participated in the different phases of the elaboration of the *Zambujeiro and Murches Plan*.

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*Chapter 10*

# URBAN SUSTAINABILITY ASSESSMENT SYSTEM – THE PORTUGUESE SCHEME, LIDERA APPROACH AND TWO URBAN APPLICATION EXAMPLES

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## ABSTRACT

Sustainable construction is still seen as a new concept for the construction industry offering multiple perspectives. Neighbourhood and urban sustainability assessment tools have become widespread in several countries.

LiderA is a Portuguese Sustainable Assessment System that has been applied in the Portuguese Market to buildings and urban areas since 2005. LiderA applications are not well known internationally, so the objective of this chapter is to explain the application of a sustainable assessment system, LiderA, in Portugal namely the urban assessment system version.

The LiderA system assumes the search for sustainability (environmental, social and economic) based on the following principles: (1) Enhancement of the local land dynamics and promotion of a proper integration; (2) Promotion of the efficient use of resources; (3) Reduction and management of the environmental impact loads; (4) Focus on the services provided by the built environment and its sustainability search; (5) Promotion of sustainable socioeconomic aspects and (6) ensuring the best use of sustainable built environments, through environmental management and innovation.

The six key LiderA principles are detailed into areas (22) and criteria (43), which comprise the assessment criteria that allow the support of the search for sustainable urban areas. An innovative logic of LiderA is the assessment scale that will go from practice (factor 1) to structural factorial improvement (factor 2, 4 and 10).

In this chapter, the LiderA approach will be presented, as well as examples of municipal application, the LiderA urban assessment version and its application in two

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distinct case studies. One case is the urban district development for 65,000 inhabitants in Lisbon, denominated "Alta de Lisboa". The other case is in an area outside of Lisbon with a low density of urbanization, in an area denominated "Belas Clube de Campo.

This chapter concludes with a discussion of the potential contribution of the LiderA system and similar approaches to create sustainable dynamics and value. A conclusion that can be taken from the applications is that LiderA could act as a base to support the search for sustainability, since it creates an integrated view of that search and allows the identification of different kinds of solutions to be applied in both the short and long term.

**Keywords**: Sustainable Assessment, Urban Planning, Urbanisation, Ratting Systems, LiderA

## 1. URBAN SUSTAINABILITY RATING SYSTEMS

Sustainable construction is still seen as a new concept for the construction industry offering multiple perspectives (CIB, 1999; CIB, UNEP-IETC, CSIR - Building and Construction Technology, & CIBD - Construction Industry Development Board of South Africa, 2002) according to different approaches. Practical ways to assess and recognise sustainable construction have increasingly become a reality in different countries, especially in those that have promoted sustainable construction through market systems (Kibert 2012) which began by targeting the building scale and progressively evolved to the urban scale.

An increased body of literature has sprung up to demonstrate the problems associated with urban sprawl and the benefits of energy-efficient buildings and more compact and connected forms of development and the search for sustainability (Krause & Bitter 2012).

The interest towards green and sustainable certification systems is increasing amongst the authorities, as it is expected to bring measureable publicity for the developers. The assessment of urban areas enables the comparison of municipalities and urban environments, while notably supporting decision-making processes. Authorities, city planners, and designers would benefit most from the use of these tools during the decision making process (Haapio 2012).

During the past decade, sustainability has emerged as a dominant topic of interest amongst urban scholars, although academics and urban planners have yet to make substantial inroads into the marketplace, which has almost fully accepted the superiority of these forms of development (Krause & Bitter 2012).

Neighbourhood and urban sustainability assessment tools have become widespread since the turn of the 21st century and many communities, mainly in the developed world, are utilising these tools to measure their success in approaching sustainable development goals (Sharifi & Murayama 2013).

Since the early 1990's, modern societies have witnessed the wide spread of environmental performance assessment systems across the globe, some were created to be applied to specific cases, like the PIMWAG that is used to support the development of Eco-Viikki, in Helsinki, Finland (Aaltonen et al. 1998).

The PIMWAG was developed to support a different type of scheme in which a set of given criteria defines specific goals that need to be achieved in the search for sustainability and was meant to be applied as a tool to select projects during urban development stages

(Pinheiro 2006) as defined in a specific protocol (Figure 1-1). A view of part of the campus organisation and the detached houses is shown in Figure 1-2 and 1-3.

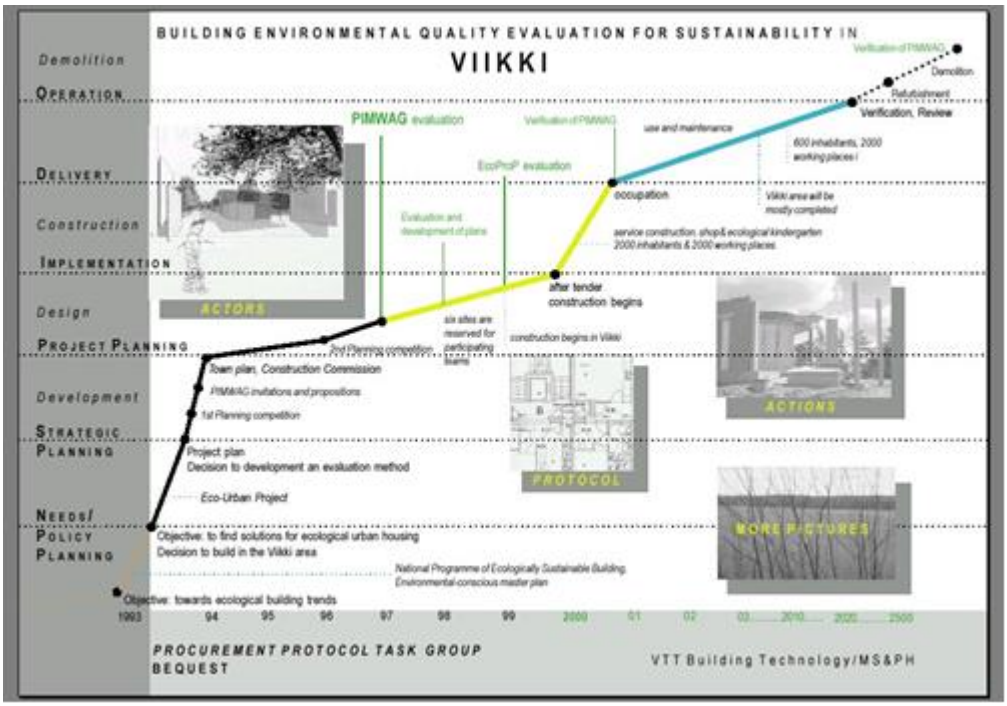


Figure 1.1. PIMWAG protocol (VTT n.d.).


Figure 1.2. Organisation of Vikki the university part.

Figure 1.3. Perspective of Vikki detached houses area.

The example of Vikkii and the application of PIMWAG show that green or sustainable assessment systems could be used as a base to promote sustainability together with urban planning. This synergetic relation and the involvement of stakeholder are potential key aspects to taken into consideration.

At another level are the systems that were developed to support national or international settings. In this context, following the creation of BREEAM in the United Kingdom, several other countries adopted new systems to assess the sustainability of built environments, such as LEED in the United States, HQE in France, LiderA in Portugal, VERDE in Spain, DGNB in Germany, CASBEE in Japan, QSAS in Qatar, IGBC in India, amongst many others, supporting the process of sustainable development.

As Cole and Valdebenito (2013) say "even though there is a widespread use of BREEAM and LEED, many countries around the world have domestic methods that will remain the sole or dominant system within their respective market's Market forces and 'branding' will, in the fullness of time, invariably play a role in dictating the extent to which voluntary systems become de facto international approaches and influence how domestic systems will evolve."

LiderA is a Portuguese System with an important application in the Portuguese Market and not well known. So the objective of this chapter is to explain the application of the sustainable assessment system LiderA, in Portugal, with special detail of the urban assessment system.

This chapter will present: the LiderA approach (section 2) from organisation (subsection 2.2) to municipal application (subsection 2.7); the LiderA urban assessment version (section 3) and its application in two distinct case-studies, one in a new urban district in Lisbon, denominated "Alta de Lisboa" (section 4) and another in the outskirts of Lisbon, in an area

denominated “Belas Clube de Campo” (section 5); a discussion of the potential contribution of the system (section 6) and the chapter conclusions (section 7).

# 2. LIDERA

## 2.1. Introduction

Since 2000, at the Department of Civil Engineering, Architecture and Georesources of Instituto Superior Técnico, with the support of IPA – Inovação e Projectos em Ambiente, Lda., the author has been developing studies for the technical support of sustainable construction. Amongst these studies, the development of a support and assessment system for sustainable construction at the national level, with particular emphasis on buildings and enterprises, known as LiderA - Portuguese acronym for Lead for the environment in search of sustainability in built environments, stands out (Pinheiro et al, 2002; Pinheiro and Correia, 2005).

LiderA is a Sustainable Evaluation System that can be used to search for sustainability in plans or projects and be applied to urban environments or buildings, allowing them to be certified or recognised by the system’s brand, according to different final purposes. LiderA is based on the concept of re-positioning the environment in urban environments, enterprises and buildings, according to a sustainable perspective, assuming itself as a leading system for an efficient search for sustainability.

## 2.2. LiderA Organisation

***From Green to Sustainable Built Environment***

The first LiderA version (Version 1.02), released in 2005 (Pinheiro 2005), was mainly intended to evaluate, certify or recognise projects within a building’s scale and respective surroundings. However, given the number of applications studied, a new version (V2.00) has been developed, extending the possibility of application from a building’s scale to built environments and urban districts, including the demand for sustainable outdoor spaces, blocks, neighbourhoods and/or communities (Pinheiro 2011).

The version published in 2010 (V2.00) is based not only on environmental areas, but also economic and social areas. The system is based on a set of six sustainable performance principles (local integration, resources, environmental loads, environmental comfort, socio-economic adaptability, and environmental management and innovation) that are then translated into a set of criteria, according to which the built environment (based on the buildings) is assessed in terms of its sustainable performance.

The demand for sustainability in the built environment is based on principles which cover the main aspects considered in six different categories and twenty-two areas, including:

- Enhancing local dynamics and promoting proper integration (Site and integration), with regard to Soil, Natural Ecosystems, and Landscape and Heritage;

- Promoting the efficient use of resources (Resources) including Energy, Water, Materials and Food Production;
- Reducing the impact of environmental loads, both in value and in toxicity (Environmental Loadings) involving Wastewater, Atmospheric Emissions, Waste, Noise Emissions and Thermal and Light Pollution;
- Ensuring environmental quality in urban zones, highlighting the contribution to functional structure, namely the way the objectives, the process and space are organised to assure the search for sustainability; for buildings, this is focused on environmental comfort (Environmental Comfort), including Air Quality, Thermal Comfort, and the Lighting and Acoustics;
- Promoting sustainable socio-economic (Socioeconomic aspects), which includes Access for All, Economic Diversity, Amenities and Social Interaction, Control and Participation, and Life Cycle Costs;
- Ensuring the best use and management of built environments through environmental management and innovation (Support sustainable use), which includes Environmental Management and Innovation.

***The New Urban Version***

In 2010-2013 a new version (V3.00) of the LiderA System was developed. This version maintains the principles of promoting good local integration, good use of resources, reducing environmental loads, but changes the logic of the environmental service in the urban zone, which is now centred on the urban development process, suggests some improvements in areas and criteria of socioeconomic dynamics (social vitality, culture, green and sustainable economy, value and costs) and sustainable use (including awareness and marketing). A summary of this urban version is presented in section 3.

## 2.3. The Factorial Scale

***Performance Scale***

The LiderA structure (V2.00 and V3.00) details six principles in 22 areas, and 43 criteria. Each criterion has a detailed specification, a way of defining the scale of assessment and its respective weights. Each criterion (of the total 43 criteria) has a scale which allows the evaluation of the level of demand for sustainability, and guidance towards more challenging objectives (Figure 2-1).

The criteria have different performance levels (from 0 to 10 or higher) and a numerical assessment which is then communicated as a class from G to A++. LiderA performance in each criterion has a scale that is defined from the common practice (Class E) to an incremental performance scale, which includes an improvement of 12,5% (Class D), an improvement of 25% (Level C), an improvement of 37,5% (Class B), an improvement of 50% (Class A), an improvement of 75% or factor 4 improvement (Class A+), and finally an improvement of 90% or factor 10 improvement (Class A++) (Figure 2-1).

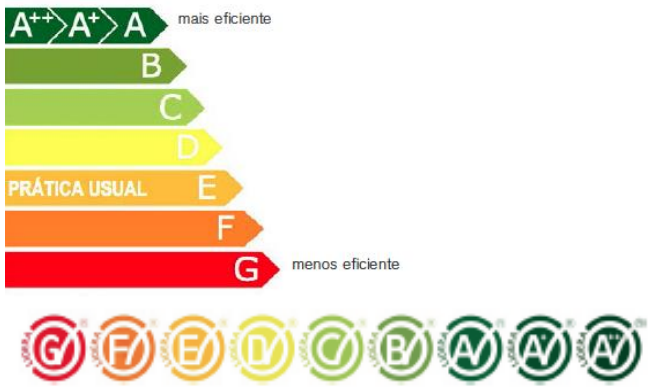


Figure 2.1. LiderA's certification levels.

| SITE AND INTEGRATION | | | | | |
|---|---|---|---|---|---|
| SOIL | | NATURAL ECOSYSTEMS | | LANDSCAPE AND HERITAGE | |
| Territorial Valorisation | Environmental Deployment Optimization | Ecological Valorisation | Habitats connection | Landscape Integration | Heritage Protection and Enhancement |
| C1 | C2 | C3 | C4 | C5 | C6 |

| CATEGORY |
|---|
| AREA |
| CRITERIA |
| Nº |

| RESOURCES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| ENERGY | | | WATER | | MATERIALS | | | FOOD PRODUCTION |
| Energy Certification | Passive Design Performance | Carbon Intensity (equipment efficiency) | Potable water consumption | Local water management | Durability | Local materials | Low impact materials | Local food production |
| C7 | C8 | C9 | C10 | C11 | C12 | C13 | C14 | C15 |

| ENVIRONMENTAL LOADINGS | | | | | | | |
|---|---|---|---|---|---|---|---|
| WASTEWATER | | ATMOSPHERIC EMISSIONS | WASTE | | | NOISE EMISSIONS | THERMAL AND LIGHT POLUTION |
| Wastewater treatment | Wastewater use | Atmospheric emissions control | Waste control | Waste management | Waste Valorisation | Noise emissions control | Thermal and light pollution |
| C16 | C17 | C18 | C19 | C20 | C21 | C22 | C23 |

| ENVIRONMENTAL COMFORT | | | |
|---|---|---|---|
| AIR QUALITY | THERMAL COMFORT | LIGHTING AND ACOUSTIC | |
| Air Quality Levels | Thermal Comfort | Lighting levels | Acoustic insulation/noise levels |
| C24 | C25 | C26 | C27 |

| SOCIO-ECONOMIC EXPERIENCE | | | | | | |
|---|---|---|---|---|---|---|
| ACCESS FOR ALL | | | ECONOMIC DIVERSITY | | | |
| Public transportation access | Low impact mobility | Accessibility to disabled people | Flexibility / Adaptability | Local Economic dynamics | Local Work | |
| C28 | C29 | C30 | C31 | C32 | C33 | |
| AMENITIES AND SOCIAL | | CONTROL AND PARTICIPATION | | | | LIFE CYCLE COSTS |
| Local Amenities | Community Interaction | Controllability | Participation and governance conditions | Natural risks - Safety | Human Threats - Security | Life cycle costs |
| C34 | C35 | C36 | C37 | C38 | C39 | C40 |

| SUSTAINABLE USE | | |
|---|---|---|
| SUSTAINABLE USE | | INNOVATION |
| Environmental Information | Environmental Management System | Innovation solutions |
| C41 | C42 | C43 |

Figure 2.2. LiderA (V 2.0) categories, areas and criteria at the Building level.

The criteria (figure 2-2) and the guidelines presented intend to help select not necessarily the best existing solution, but the solution that significantly improves the current performance of buildings and other urban environments, and also the economic perspective.

The criterion specification depends on the phase of development. The criteria are prescriptive in the initial phase, or performance based in later phases (detailed design, construction or operation) since the information available will be more quantitative.

In LiderA schemes, the criteria are focused not only on a specific scale of analysis but also include lower and upper scales. For example, if a building is being analysed, the scheme also considers a specific set of criteria that assesses other scales, including:

- Materials and small scale solutions are interlinked and assessed by:
  - Performance of the solution in terms of energy (C9 - Carbon intensity), water (C10 - potable water consumption) and other criteria;
  - Materials durability (C12) and low impact materials (C14), controllability (C36) and life cycle costs (C40);
- Neighbourhoods and larger urban scales are interlinked and assessed by:
  - Structural areas and criteria:
    - Site and integration, namely: territorial valorisation (C1), habitat connection (C4) and landscape integration (C5);
    - Resources, namely: passive design performance (C8, which includes the building and surrounding urban morphology), local materials (C13), local food production (C15) and waste;
    - Socioeconomic aspect, namely: public transportation access (C28), local economic dynamics (C31) and community interaction (C35).
  - Complementary – Passive design performance (C8) and local water management (C11).

Most of the criteria have a prerequisite that demands that all legal requirements are met and adopted as minimum base points in each area, including applicable building regulations. The improvement of these conditions is what is considered the search for sustainability.

***Threshold for Each Type of Use***

Built environments have various spatial scales and project types. Although it is important to reduce energy use in different land-uses, the level of energy consumption is not the same in a house, in a hotel or in a larger urban zone.

In this context, LiderA has developed different thresholds for each criterion, according to different types of built environments, different uses (e. g: buildings: residential, touristic, commercial, offices) different scales, and different land-uses. For each criterion, LiderA defines the performance levels (or thresholds) that should be considered, according to a scale from 0 to 10, which indicates the level of sustainability achieved by the solutions adopted. The parameters for each one follow either the improvement of the existing practices or the reference to the values of best practices, as it is usual in the similar international systems.

The thresholds defined by LiderA derive from three reference points:

- Technological performance, in which the existing constructive practice is considered the common level (Level E or Factor 1);

- Best performance, where it is considered that this results from the best viable constructive practice to date (Level C, B and even A (Factor 2));

- And the definition of higher levels of sustainability, which focus on searches for neutral or regenerative cases (level A++ (Factor 10).

The performance levels are numeric, as mentioned earlier (from 0 to 10). However, for communication and reporting purposes, they are transformed into alphabetical classes (G to A+++).

***Weighting***

Weighting means giving importance to some aspects, which is a subjective process (Casasnovas & Riera, 2012). In some specific cases, Chandratilake and Dias (2013) reveal that professionals can give similar importance to similar criterion.

Although LiderA is multi-criteria based, it also enables the aggregation of results using a weighting process. In the case of LiderA, the weighting process is done (Soares & Pinheiro 2005) through an inquiry process in which four sets of stakeholders are asked to rank the most important areas in a two by two comparison. A Categorical Based Evaluation Technique calculates the final weightings using an approach designated MACBETH that stands for Measuring Attractiveness by a Categorical Based Evaluation Technique (Bana e Costa & Vansnick 1994)[1].

The weights for each area were obtained (figure 2-3) through this method, through inquiry and consensus. The area considered as most important was the Energy (17%) area, followed by the Water (8%) and Soil (7%) areas.

When taking into account the weights of the different areas within the 6 comprehensive sections of the system (figure 2-4), Resources are positioned as the most relevant area, constituting 32% of the final evaluation, followed by socio-economic aspects (19%), Environmental Comfort (15%), Local Integration (14%), Environmental Loads (12%), and Environmental Management (8%).

Overall, within each area, the criteria have equal importance. Consequently, their grouping gives the classification of each area. The global aggregated value is obtained by weighting each level of performance of the 22 areas. The new version involves an actualisation and adjustment of the weights of the areas of the system.

[1] As assessments are entered into the software, it automatically verifies their consistency. A numerical scale is generated that is entirely consistent with all the decision makers' judgments. Through a similar process weights are generated for criteria (see http://www.m-macbeth.com/en/m-home.html).

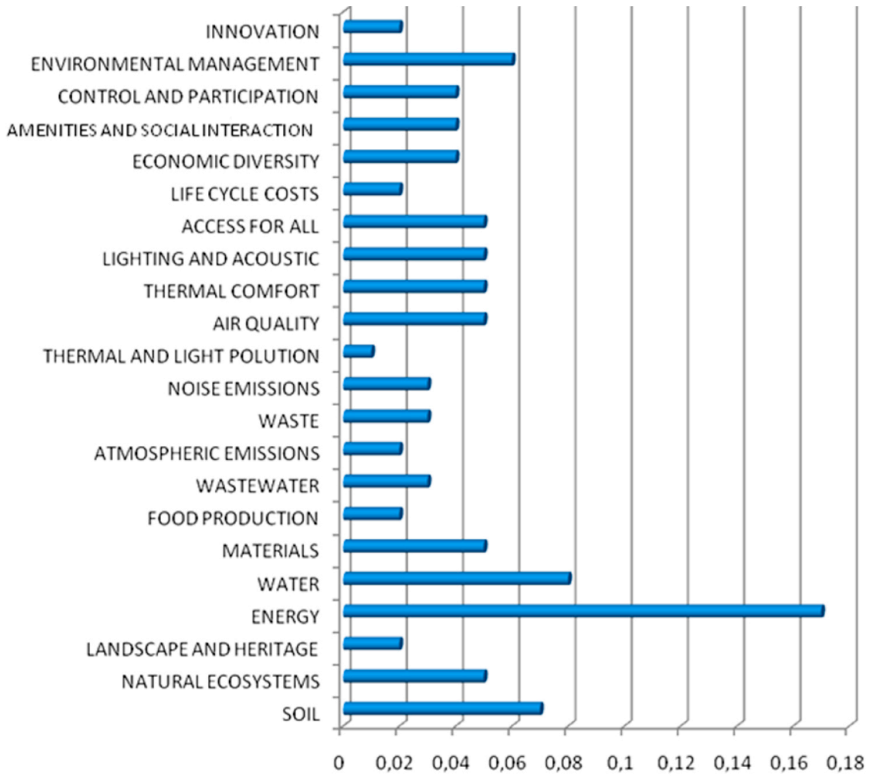


Figure 2.3. Weighting (wi) by Areas (%) - LiderA (V2.00).

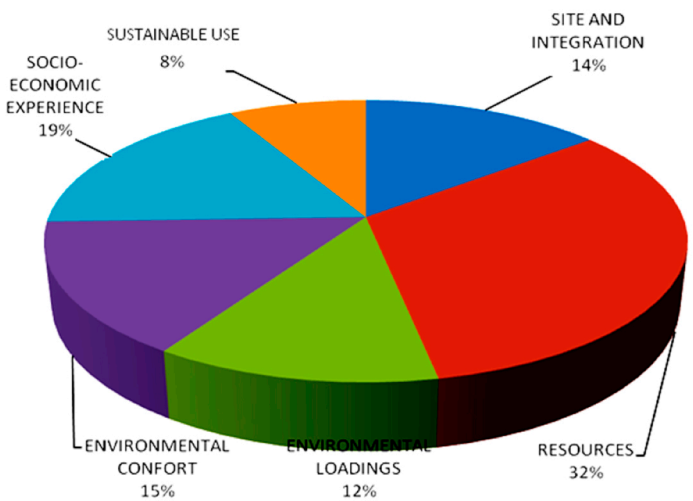


Figure 2.4. Weighting by Categories LiderA (V 2.00).

## 2.4. Typologies

LiderA has five specific schemes (figure 2-5) that can be used to assess buildings (residential, offices, commerce and tourism), urban zones, sustainable destinations, sustainable infrastructures and sustainable communities.


Figure 2.5. LiderA versions.

## 2.5. Application in Life Cycle

LiderA can be applied at various life cycle stages, and in fact, is particularly relevant in the design phase, as it can obtain a performance value that can be improved for the construction phase.


Figure 2.6. Schematic application at the building level, from preliminary phase to operation.

From the early stages (figure 2-6), each promoter must adopt an environmental or sustainable policy (or demonstrate its implementation), which should be suitable for its development and environmental characteristics when considering the sustainable principles, referred before.

***Initial Phase***

In the initial phase of each project, the Developer, being responsible for commissioning operations and awarding a contract to the winning plan or design bid, defines the characteristics, conditions and solutions that should be implemented. There must be an environmental policy that is able to provide that all the involved stakeholders conduct the undertaken work with good environmental practices. The developer needs to establish general rules for planning, organising and coordinating the project during all phases.

The Developer needs to be aware of the planning conditions necessary to execute the proposed work and thus anticipate all the risks inherent to each type of work. In subsequent interventions or necessary adjustments, he must ensure that the technical compilation is updated, and that the adopted solutions are flexible and modular, in order to provide the building with a new use in the future, if needed.

***Planning Phase***

In the planning phase, the approach principles must be defined according to an environmental or sustainability policy. Agenda 21 and the LiderA Sustainability Guidelines presented must be taken into account as orientation at this level. This approach consists of the following principles: to promote proper location and environmental integration, to attain efficiency in consumption and management, to reduce the impact of environmental stressors, to achieve adequate comfort, to pursue socio-economic adaptability, and to foment a consistent environmental management and a proactive search of innovation.

These principles, established at the policy level, should be applied at an early design stage and define performance as the commitment which needs to be met in order to achieve them. This commitment should be formalised as an on-going strategy towards the sustainability of the built environment, in which a set of sustainable principles must be assumed. This approach should define the principles that will regulate the planning and urban development throughout all stages of approval. The potential principles to be considered (with minor or major efforts) are the following:

- Principle 1 - To improve local dynamics and promote appropriate integration;
- Principle 2 - To promote the efficient use of resources;
- Principle 3 - To reduce the impact of environmental loads (both in value and in toxicity);
- Principle 4 - To ensure an urban development process (search for sustainability, planning and implementation process and structural adaptability);
- Principle 5 - To promote sustainable socioeconomic dynamics;
- Principle 6 - To ensure the sustainable use of the built environment, through environmental management and innovation.

In the different planning steps, LiderA can be used according to a triple dynamic: (1) assess the actual situation of the urban zone from a sustainable point of view; (2) identify

what proposals will improve the search for sustainability; and (3) assess and recognise the search for sustainability of the plans.

***Implementation Phase***

In the implementation phase, during the different project developments, the system could be used in the dynamic triple process – to determine what is the actual sustainable performance of the urban zone, to support the search for sustainability and detailed proposals, and to assess and certify if the level of performance is proven to be consistent with Level C or higher.

In the implementation of proposals, refurbishment and new construction of public and private ventures, for each type of intervention (building, infrastructure, or other) it is recommended to apply the LiderA scheme to buildings or infrastructures from the design phase, through construction and operation phases, and at the end-of-life phase. During implementation, the sustainable assessment and monitoring will allow to understand the evolution and the need for improvement. The application of the sustainable communities scheme could also be considered a very useful tool.

## 2.6. Interconnections and Links - Potential and Limitations

LiderA has a defined set of criteria that can be applied to all types of buildings. The performance scale and thresholds differ with each type of building. For example, it is important to reduce water consumption. However, the quantity that defines usual practice and best practices will be different in an office, residential or other type of building. This logic allows adjusting and tailoring criteria to the specific sustainable assessment of each type of building. Since the criteria are similar and the scale is relative (0 to 10), it allows the comparison of the performance of different types of buildings and in a specific zone (or in another locale).

This performance scale together with life cycle cost criterion could be used to assess what is the best scale to apply to a given solution (one building, several buildings or an urban zone). For example, in terms of energy level, a good balance between performance and payback costs could be solar heating collectors at the individual building level, and wind energy at the urban scale. Some solutions could be, at the urban scale, public transportation, or storage of rainwater in a small dam; both of which are not as performance cost effective at the individual level. Thus, this approach promotes an integrated framework interlinking different types of buildings and the urban scale.

On the other hand, interconnected schemes, such as the ones generally foreseen by LiderA, will allow system users to have a glimpse at narrower or wider horizons without having to recur to the scheme that assesses the scales that are immediately above or below. In other words, this strategy will allow users to understand a building's integration in local surroundings, without having to use the neighbourhood's development scheme, for example. Using interconnected schemes also means that system users are able to use criteria that are specifically adapted to the assessed scale, as narrower assessment horizons will imply more objective goals, and wider assessment horizons will imply more comprehensive goals.

Furthermore, the usage of interconnected schemes could mean that it will be easier to assess or establish successive goals that contribute to the common goal of meeting bottom-up

with top-down sustainable development policies. This will enable transforming the search for sustainability into a process that ensures the accomplishment of environmental performance goals whether the policies are implemented top-down or bottom up. One of the main benefits of such contribution would be underpinned by the fact that the implementation of sustainable development strategies could more easily be interconnected and become complementary so that bottom-up and top-down policies could actually be implemented at the same time, guaranteeing that they actually meet somewhere along the way.

The complementarity of schemes of the same system should not be underestimated. Complementary schemes of the same system allow its users to assess sustainability at different scales, considering also the environmental performance of different or mixed uses. It also means that, nowadays, it is possible to establish a complete set of environmental performance criteria to address the search for sustainability of a certain built environment. However, complementary schemes, such as the ones offered by BREEAM or LEED, also imply that it is not likely to understand the complete picture of sustainable development without using more than one scheme. Consequently, users will have to recur to the usage of the Building and Neighbourhood development schemes if they intend to foresee, for example, how the building is locally integrated.

On the other hand, using interconnected schemes for different scales would definitely imply a better adjustment of each scales' goals, thereby contributing to the better management of the sustainable development process. Many decisions that affect long-term economic, environmental, and social functions at larger scales are made at a lower level (the community). Conversely, broader-level sustainability depends on the combined effects of both comprehensive policies and a larger number of smaller-scale decisions or policies. These decisions are dependent since there are effects that spill over socio-economic and environmental boundaries. Although, most of the schemes that have been proposed have not yet been developed in order to promote full interconnection between scales.

This theory and the approach at stake will probably be easier to understand if they focus on three themes that are dear to most sustainable development frameworks, namely: energy, wastewater, and low impact mobility. For example, for a building, it can be argued that one way to promote low impact mobility would be to install parking spaces for bicycles inside residential buildings, or outdoor parking within the building's allotment. Furthermore, buildings could also have dedicated parking spaces for electric cars, and promote comfortable sidewalks within the allotment. Office buildings, on the other hand, could promote the same measures and include locker rooms and showers for the employees that adopt the bicycle as their mean of transport.

When considering a broader horizon, for example at the Neighbourhood scale, one could probably implement measures, such as: bicycle paths, comfortable and appealing sidewalks, quick access to public transport, comfortable waiting stops, and quick electric charge points (which are still expensive, and would probably imply a significant investment at the Building scale) that would complement the electric car parking spaces. If the city scale is considered, these measures could probably be complemented by an efficient system of public transport (such as electric bus or trams), comprehensive nodal transport facilities, low impact transports (carpooling lanes and car sharing frameworks and facilities). As a result, the combination of all these measures, at different scales, would promote walking, cycling, the use of public transport, the use of low impact mechanical means of transport, with all the respective

environmental, social and economic benefits that would be visible in a given built environment.

As far as wastewater treatment, one could probably promote local grey water treatment at the building scale. This would mean that building infrastructures would be prepared to treat grey water, and eventually reuse the treated water for secondary water consumptions such as toilet flushing. This would imply local grey water treatment and thereby reduce the pressure on the neighbourhood's wastewater infrastructure. If this is complemented at the Neighbourhood scale by black water treatment, city infrastructure could be downsized, as the pressure on municipal infrastructure would decrease.

Once again, interconnected schemes at different scales would bring a reduction of expenses and a better use of resources. Wastewater would not have to travel tens of kilometres in order to be treated, and wastewater facilities would probably be larger in number, but smaller in size, and would be adapted to local treatment needs. Consequently, environmental impacts and costs related to wastewater treatment would be reduced and local authorities would be one step closer to completing local water cycles.

When considering the energy aspects within an urban environment, one must also consider the physical implications of applying measures such as energy production from renewable sources. If the Portuguese reality is taken into consideration, it is easy to understand that steps have already been engaged in order to reduce energy consumption through energy production from renewable sources in new buildings. Nowadays, Portuguese energy legislation implies that every new building, regardless of its use, must guarantee that a percentage of the energy used to warm water comes from renewable sources, specifically solar collectors. This means that additional costs must be supported in order to meet legislation demands. As a result, few projects have the economic viability to support further measures of energy production.

If the prescriptive option of the legislation specified a performance level instead of solar collectors, for example the percentage of renewable energies, this would allow the selection of other alternative solutions like biomass or geothermal. These options would improve performance and cost effectiveness. For this reason, LiderA promotes a performance scale in the detail design, and subsequent phases

At the building scale, planners and builders that apply LiderA guarantee that more passive design measures are taken into consideration and that buildings comply with current energy Legislation. Buildings will play an important role in reducing energy demands. If on the other hand, at the Neighbourhood scale, other energy production strategies are applied such as photovoltaic systems, wind turbines or any other form of energy production from renewable sources, communities will have the ability to converge to near zero energy policies, that are being implemented in the European Union.

Furthermore, by creating an energy framework that complements itself at different scales, costs could be reduced as more expensive systems with larger pay-back times would be applied at larger scales, serving a wider population and therefore reducing the direct costs that a single inhabitant would have to support. Creating energy strategies that are not only complementary but also take into consideration pay-back times of the implemented systems to define which scale is more appropriate to each system can definitely improve local energy policies, contributing to a better management of energy related resources.

Interconnecting schemes of the same system, optimising the foreseen sustainable measures, and adjusting them to the respective scale of application will allow users to better

understand and explore the search for sustainability. This will also allow all involved stakeholders to consider which measures are more appropriate to a given scale, without compromising the narrower or wider horizons of other scales. As a result, development fees and costs, as well as other socio-economic interests, may be correctly weighted and adjusted to local needs.

Consequently, it is important to discuss the true potential in exploring interconnected schemes of different scales. Therefore, one should recommend that future studies in this area of approach to sustainable development should be conducted, in order to better understand the problem and likewise optimise and adjust system schemes to local needs and different scales of approach. These studies would help practitioners to fully understand the benefits of interconnecting sustainable development bottom-up and top-down policies. In order to proper envision the future of sustainable communities, practitioners will have to understand environmental, social and economic consequences of measures applied through a set of interconnected criteria that can be applied throughout the set of scales that constitute present and future urban environments.

Assessing the link between global structures and individual buildings is not the only fundamental interlink. Other links are the relationship between structures, and their use in common situations, the global performance dependent upon its way of use. Also, the deviation of usual performance under natural risk and other questions must be researched at different scales. Other areas of research are the process of weighting, ratings and certifications, and how spatial upper and lower scales could be integrated, namely with an increased use of the LCA approach.

## 2.7. Municipalities

The LiderA system has been used since 2005 in different types of projects and by different agents, and has been used to assess projects from the initial design phase to the construction and operation phases. The system is recognised and referenced by many different entities or agents, namely from design and planning professionals to Portuguese municipalities.

***Santarem Municipality - Agreement to Sustainable Construction***

The municipality of Santarém is located on the right bank of the Tagus river in the eastern limit, south of the Estremadura Limestone Massif of Porto de Mós. This municipality, with 560.2 km2, has a population of around 63 500 inhabitants, subdivided into 28 parishes.

On the 12th of June 2008, the Municipality of Santarem signed a protocol with the Environmental Certification System for Sustainable Construction - LiderA at Instituto Superior Técnico (IST). Due to this protocol, the Municipality of Santarém committed itself to conduct environmental practices applied to the construction of buildings, in an integrated, interactive and sustainable way.

The protocol involved LiderA as a tool and a base to develop exemplary municipal projects with higher environmental and sustainable performance. Most of the employees of the municipality departments, such as the urban, construction or environment have taken a LiderA course and are LiderA assessors. This allows internal promotion of the LiderA approach.

One of the objectives of the protocol between the municipality of Santarém and LiderA consists in the certification of private buildings and equipment, as a way to implement and monitor local sustainable development, and to promote sustainable construction. The Santarem urban legislation defines that a private project with LiderA environmental certification will benefit from a reduction of 25% on the rates of urban operations in this municipality.

***Application to New Santarem Schools***

Within this dynamic search for sustainability, the municipality gave the example by agreeing to the inclusion of the LiderA approach by the selected designers in the design and construction of two new schools. The projects for the two School Centres have had safety, landscaping, adaptability and maintenance issues in mind, amongst others, which have been formalised in their architecture and construction techniques. The project calls for an integrated and improved building environmental performance. The choice of native species, the energy and environmental comfort levels, and the range of materials used are some of the good practices implemented, which were clear in the strategic plan draft. The School Centres of Alcanede and Jardim de Baixo were certified respectively by version 1.02 and version 2.00 of the LiderA system. Both schools were certified as an A Class and have achieved an environmental performance level 50% higher than the current standard practice, suggesting positive solutions from an environmental, economic and social point of view.

***School Centre of Alcanede***

Although the initial project did not foresee local energy production through renewable sources (photovoltaic panels), it forecasted the use of solar energy for domestic hot water (DHW) heating as well as for central heating (energy from renewable sources– C14). In total, 30 panels were installed on the roof (with an inclination of 40°). Given the 2800 hours of annual sunlight available, the expected annual energy production is of 45 074 kWh, corresponding to a savings of more than 4 000 $m^3$ of natural gas.

Natural lighting (C41) is an important criterion in buildings such as schools (figure 2-7). In this context, natural light is provided mainly in all interior spaces with more emphasis in classrooms which are oriented to the South, maximising their exposure. All rooms or compartments have suitable colours, shapes and dimensions. The control of intensity levels is assured with adjustable external blinds. In other areas, the blinds are located inside the rooms

Figure 2.7. Alcanede School- a) Building Stage - diversity of glazing according to solar orientation b.) 3D Model.

The building ensures good accessibility to disabled people (C46). The pathways have been carefully designed, allowing permanent access to ramps or lifts (DL 163/2006). Access to bathroom facilities was also achieved through the installation of adequate spaces for disabled people on each floor (figure 2-8). Moreover, the parking lot is well located, with parking spaces dedicated to disabled people, allowing an easy access to the building.

Figure 2.8. Access ramp.

The awareness of sustainable principles to be taken into consideration by future occupants will be assured by the publication of a manual. This manual will include information for the potential optimisation of the facilities of the School Centre, regarding a practical daily use. As a result, this document will disclose environmental information (C48) about the building itself and its proper use.

***School Centre of Jardim de Baixo***

The School Centre of Jardim de Baixo is located in an infrastructured area, within the urban perimeter of Santarém, in a medium density area. The project offers various types of vegetation (figure 2-9) that allow several connections (habitat connection - C4) with other green areas outside the school perimeter such as street forestation, meadows, lawns and gardens.

Figure 2.9. Jardim de Baixo School - Possible interconnections between habitats.

Furthermore, domestic water consumption (C10) is expected to be about 30 litres/user/day. Several measures to reduce the potable water consumption were adopted, namely the use of flow regulators, timing mechanisms in lavatory taps, and double flushing toilets. The project also foresees the reuse of rainwater for garden irrigation and supply of flushing systems.

In socio-economic terms, the uses of the building allow the creation of local work (C33). This strategy includes local job offers at different levels of qualification, namely for teachers with different qualifications or degrees, teaching assistants, cafeteria and cleaning staff, among others.

***Creating Dynamic***

Due to this factor, the Municipality has already built and certified two public schools and a social centre that were clearly recognised by LiderA as having a good performance (Class A).

Nowadays, there are also some private promoters in the Municipality that have shown interest in application and certification of LiderA. This could open new perspectives when promoting sustainable design and construction in Santarem. The application of this logic allows the implementation of the system in several public projects and potentiates the creation of a development dynamic in favour of sustainable construction

# 3. URBAN LIDERA ASSESSMENT VERSION

## 3.1. Principles and Criteria

The LiderA Urban Scheme is based (as the general purpose version of the scheme) on six key principles/aspects that are divided into areas, which comprise the assessment criteria that allow the support of the search for sustainable buildings.

The key principles suggested for this search for sustainability are:

1. Enhancement of the local land dynamics and promotion of a proper integration;
2. Promotion of the efficient use of resources;
3. Reduction of the impacts of environmental loads (both in amount and toxicity);
4. Focus on the services provided by the built environment and its sustainability search;
5. Promotion of sustainable socioeconomic aspects;
6. And ensuring the best use of sustainable built environments through environmental management and innovation.

In the LiderA Urban Scheme (as in the other schemes) the six main principles are subdivided into 22 areas and 43 criteria that are used in the process of search for sustainability and assessment (Table 3-1 and Table 3-2).

**Table 3.1. LiderA Urban Scheme (v2.1) 1/2**

| CATEGORY | | AREA | Objective | Nº | Criteria |
|---|---|---|---|---|---|
| SITE INTEGRATION | 1 | SOIL | To assure the use of soil adjust that preserves sensible areas and soil and promote compact development | 1 | Territorial Contextual Valorisation |
| | | | | 2 | Land Use |
| | 2 | NATURAL ECOSYSTEMS | Preserve and develop natural ecosystems | 3 | Ecological Valorisation |
| | | | | 4 | Habitats network and services |
| | 3 | LANDSCAPE AND HERITAGE | Preserve and develop local landscape and heritage | 5 | Landscape |
| | | | | 6 | Built Heritage Valorisation |
| RESOURCES | 4 | ENERGY | Reduce the need for energy and promote low carbon energy systems | 7 | Energy Passive Management |
| | | | | 8 | Energy Systems |
| | | | | 9 | Carbon Management |
| | 5 | WATER | Reduce the need for water and close the water cycle | 10 | Water supply systems |
| | | | | 11 | Local water management |
| | 6 | MATERIALS | Reduce the need for materials and close the material cycle | 12 | Built structure durability |
| | | | | 13 | Material Responsible Sources |
| | 7 | FOOD PRODUCTION | Promote progressive production - if appropriate the production and consumption of local food. | 14 | Food production and access |
| ENVIRONMENTAL LOADS MANAGEMENT | 8 | WASTEWATER | Reduce wastewater and reuse | 15 | Wastewater management |
| | 9 | LOCAL AIR EMISSIONS MANAGEMENT | Manage local air emissions | 16 | Atmospheric emissions management |
| | | | | 17 | Noise Management and other nuisances |
| | 10 | WASTE | Reduce waste and potential the use as secondary resources | 18 | Waste Management |

**Table 3.2. LiderA Urban Scheme (v2.1) 2/2**

| CATEGORY | | AREA | Objective | Nº | Criteria |
|---|---|---|---|---|---|
| URBAN EVOLUTION PROCESS | 11 | VISION AND SEARCH FOR SUSTAINABILITY | Create a vision and a search for sustainability | 19 | Sustainability vision and objectives |
| | 12 | PLANNING PROCESS QUALITY AND DESIGN | Promote a planning and design process that assures quality and involvement of the different stakeholders | 20 | Quality of the planning and development process |
| | 13 | STRUCTURAL ADAPTABILITY | Promote structural adaptability of urban space. | 21 | Adaptability of built structure |
| SOCIO ECONOMIC DYNAMICS | 14 | ACCESSIBILITY | Promote accessibility special low impact | 22 | Transport systems and low impact modes |
| | 15 | SPACE FOR ALL | Assure safe space for all | 23 | Safe and appealing streets, public spaces |
| | | | | 24 | Space layout for all |
| | 16 | SOCIAL VITALITY | Promote social vitality through good conditions in housing, health, education, sports, leisure and social responsibility | 25 | Housing |
| | | | | 26 | Health structure |
| | | | | 27 | Education |
| | | | | 28 | Sport and leisure |
| | | | | 29 | Social responsibility (and Social vitality) |
| | 17 | AMENITIES AND CULTURE | Assure good amenities (natural and man made) including cultural | 30 | Friendly Amenities |
| | | | | 31 | Cultural heritage, identity |
| | 18 | SUSTAINABLE (GREEN) ECONOMY | Foment sustainable economy | 32 | Local eco dynamic and economic attractiveness |
| | | | | 33 | Local Employment |
| | | | | 34 | Digital Network (IT economy) |
| | | | | 35 | Sustainable or Green buildings and infrastructure |
| | 19 | VALUE AND COSTS DYNAMIC | Promote economic value and low costs | 36 | Value and Fiscal policy |
| | | | | 37 | Contribution to the low-costs in the lifecycle |
| | 20 | RISK CONTROL AND MITIGATION | Control and mitigation of natural and man made risks | 38 | Natural risks |
| | | | | 39 | Crime Prevention |
| SUSTAINABLE USE | 21 | SUSTAINABLE MANAGEMENT | Assure sustainable use and management | 40 | Awareness |
| | | | | 41 | Maintenance and Environmental Management |
| | | | | 42 | Monitoring and governance to community |
| | 22 | MARKETING AND INNOVATION | Promote sustainable innovation and marketing of sustainable urban development | 43 | Marketing and Innovation |

### 3.2. Examples

As an example of urban applications of LiderA, two case studies in Portugal (figure 3-1) will be presented in the next sections: one in a new urban district in Lisbon, denominated "Alta de Lisboa" (section 4) and another in the outskirts of Lisbon, in an area denominated "Belas Clube de Campo" (section 5).


Figure 3.1. Location of the two case studies.

## 4. "ALTA DE LISBOA" - SEARCH FOR SUSTAINABILITY IN AN URBAN ZONE OF LISBON

The municipality of Lisbon wanted to develop the northern zone of Lisbon (near the airport) through "Alta de Lisboa". In order to assure the development and management of the new areas the Municipality opened a competition to define and establish a partnership with a private contractor that would have the responsibility to invest and develop this new area. Lisbon Municipality would still be responsible for approving all the important decisions and further plans from such contractor. The project of "Alta de Lisboa" was officially born in 1984, when SGAL ("Sociedade Gestora da Alta de Lisboa"[2]) company signed the contract with the Municipality of Lisbon, following an international public competition.

### 4.1. Original Planning and Environmental Aspects

"Alta de Lisboa" is the name of the development located in the north of Lisbon, whose specific urbanisation plan was approved in 1997 and published in 1998[3], adjusting the Lisbon

2 http://www.altadelisboa.com/

3 Plano de Urbanização do Alto do Lumiar, Diário da República, 1ª Série B, Nº 248 de 24/10/1998

Municipality Development Plan. The Urban Plan of "Alto do Lumiar" (PUAL) was approved by the Municipality of Lisbon on the 18th of July 1996, on the 16th of June 1997, and was ratified on the 24th of September 1998 (Council Resolution Ministers n. º 126/98 published in 27/10/98).

"Alta de Lisboa" is an urban area, near the Lisbon airport, which was marked by marginal uses that influenced its dynamic. In order to overcome these problems and expand Lisbon to its periphery a new urban regeneration project was elaborated, comprising 300 ha of pre-used and degraded land. The project of "Alta de Lisboa" is a large-scale project, with an expected final population of 65,000 inhabitants.

The urbanisation plan specifies the strategy and urban specifications to be applied to the existing areas and to the new areas to be developed (figure 4-1). The urbanisation plan defines 13 urban zones, some of which must have a specific development plan (specific rules allow different types of occupation, construction volumes and areas, heights, main and secondary roads, minimum green areas, etc.).

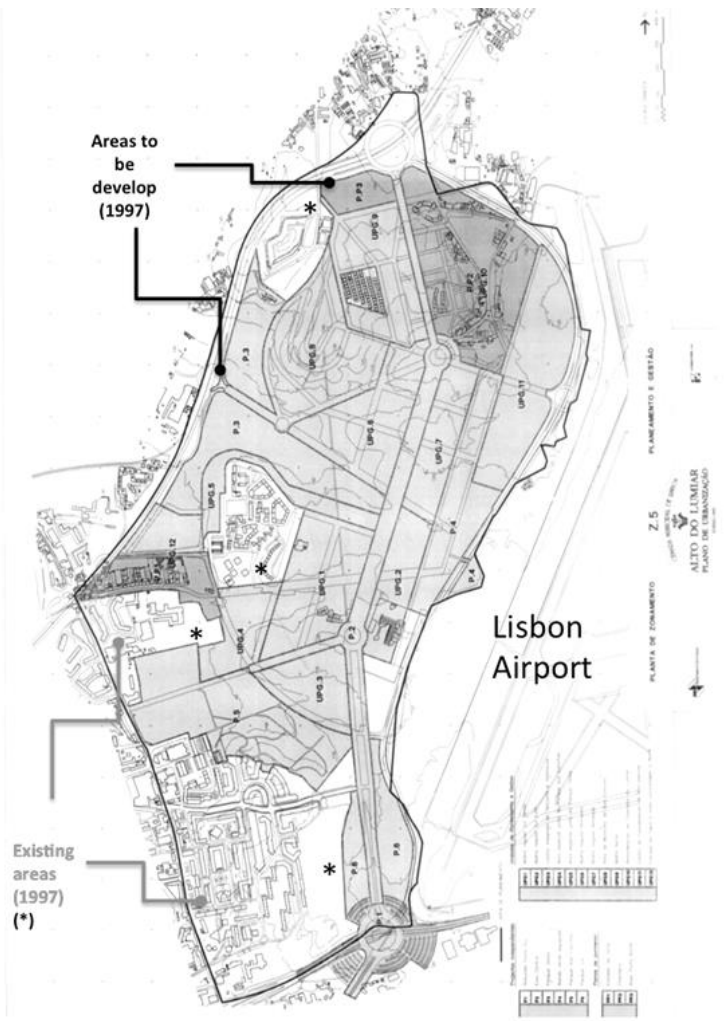


Figure 4.1. Urbanisation Plan Spatial Zoning (PCM 1998).

"Alta de Lisboa" represents a total investment of about 1.1 billion euros and comprises 300 ha of land, 2,500,000 m2 of construction, 20,750 fractions, 60,000 residents, 500,000 m2 of tertiary ventures (including shopping centres, offices, hotels and other commerce), 4 subway stations, 3 large parks, 70 ha of green areas, 20 sport grounds, 21 schools, day-care centres, leisure facilities, day centres, homes for the elderly, cultural centres, youth centres, police stations, fire stations, among other facilities (SGAL 2008).

The original plan did not focus on the search for sustainability; it already had some sustainability principles that were a base for that search. These included mixed-use ventures, a compact development, an important creation and concentration of green areas (Figure 4-2), open blocks with public accesses and a defined transportation strategy.

Figure 4.2. Potential perspective of the new urbanisations (SGAL 2010).

Since the publication of the plan, transport systems have been improved in "Alta de Lisboa", mainly including the construction of new roads and bus stops, and the expansion of an existing subway line and the construction of a new subway station. The existing area has been consolidated with the construction of new buildings in the available plots and interventions in public spaces. The new area (figure 4-3) has been developed according to an idea of congregating open blocks with public space.

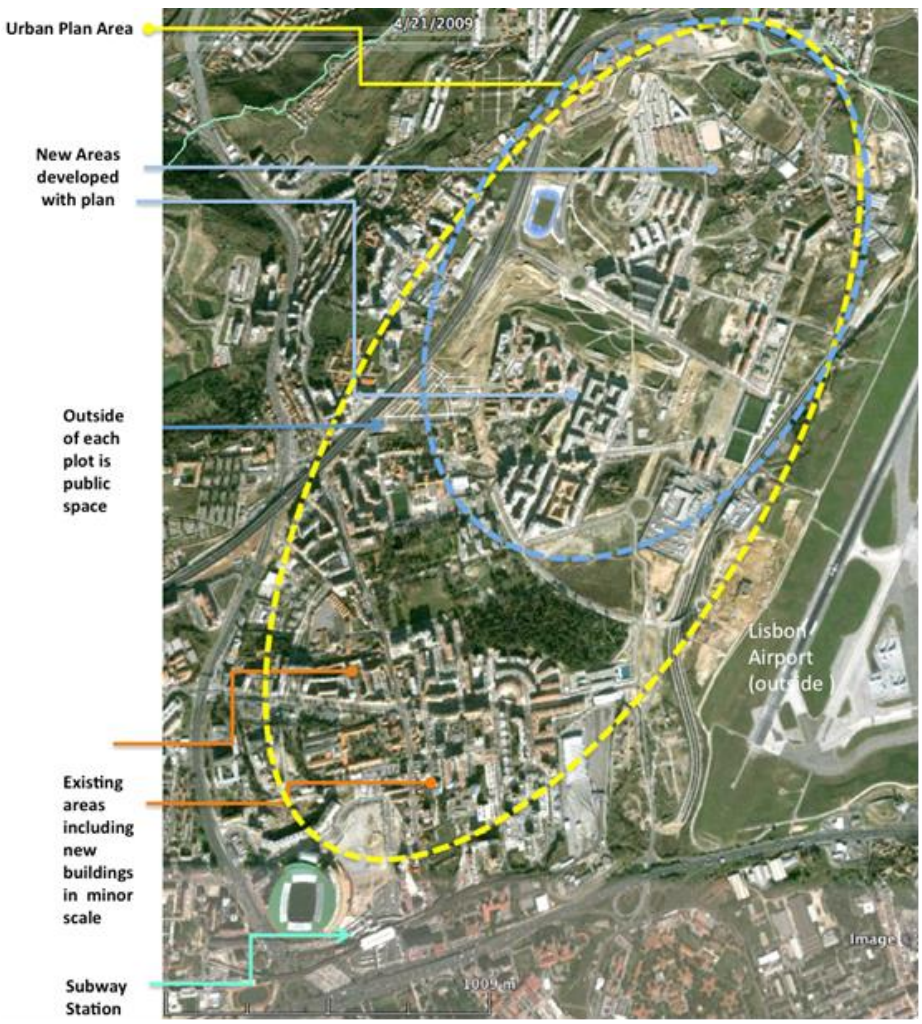


Figure 4.3. Alta aerial photo of the zone with main areas (Source: Google earth).

## 4.2. Integration and Sustainability Assessment

In 2009, a contract to assess the sustainable performance of "Alta de Lisboa" by LiderA and propose a strategy for the progressive integration of sustainability, in a medium term horizon of 2020-2030, was signed. This examination involved assessing the actual performance of the area by LiderA and proposing improvement lines for the future. In this context, the analysis of typologies identified different types of urban zones:

- An existing zone in which the buildings and flats are private properties (some with more than 20 years). In this zone, SGAL has a very limited capacity to implement proposals. In some cases, the buildings result from a previous plan of social integration.
- New developments resulting from the plan and where new buildings, flats or plots had involved SGAL management and the potential to communicate proposals is higher;
- Future developments where proposals could implement from their inception a broad range of social, economic and environmental enhancements;
- Public spaces where the proposals must gather a larger consensus and the key entity is Lisbon Municipality.

For each of these typologies, the actual performance level was assessed, analysing which type of strategies could be implemented, what solutions could be adopted, potential environmental, economic and social implications, and the global sustainability level. This analysis became the base to discuss a future strategy with SGAL and other stakeholders in favour of a search for sustainability.

## 4.3. Actual Sustainability Performance Level and Improvements

The assessment of the current performance of "Alta de Lisboa" by LiderA involves the site characterisation, the analysis of the built zone – infrastructure, buildings (characteristics, existing solutions, type of uses) and public spaces (figure 4-4)– and the green areas included in the project – type of soil, water lines and ecosystems.

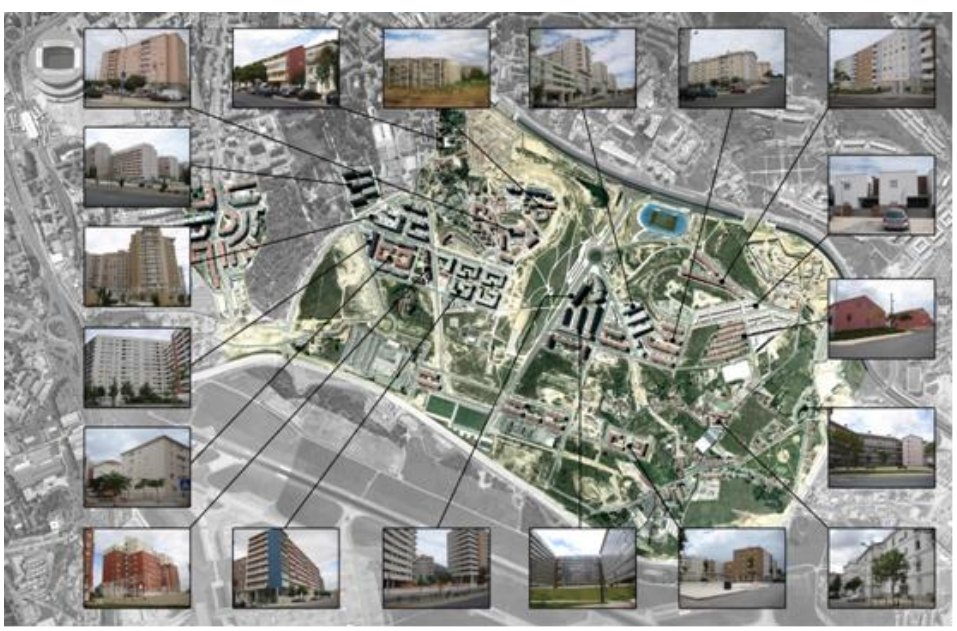

Figure 4.4. Examples of buildings in the area (Calixto & Pinheiro 2008).

For each criterion, the performance in LiderA factorial scale was analysed taking into consideration what was built in 2010 and the original proposed plan (1997). The global assessment shows that good practices have already been adopted in soil and valorisation, landscape and heritage, structural adaptability, and social vitality (since there are several social interventions). In factorial terms this results in a small improvement of the usual reference practice, a factor 1.28 improvement, this means an increase of 28 % (class C) when compared to common practices.

***Site and Integration***

Even though the original urban plan defined a full set of urbanisation rules, there was some degree of freedom with the construction being done in several periods and achieving some range of variation. For example the plan defines that each plot and urban block must be open to promote public access, yet the practical application reveals plots where the buildings are near the road and the centre is completely open, as well as cases (Jardim de S. Lourenço) where the centre is occupied by the buildings and private courtyards.

The plan promotes a compact urbanisation with concentrated green areas in larger parks. The green areas and small parks in the blocks are designed according to the strategy adopted by each designer and specific promoter. This leads to the creation, in the newer part of the urbanisation, of reduced green areas, which in turn could lead to fewer opportunities for community contact.

The assessment has proven that the urban plan and its development have demonstrated a good performance (Figure 4-5 and 4-6) since they promote local valorisation (C1), compact urban areas (medium density), minimize suburban sprawl, promote building in degraded and abandoned areas, as well as in areas in need of a rehabilitation/regeneration, and promote the construction of basic infrastructures and the adoption of a mixed-use strategy (factor 2).


Figure 4.5. *Masterplan* of "Alta de Lisboa" (P.U.AL.) – Green Spaces (SGAL 2010).

The land uses (C2) take into consideration territorial planning conditions as well as sensitive areas (according to territorial planning and management instruments) - using partial impermeable zones or already constructed areas for the yard's placement, minimising the impact of construction operations on the ground. Promoting the adoption of various uses in the area at the same time (factor 2).

Ecological areas were also defined to valorise the plan for green spaces (C3), taking into consideration habitat interconnection (C4), creating not only important green areas (%) but also prolonging existing areas and interlinking distinct areas.

In landscape (C5) there is an effort to adapt the interventions to the local natural conditions (topography, fauna, flora, green structures), and to promote the valorisation, maintenance, recovery or rehabilitation of the built heritage (C6).

When considering the actual plan, the opportunities for improvement are limited in land use and territorial valorisation (due to the rules defined) but can be significant in ecological valorisation and habitats network, both on a global scale (figure 6.5) and on a more reduced scale (block scale).

It is possible to select and plant more local species, especially in the inner block areas, increase the proximity to green areas and create interlinking ecological corridors using the larger green areas available, together with micro scale green areas, achieving a factor 4 improvement in these two criteria.

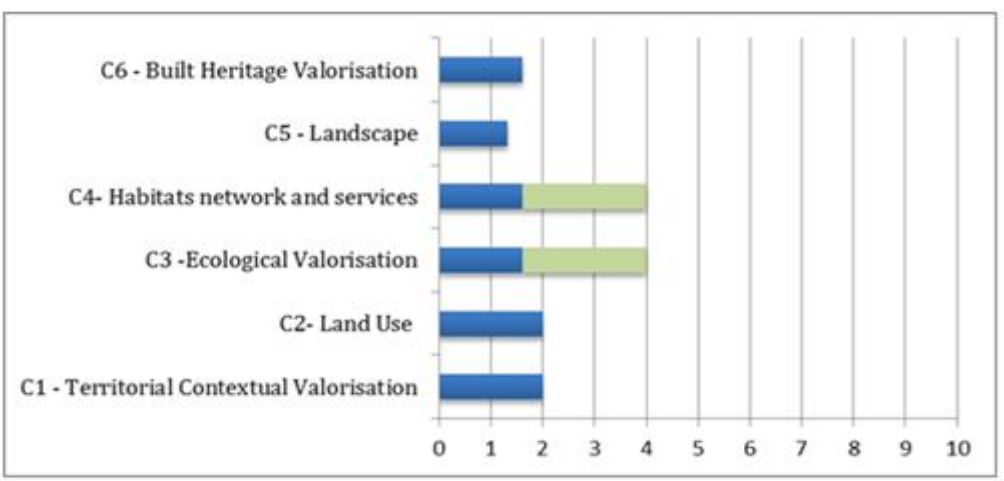


Figure 4.6. Assessment of existing solutions on site and integration and potential improvement (C4 and C5).

A potential review of the plan could allow the increase of performance in other criteria namely (C2) land use (more mixed uses), C1, C5 and C6, which for the moment are not yet considered in the improvement proposals since the future development of the plan is not yet known.

***Resources***

In the use of resources like energy, water, materials and food production the urban plan (dating back to the 1990s) does not give clear orientations and does not establish an explicit strategy for the use of resources in urban areas and buildings. The new areas will have larger

roads. This larger distance between buildings will allow access to the sun to buildings and public spaces and potentially reduce energy needs.

In the resources area, energy (C7 to C9), water (C9 and C10), materials (C12 and C13) and food production and access (C14) all have a small improvement when compared to common practices (15% in most, level D) as shown in the next figure (4-7). The proposals (that are explained later) try to improve local water management to factor 2, and energy and carbon management to factor 4.

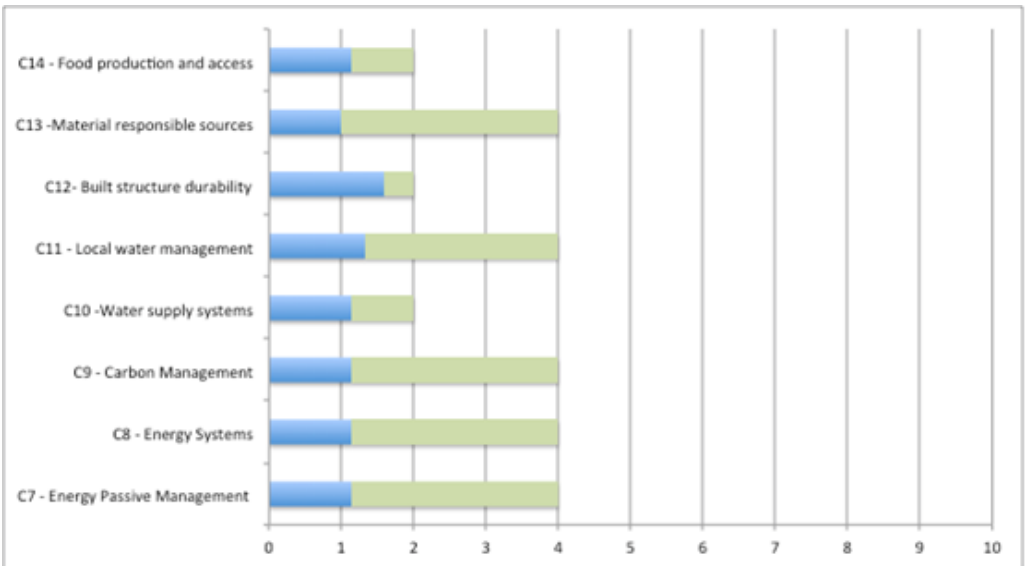


Figure 4.7. Assessment of existing solutions in resources and potential improvement (C7 and C14).

Since 1990 (and the urban plan publication), several environmental legal requirements for the area were published so the performance of urban zones and existing buildings results from these legislation drivers. An example is the energy certification system applying the EPBD - European energy performance building directive (2002/91/EC), which requires since 2006 (Decreto-Lei nº 78/2006), in Portugal, designers to follow actualised thermal regulation that increases the insulation level and applies other active energy measures in buildings.

In a few cases, the good will of promoters, their need to create a better position in the market, or the environmental knowledge of the designer teams lead to the implementation of better environmental or sustainable solutions.

In energy, even a simple analysis (C7) of the building's orientation (figure 4-8) shows that most designers, even considering that the plan does not define good practices, try to promote the best orientation (south) for the residential buildings.

However, in some cases (figure 4-9, 4-10) the design does not take into consideration passive design principles (or a bioclimatic approach) which leads to critical situations (e.g., Jardim de S. Lourenço, where a large glass façade with lack of appropriate shadow devices creates huge comfort problems; public spaces have shadows in the winter and are exposed to dominant winds (from the north).

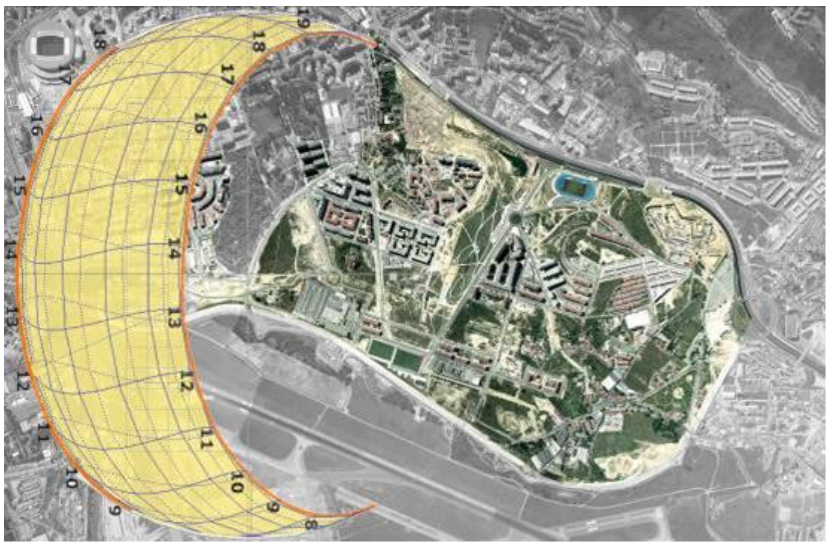

Figure 4.8. Alta Lisboa Solar circle (Calixto and Pinheiro, 2008).


Figure 4.9. Schematic design with orientation of buildings (Calixto and Pinheiro, 2008).

Because the plan rules have not defined several environmental aspects, it could be argued that if an environmental problem happens, it is not the blame of the promoter. This could be fallacious because the claims of the buyers or users pressed the promoter to find and to pay for a solution. Such is the case of the shading solution in Jardins de S. Lourenço. In conclusion, if the plan or development omit or forget important environmental aspects, in the end (in most cases) it could bring image damage and financial cost to promoter. The adoption of an integrated and preventive (and proactive) approach such as LiderA could highlight the supply of solutions that reduce the risks of image damage and supplementary financial costs.

Figure 4.10. Schematic design with orientation of buildings (Laranjeira et al. 2010).

For example, an academic work (Laranjeira et al. 2010) in Masters of Architecture that the author supervised, proposed a shading system that combined a range of traditional sunblinds with living façades, composed of vegetation curtains of seasonal plants (see figures 4-11 to 4-13).

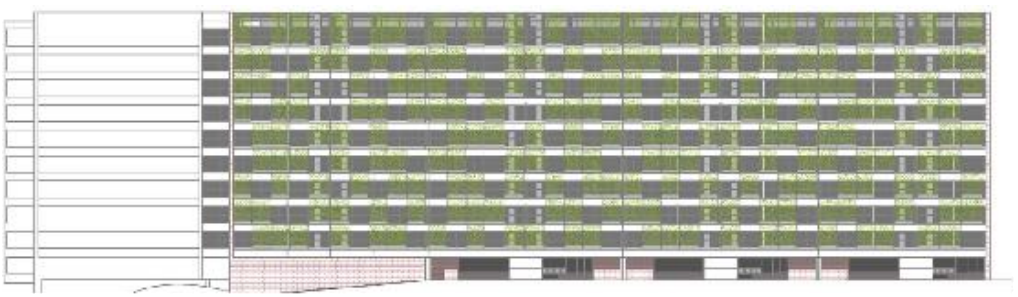

Figure 4.11. Proposed solution for a Living façade (Laranjeira et al. 2010).

Figure 4.12. Perspective of the Proposed solution for a Living façade (Laranjeira et al. 2010).

Figure 4.13. Potential of the interior of one apartment (Laranjeira et al. 2010).

The condominium has built (with support of SGAL) a local photovoltaic central that sells energy to the network and reduces the cost of the energy in the buildings. It has been allowed and when it is installed, it will be the largest residential central in Portugal.

The strategy for new projects and refurbishments is to promote passive design, increase window wall and roof insulations, and promote natural ventilation and more efficient energy systems in both buildings and public spaces.

In the water use and management, the plan assures the existence of water supply and sewer systems (as in other urban zones of Lisbon). The development incorporates, in its largest green area, a large water lake and reservoir that is used for irrigation.

Figure 4.14. Potential perspective view from one flat.

Future opportunities for improvement in the water area include: installing efficient water systems in each house (taps, washing machines and others) - in this context, SGAL (in 2010) made an agreement with suppliers to reduce the price of such systems; implementing local water management to promote local infiltration and perhaps local storage in zones managed as basins.

In the use of materials, in durability, there is a case where the average calculated could give a wrong idea, because of the huge differences in existing buildings. Globally, structural materials and solutions have durability (100 years or near), the major difference will be for example in envelope and interior finishes.

This could be a problem for social buildings, but it is not only of these. There is a large range of materials durability even in other buildings. For example some paint and exterior materials have to be fixed or replaced just after 3 or 5 years. The improvement of applied materials and solutions must be a point to readdress in the future refurbishment projects and new construction.

The use of responsible material sources is reduced (mainly because a rating is not available and the designers have little information). However, given the larger design knowledge and material offer (from local, regional and national sources) the adoption of low impact materials can be implemented.

***Environmental Loads***

The assessment of environmental loads in the area revealed good practices (figure 4-14) resulting from the waste management (which is a responsibility of Lisbon municipality). The air and noise emissions are important locally, due to heavy traffic and the airport nearby, even though take-off and landing of the planes will mainly have a large impact in the south area.

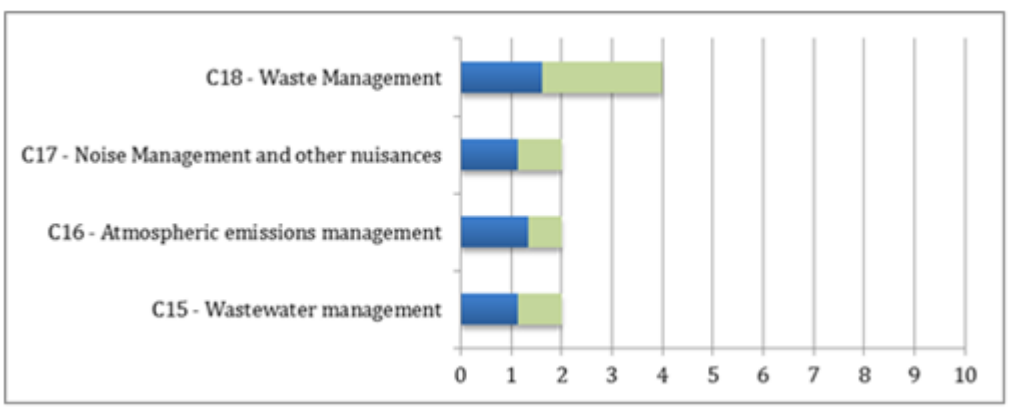


Figure 4.15. Assessment of existing solutions and potential improvement in environmental loads (C15 and C18).

The control of traffic noise can be improved, since there is now a defined hierarchy of the roads that will promote avoiding more sensible areas (residential). The actual strategy of deploying the buildings parallel to the airport, enclosing sensible activities far away from the exposed façades and areas has largely contributed to the control of noise levels.

Meanwhile, because of the national noise regulation, the airport authorities have implemented a new set of measures including limiting night operations.

The waste management follows municipal strategy. There is already a full set of "eco-points" to collect waste for recycling (glass, paper, packaging) and there is another specific system under implementation to collect the organic waste.

***Urban Evolution Process***

The assessment of the urban evolution process has emphasised the search for good practices and achieves a value of 1.4 (figure 4-16). The original plan contains (C19) specific environmental orientations (green areas, organisation of the blocks) that have been applied, but the focus of the analysis and vision of the search for sustainability does not include a structural objective.

Both the promoters and Lisbon municipality are interested in projecting a vision of searching for a high level of sustainability, from green areas to energy, water, materials and socioeconomic performance.

The urban plans have progressively evolved to guarantee mechanisms that assure quality and involvement of the different stakeholders (C20) in the planning and design process. This has involved the general public, and in the case of private lots their promoter, even though it is not clear if the process has been interactive and taken into consideration all the different perspectives.

The actual logic is to have a strong involvement of all stakeholders, as well as public participation that will assure a good involvement and the quality of the planning process.

Since the beginning the urban plan have considered some options of urban space adaptability (C21). In the future developments the structural adaptability must be improved to answer market changes and the growing consensus between the SGAL others promoters and the Lisbon municipality.

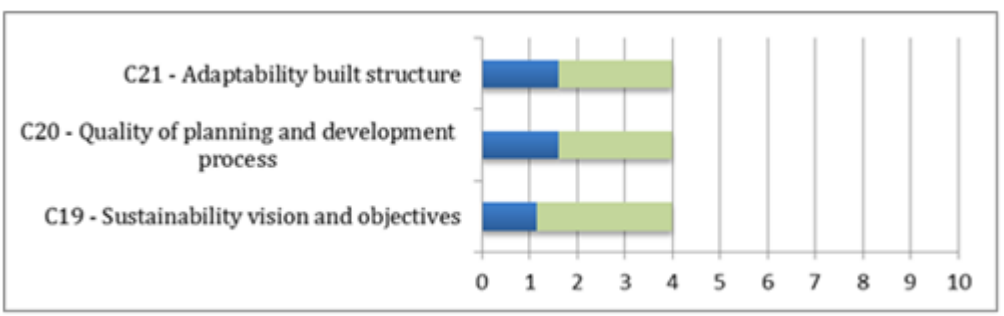


Figure 4.16. Assessment of existing solutions and potential improvement in urban evolution process (C19 and C21).

***Socio-Economic Dynamics***

The assessment of the socioeconomic dynamics of "Alta de Lisboa" revealed that numerous criteria achieved good economic performance levels, with values near 1.4 (figure 4-17).

In this urban zone there is a good mix of different uses, a mix of properties for low income and high income residents, zones defined as social projects that assure good social responsibility (C29), a good offer of public and private education structures (C27), and sport

and leisure facilities (C28). The upgrade of community and public spaces could generate the improvement of social vitality.

Plan and application practices have assured in specific zones the maintenance of cultural heritage (C31); a good housing offer (C25); friendly amenities (C30); safe streets and good public spaces (C23); and local employment (C33).

There is still strong potential for improvement. The transport system could be improved, namely the links with the subway system (C22), design should guarantee more appealing streets and public spaces, especially inside the blocks (C23), and a systematic approach to low-costs in the life-cycle should be pursued (C37). There are also strong opportunities to promote more friendly amenities at the neighbourhood scale (C30), to promote local identity (C31) and to promote local eco attractiveness (C32).

Other improvements could include increasing the offer of green buildings (C35), promoting a digital economy (C34), conceiving a fiscal policy (C36) to support sustainable measures (as has already happened in other municipalities like Santarem, as explained earlier) and assuring an increased organisation of public spaces within a logic of access to all (C24).

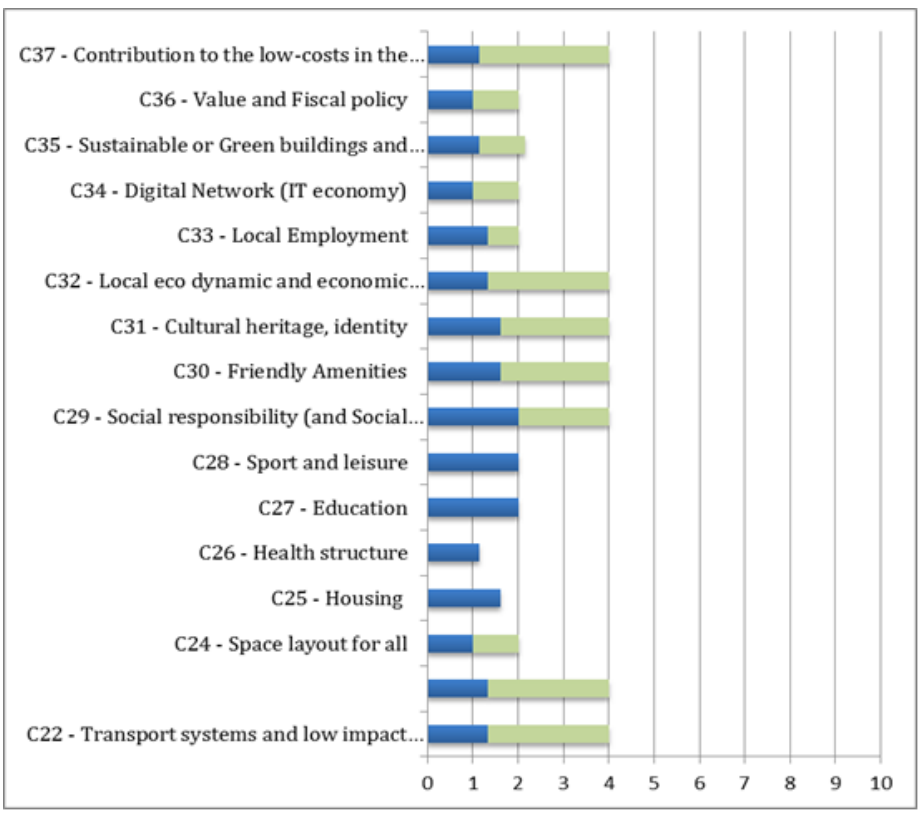


Figure 4.17. Assessment of existing solutions and potential improvement in socioeconomic dynamics (C22 to C37).

***Sustainable Use***

The sustainable uses considered in the plan mainly focus on risk control (seismic, floods) and on marketing and awareness (there is a specific website for "Alta de Lisboa"), which sum up to a performance around 1.3 (figure 4-18).

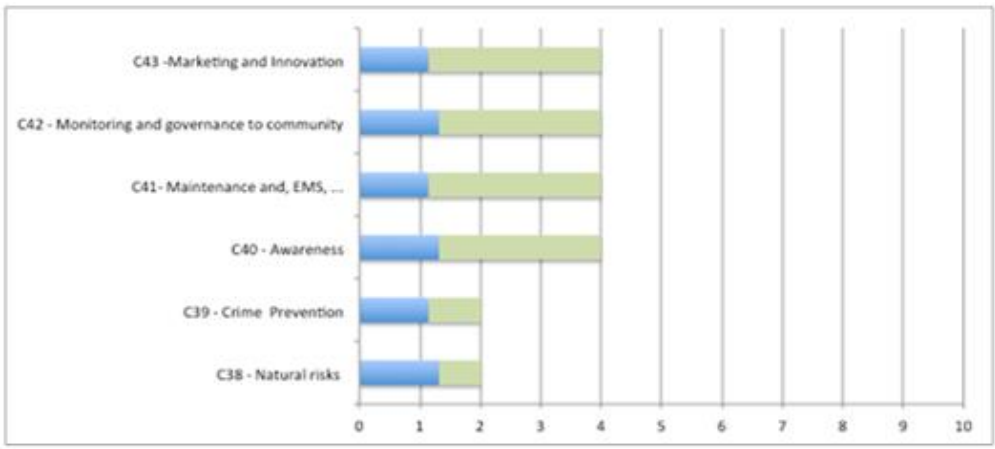


Figure 4.18. Assessment of existing solutions and potential improvement in sustainable use (C38 to C43).

A strong improvement can still be promoted without the necessity to recur to a new plan, especially in Sustainable Awareness (C40), including: the introduction of a new support and environmental management system in public spaces (C41); data collection, monitoring and sharing; the promotion of community participation and governance in future decisions (C42); the promotion of innovation and marketing (C43). Furthermore, efforts made for natural risk management (C38) and crime prevention (C39) must be maintained.

## 4.4. Sustainable Assessment Contribution

The assessment performed allowed the definition of the actual performance level, which achieved a value of 1.13 (C class). It also identified a full set of opportunities that would allow Alta of Lisbon to achieve a factor 4 improvement. Thus, the sustainability improvement plan proposed (Pinheiro, 2010) has four main guidelines:

- Support information and orientation to implement sustainable measures in existing buildings, which is mainly directed to small private proprieties;
- Assess and implement sustainability measures in new buildings, proposing minimum levels of environmental performance that should be considered in future design projects and licences. This should be pursued by both promoters and designers;
- Public space and infrastructure sustainability, which should be discussed and agreed with the municipality of Lisbon;
- Sustainability plan for the promoter, which should be applied by SGAL, including sustainable management measures and the applications of sustainable solutions to SGAL headquarters and all the buildings that are under its responsibility.

This approach should allow the establishment of a framework that supports the search for sustainability in blocks and buildings, as the examples mentioned in the text, but also lead to several other analyses and proposals.

The actual performance assessment demonstrates that "Alta de Lisboa" already has a full set of good performance case-studies already built like the main avenue designed by Manuel Salgado Architects, the larger parks, or block 17 designed by Manuel Carrilho da Graça, which pursue a high level of energy performance, along with other sustainability measures.

# 5. BELAS CLUBE DE CAMPO - SEARCH FOR SUSTAINABILITY NEIGHBOURHOOD OUTSIDE THE CITY

## 5.1. Belas Main Characteristics

"Belas Clube de Campo" is an urban development located in Belas village, in the municipality of Sintra that covers a total area of 1.380.000m$^2$. It is essentially a residential neighbourhood, representing a new development started in the 1990's. The development has undergone Environmental Impact Assessment (EIA) studies for each of its development phases, in which the environmental impacts (as legal requirements) have been addressed (e.g., the third phase EIA study was done in 1998).

The urban plan for "Belas Clube de Campo" comprises three phases (figure 5-1). The first two phases have already been built (these include a built gross area involving 286 942 m²), although they have not yet been completely finished (figure 5-2). These have comprehended a zonal plan, global infra-structures and various multi-storey apartment buildings and single-family houses, which were complemented by several community facilities that contribute to improving the services offered to local residents. These include, for example, a Club-House, an 18-hole golf course and a Health Club, amongst others.


Figure 5.1. Belas Phase 1, 2 and 3.

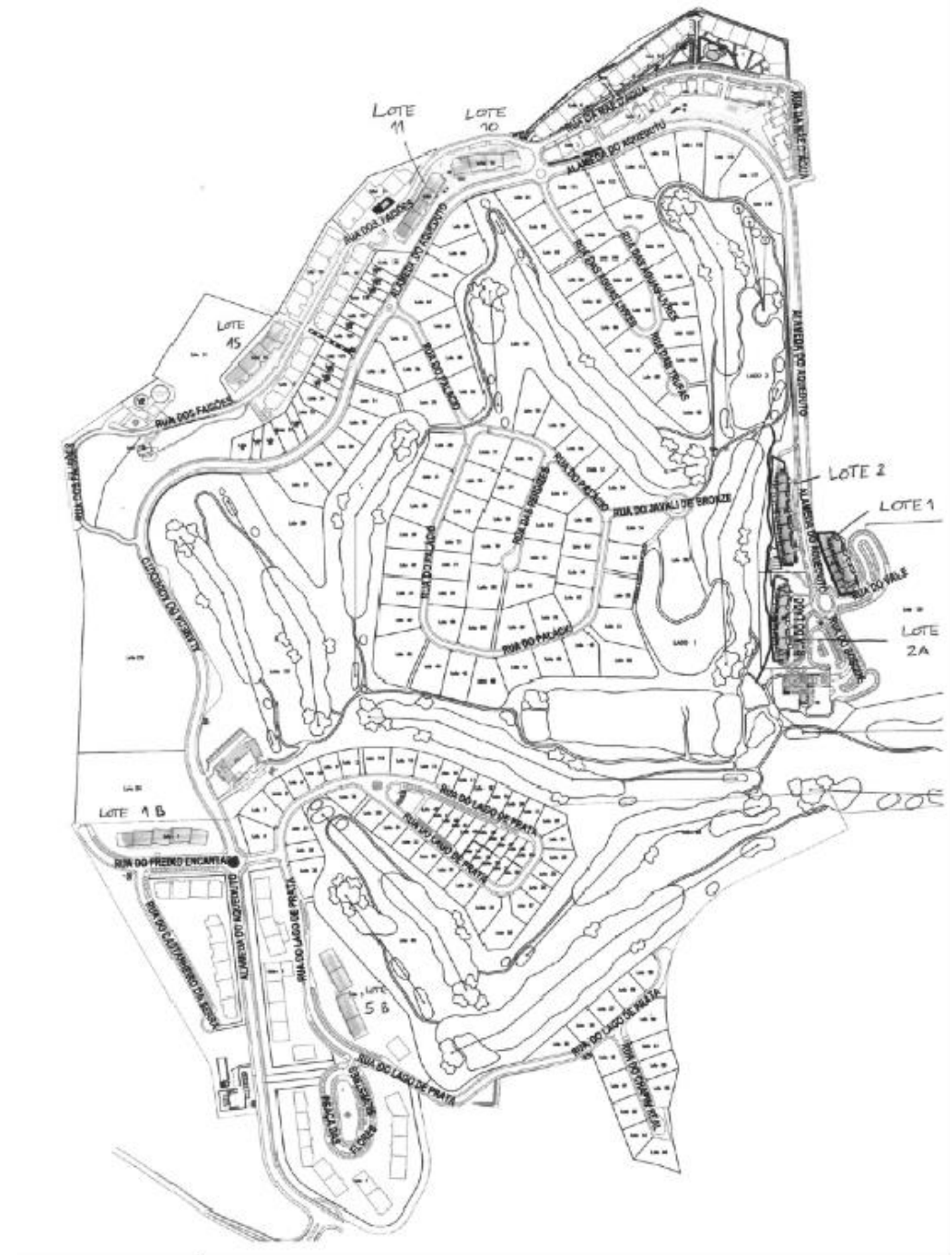


Figure 5.2. Urban organisation of the plots.

The neighbourhood is mostly comprised of two-floor single-family homes and several multi-storey apartment buildings (figure 5-3) whose number of floors varies between three and five floors.

Figure 5.3. “Belas Clube de Campo” – Phases 1 and 2 (photo example).

The urbanisation plan has also projected the other community facilities that have not yet been constructed. These will allow “Belas Clube de Campo” to adapt to future needs of the resident population (as exemplified by plot nº. 14 of phase 1, which is dedicated to the construction of a new neighbourhood school). This venture also offers several recreational areas, like an 18-hole golf course or even a Leisure Club where adults, teenagers and/or children can spend their free time.

## 5.2. Strategy and Performance

***Strategy***

The promoter of this venture has defined the environment as a key element, since its early conception stages. “Belas Clube de Campo” was created with the aim to protect and preserve a green-field area, whilst developing an urban project that pursues high environmental qualities.

***Performance***

In 2010, the phases that were already completed where assessed by LiderA, according to an approach at the urban level. The performance for each LiderA criterion was analysed, according to the system’s factorial scale in 2010. This included the global assessment of the original plan and the current “Belas Clube de Campo”. The assessment showed that the venture had already adopted outstanding practices in habitat network and services (C4), sports offer and leisure (C28), and maintenance and environmental management system (C41), for example. A very good practice is achieved in the sustainability vision (C19), quality of planning and development process (C20); and in several other criteria including land use (C2), landscape (C5), passive energy management (C7), carbon management (C9), local water management (C11), responsible material sources (C13), noise management (C17), safe and appealing streets and public spaces (23), housing (C25), friendly amenities (C30), natural risk control (C38), awareness (C40), and monitoring and governance (C42).

In factorial terms, the weighting calculated resulted in a large improvement of common practices. The venture achieved a factor 4 improvement (class A+).

***Site and Integration***

Infrastructure and building development was planned to respect the surrounding landscape, including low residential density, taking into consideration local topography, the protection of existing natural habitats, the diversity of native flora, and the preservation of REN (National Ecological Reservations) and RAN zones (National Agricultural Reservations) for which the EIA studies were developed and approved for the three phases of the project. The master plan took into account the organisation and distribution of lots, and the deployment and solar orientation of the buildings. This reflected an attempt to reduce the energy requirements of buildings for lighting and thermal comfort purposes. The entire building and construction works were based on and followed the strictest environmental requirements. In the soil criteria, the assessment of the supplied urban indexes (phases 1, 2 and surrounding permeable areas) demonstrated that 80 % of the areas of the venture are permeable (figure 5-4). This has contributed significantly to a proper environmental optimisation of the implantation of the venture (C2).

Figure 5.4. Photos showing permeable solutions.

***Natural Ecosystems***

"Belas Clube de Campo" incorporates several diverse and sizeable ecological components (figure 5-5). The assessment has proved that about 85 % of the total area of the venture consists of permeable green areas.

Figure 5.5. Layout with interconnecting habitats.

In interconnecting habitats (C4) the main green corridors are developed along the pathways defined by the golf course, where artificial nests for birds, that help develop the existing ecosystem, can be found. “Belas Clube de Campo” also has a wide variety and diversity of natural species (over 150 plant and animal species observed in the field).

Vegetation is also an element present in built-up areas, within public parks or gardens, containing walls (figure 5-6) of the lots (mostly composed of limestone walls, which have naturally been covered by vegetation) or profiles of the streets.

Figure 5.6. detail of solution with natural vegetation beginning to grow.

***Landscape Integration***

Landscape integration (C5) creates a privileged relationship that integrates built environments with the local topography and surrounding landscape. Buildings have a medium average height of two floors when it comes to detached houses and four floors in apartment buildings (figure 5-7).

Figure 5.7. Photo of buildings.

The boundary walls of the lots, containment walls and roads use mainly limestone, which is a construction material representative of the region (figure 5-8).

Figure 5.8. Photo of detached house.

The vegetation is extremely important in this venture. It is a congregating element that spreads through built environments, public parks and gardens, balconies of houses and boundary walls of the lots, creating a structural habitat network (C4).

In order to adapt and better integrate the buildings into the landscape (C5), the venture has created an aesthetic committee. This committee analyses all proposed projects, which are subjected to an assessment based on the Construction Rules of this venture. Thus, this controls, in a reasonable manner, the type and quality of proposed urban environments and buildings. In the future, a potential key point for improvement could be the use of more local species and a better and more systematised promotion of ecological valorisation (C3) (figure 5-9).

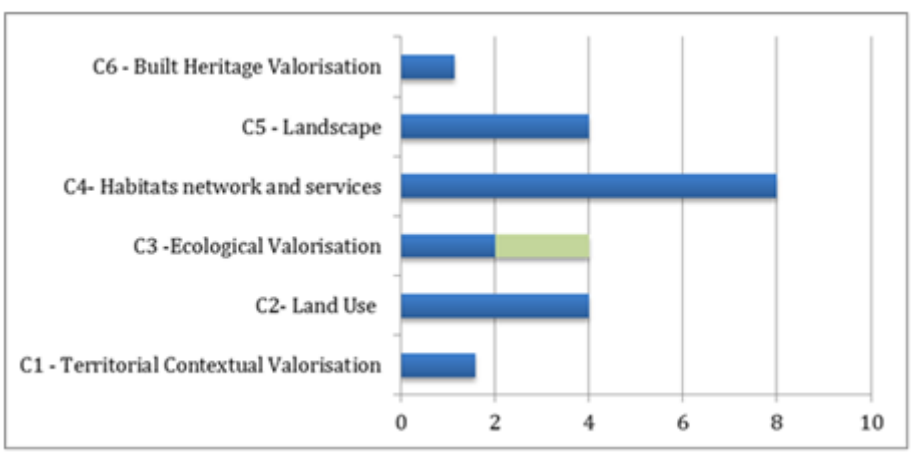


Figure 5.9. Assessment of existing solutions on site and integration and potential improvement (C3).

***Resources***

**Energy**

Passive energy design and management (C7) is a key point of the venture that was included since its inception. The venture has applied rules that suggest the orientation of the developments of each zone (figure 5-10), including buildings and detached houses.

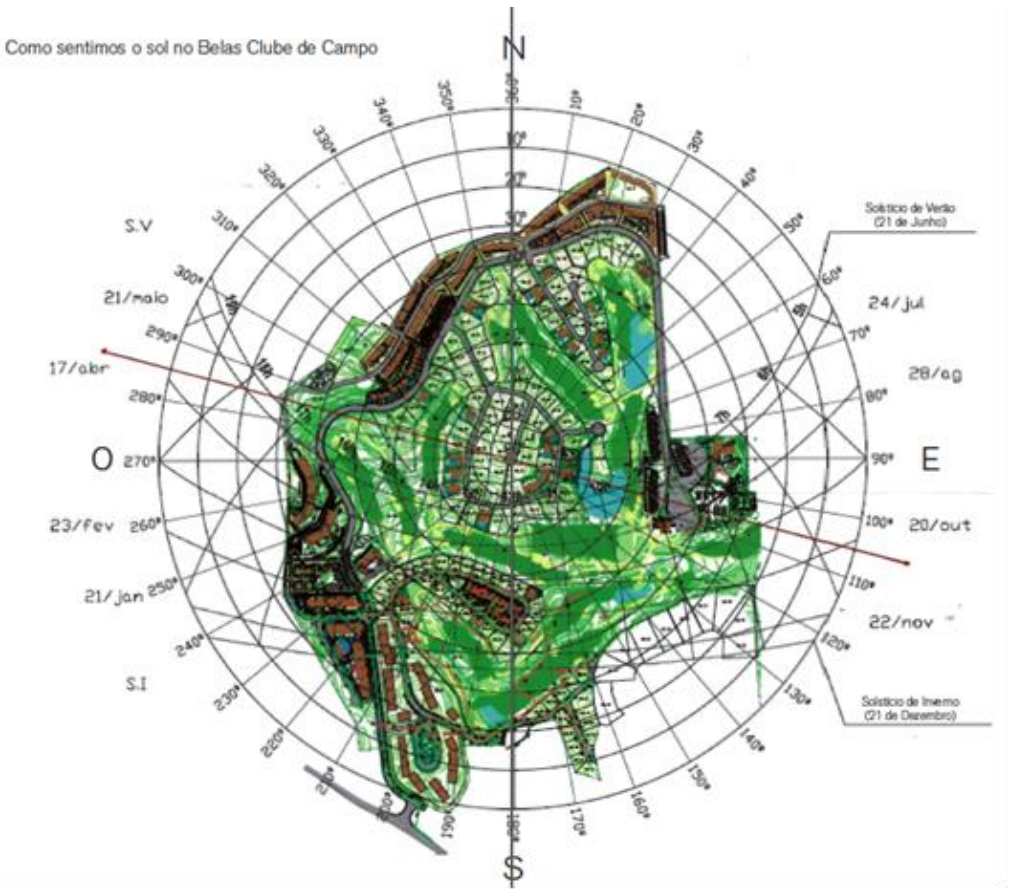


Figure 5.10. Solar orientation chart.

The search for efficient energy systems (C8) has been promoted in the last years both in the public spaces (illumination systems and others) and in the buildings of the venture. "Belas Clube de Campo" has also promoted and sponsored an energy certification program that has certified more than one hundred apartments and houses. This has also included the identification of energy measures and the use of renewable energies (C9). Passive design, increased energy efficiency and use of renewable energy (figure 5-11 and 5-12) - not only in "Belas Clube de Campo" buildings but also in private buildings – and public transport (even if in a small scale), have progressively contributed a low carbon balance on the carbon assessment of activities and events.

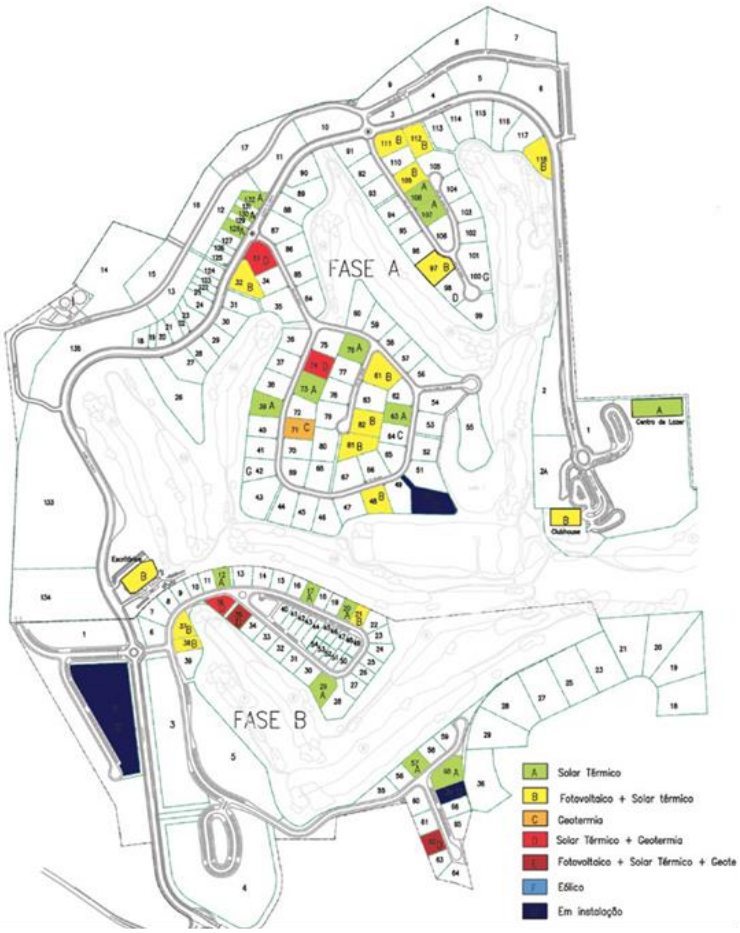


Figure 5.11. Location of some renewable energy systems.

Figure 5.12. Example of the use of renewable energy systems.

**Water**

Another main contribution of this venture focuses on the management of local waters (C11). Considering that the project consists of a large amount of areas dedicated to golf that, in general, are considered to be large water consumer areas, special care was taken in the rain water storage (figure 5-13), maintenance and management of these spaces in order to reduce water consumption.

Figure 5.13. Photo of water storage.


Figure 5.14. Example of drainage systems.

Currently, there are four lakes responsible for the irrigation of the green spaces and the golf course. The water that supplies these lakes comes from the runoff of rainwater (figure 5-14). Five water holes are used when the amount of water is insufficient. The rate of rainwater harvesting is currently between 15.5 and 20 %. (there is the intention to increase these values soon).

In the same way that the use of irrigation for the 18 holes of the golf course is controlled, residents are also prevented from drilling additional waterholes. The venture has also considered the widespread planting of trees for runoff water control, since it is mostly rocky ground.

**Materials**

The use of local materials (C13) in the project is significant, since over 75% of the materials used are extracted and produced less than 100 km away from the venture. The assessment highlighted (figure 5-17) the use of the following materials, produced within a radius of 100 km from the venture: the support walls that are made from materials extracted from the site, concrete, Negrais-yellow-stone (Pero Pinheiro), a cobblestone, other stones originating from Porto de Mós and Benedita (supplier based in Pero Pinheiro), local ceramic tiles, wood and metal furniture, amongst others (figure 5-15 and 5-16).

Figure 5.15. Use of low impact materials.

***Environmental Loads***

**Waste**

The waste management follows municipal strategy. There is already a full set of "eco-points" to collect waste for recycling (glass, paper, packaging) and there is another specific system under implementation to collect the organic waste.

Figure 5.16. Use of local materials.

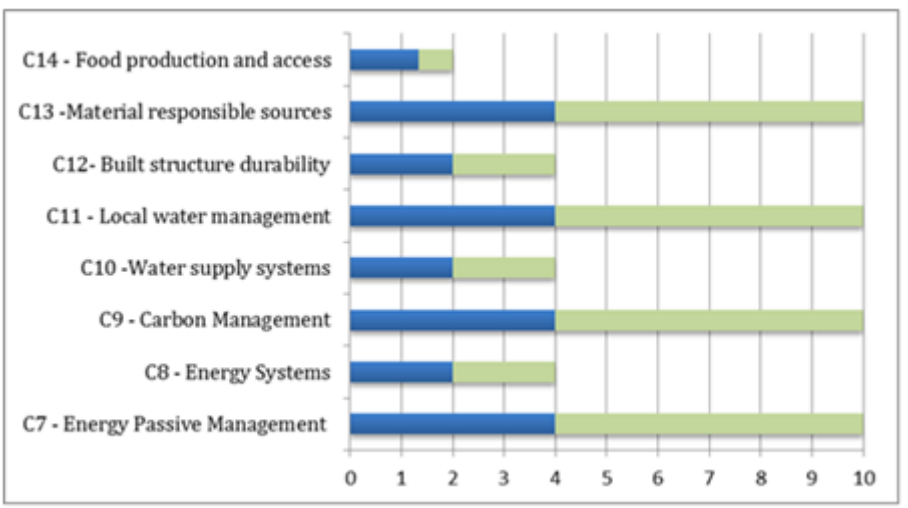


Figure 5.17. Assessment of existing solutions in resources and potential improvement (C7 to C14).

Through the Usage Regulation of "Belas Clube de Campo", residents are encouraged to separate hazardous waste from domestic waste (e.g., batteries, lightbulbs and household cooking oils). In this context, according to the 2009 Annual Report on Environmental Quality, several services and equipment that allow waste management in a more simple and effective way (sites for the deposition of batteries and lightbulbs, door to door collection of used cooking oil (figure 5-18), and specific sites for the disposal of selective waste (figure 5-19), household scraps, electronic equipment, paints and pesticides and other hazardous waste) are available to residents.


Figure 5.18. Collection of used oil.


Figure 5.19. Recycle collection points.

**Noise**

The assessment has also proven an effective reduction of external noise sources (C22), including: silent equipment in indoor and outdoor spaces with running sound levels inferior to 50 dB, electric buggies, baffles which reduce the propagation of sound, such as vegetation and suitable inner or outer insulation of buildings. Another important aspect examined in the

Usage Regulation of “Belas Clube Campo”, corresponds to the time period set for carrying out of construction and refurbishment works (between 8:00 am and 18:00 pm).

Although the project is located in an area where outside noise does not exceed 55 dB, low noise conditions were reinforced by effective soundproofing / sound levels (C27). The strategic solutions essentially adopted at the buildings level are based on the sound isolation of different parts of the building (exterior walls, partitioning walls, floors and ceilings), the use of sealing frames (with the insulating zone applied between the glass and the frame) and double-glazing. The interior design of the buildings took into account spatial organisations, suitable to noise limitation from existing facilities within the building (figure 5-20), such as lifts, cable holes, kitchens, and others considered relevant in the evaluation of projects.

Figure 5.20. Detail of Courete in dwellings insulated with mineral wool.

The assessment of environmental loads has demonstrated that the area has managed to promote good environmental practices (figure 5-21) that result from correct and efficient noise, waste and emissions management.

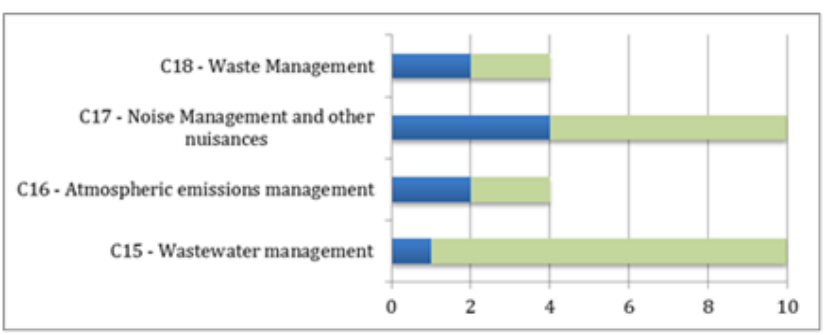


Figure 5.21. Assessment of existing solutions and potential improvement in environmental loads (C15 and C18).

One of the possible improvements would be the introduction of a composting system for all the organic waste of the green areas, whose product could be used as a fertilizer and a complementary contribution to close local material-cycles.

**Urban Evolution Process**

The urban evolution process has tried to develop good practices, since the early stages, first in environmental areas and more recently in a broader sustainability scope, which assures an excellent sustainability vision and objectives (C19), as well as a good quality of the planning and development process 4 (figure 5-22). The plan has supported, since its inception, the idea of promoting the structural adaptability of urban spaces (C21). In the future, huge improvements could be achieved through the development of an integrated development vision (low energy use and carbon emissions and closure of the urban cycles).

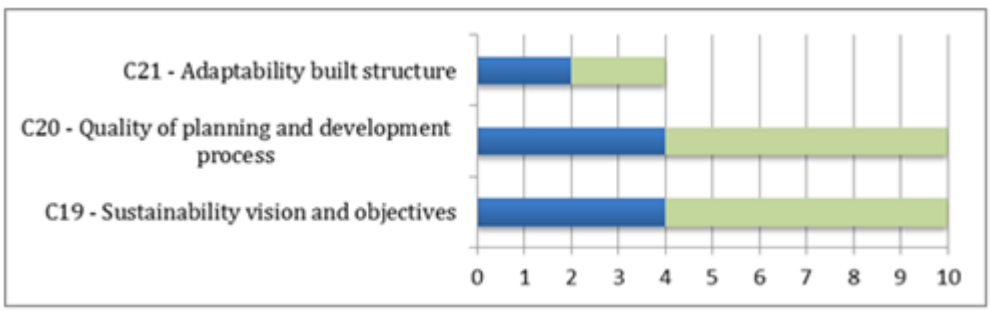


Figure 5.22. Assessment of existing solutions and potential improvement of the urban evolution process (C19 and C21).

***Socio-Economic Dynamic***

**Amenities and Social Interaction**

The venture offers a set of services and commercial locations that promote a good performance in the amenities criterion (C30). This includes the existence of several human amenities, including a food store, a pharmacy, and the existence of at least three natural amenities up to 500m distance. This also includes other services and locations such as: a medical evaluation office, a grocery store (Little Shop of Cremilde), a catering and coffee service, ATM machines, a learning support centre, a sports centre, a swimming pool, a gym, amongst others (figure 5-23 to 5-26).

Natural amenities include: lakes, large areas of lawns, parks and gardens. Engaging in closer to the venture are still many cultural amenities and natural (forest).

"Belas Clube de Campo" assessment has demonstrated a good performance in local community interaction and social responsibility (C29). The existence of certain types of facilities, such as the golf course, the playground, the terraces, as well as the periodic creation of social, cultural and sporting events (C28) promotes interaction between residents and the surrounding community (figure 5-25).

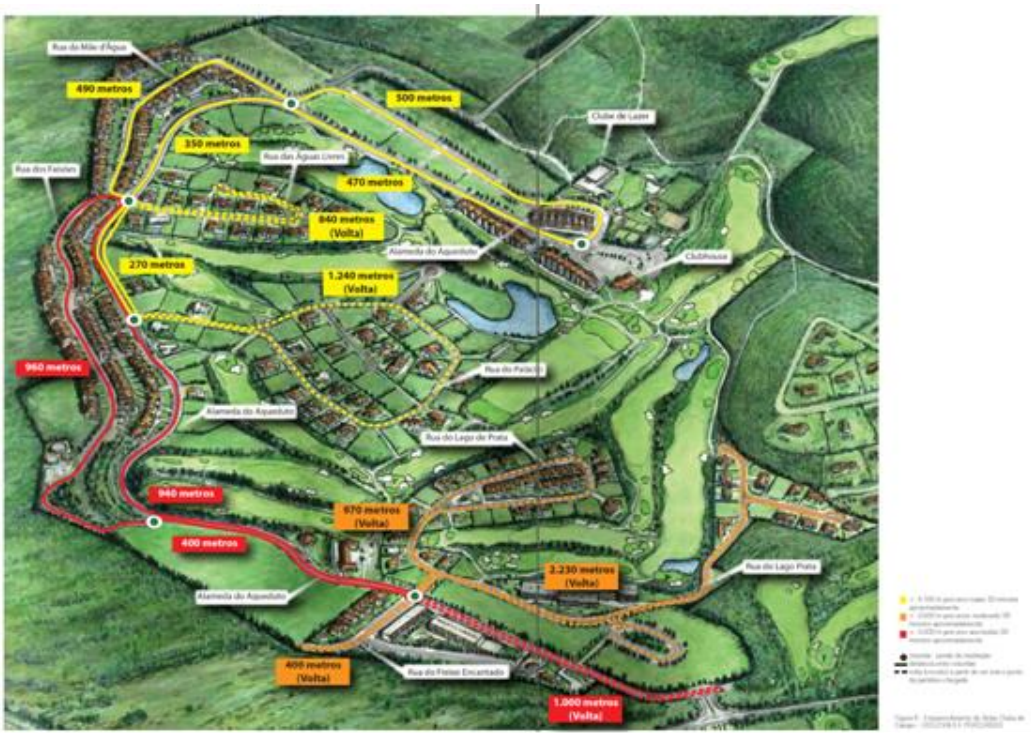


Figure 5.23. Cycling and foot path.

Figure 5.24. Photos of bicycle-racks and details of footpaths.

Figure 5.25. Golf perspective.

Figure 5.26. Kids club, multi-purpose space and terrace of the leisure centre

Figure 5.27. Watchtower and observation to detect natural phenomena.

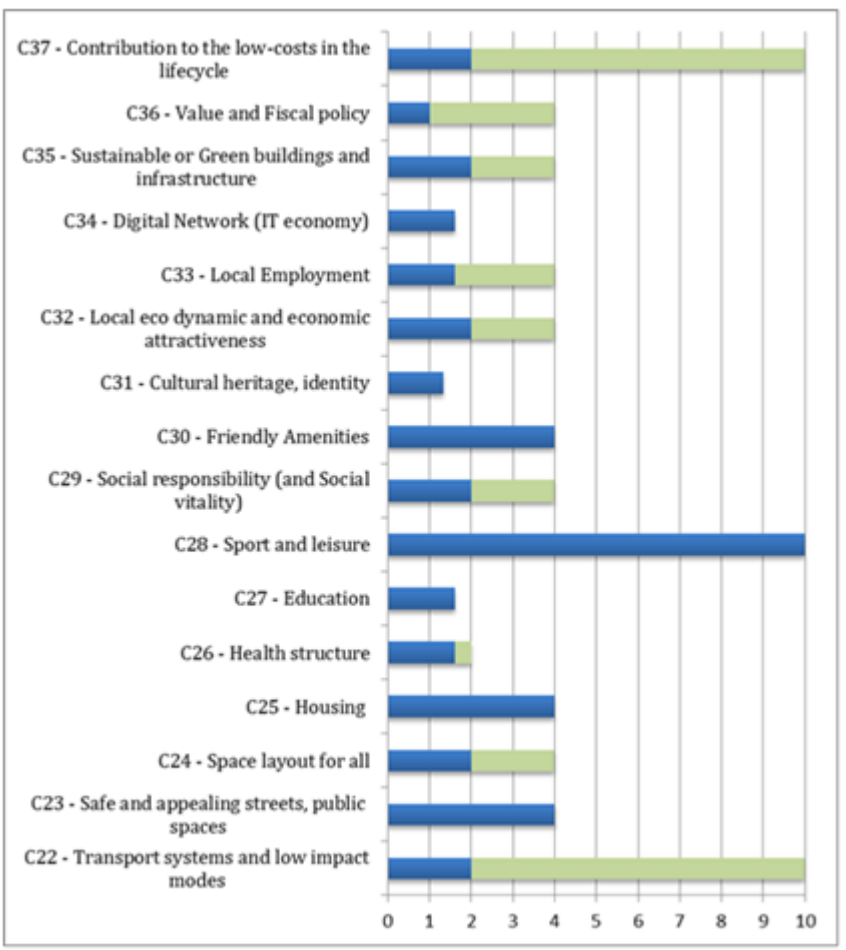


Figure 5.28. Assessment of existing solutions and potential improvement in socio economic criteria (C22 to C37).

***Participation and Control***

In order to minimise the natural risks (C38), Belas identified existing risks in the design stage and introduced solutions to deal with extreme weather events. The promoters of "Belas Clube de Campo" condominiums provide all the information and training necessary to deal with specific infrastructure systems (water, electricity, gas and telecommunications).

The plan strategically considered the security risks of increased rainfall; seismic safety risks; and security risks associated with fires (figure 5-27). Fire alarm systems in garages and common areas of the buildings are connected to central monitoring services, which also have access to keys of the fire-fighting infrastructure.

The assessment of the control (figure 5-28) of human threats - (Security) (C39) has demonstrated that all security systems connected to the central monitoring services, have a response time of 5 minutes, on average.

The surveillance team consists of seven individuals that guarantee the security of the venture 24 hours a day. In outdoor public spaces, measures to help mitigate crime and vandalism were adopted, including the existence of well-lit spaces, an open field of vision in paths and pedestrian access to buildings, buildings with main access inserted in the street front and public parks and private gardens with conditioned access.

***Sustainable Use***

**Environmental Management**

The promoter encourages "Belas Clube de Campo" residents to commit to environmentally sound practices (C41). In this sense, in addition to training courses provided to residents, diverse information regarding the buildings and built environment is available. This includes Construction and Use Regulations, which promote measures for sustainable construction (materials, water management, energy management, vegetation, land clearing and construction of green areas. There is a specific website (www.belasclubedecampo.pt) which presents and discusses the importance of sustainability and of the strategies adopted; a bimonthly newsletter with information about environmental education and recreational activities is also available (e.g., Tree Day, Firefighter day, among others).

"Belas Clube de Campo" is the first residential development at the international level to have all the components of its value chain certified, from the design stage to the commercialisation stage, including the maintenance and operation of the golf course and green areas, natural protection and resident support, among others. "Belas Clube de Campo" has obtained certifications ISO 9001 and ISO 14001, for integrated management and environmental quality (C41).

In "Belas Clube de Campo" sustainable use (C42) and innovation (C43) are important issues that are revised in new proposals, which are evaluated according to their innovative nature, associated with an improved socioeconomic and environmental performance.

In the LiderA assessment analysis (figure 5-29) four elements were considered to be innovative, three of which fall into the following areas: Local Integration - the existence of a committee of aesthetics that evaluates and monitors the projects based on the Construction Regulation; Environmental Loads - door to door collection of waste (organic waste and edible oils); and Socioeconomic Aspects - ISO 9001 and ISO 14001 certifications of the Golf Course and "Belas Clube de Campo"; the agreements and activities undertaken with the

surrounding communities; and the Shuttle that connects the venture to the nearest subway station.

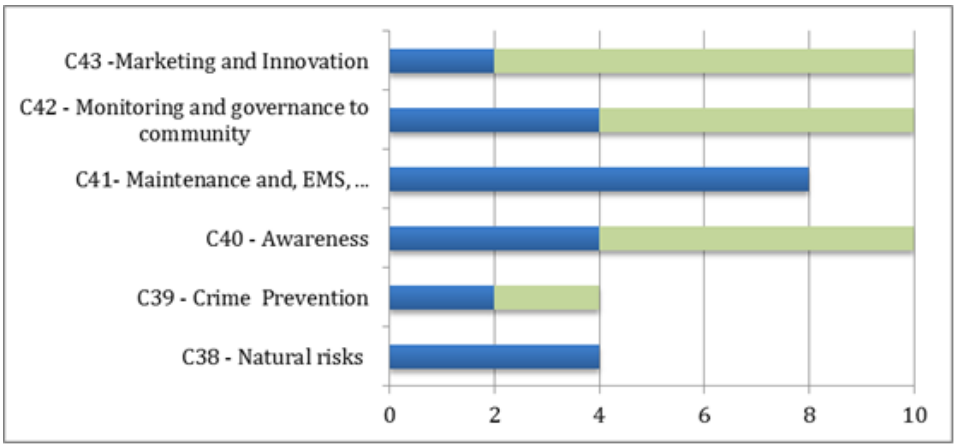


Figure 5.29. Assessment of existing solutions and potential improvement in sustainable use (C38 to C43).

A strong improvement can still be promoted without the necessity to recur to a new plan, especially in Sustainable Awareness (C40), including: the introduction of a new support and environmental management system in public spaces (C41); data collection, monitoring and sharing; the promotion of community participation and governance in future decisions (C42); the promotion of innovation and marketing (C43). Furthermore, efforts made for natural risk management (C38) and crime prevention (C39) must be maintained.

In the energy area, at the urban level, the definition of insulation solutions, a bioclimatic design charter can further support the definition of correct deployments and orientation, which can improve the passive design performance of buildings and urban zones (C8) and guarantee an interlink process between different scales (including the thermal mass of materials).

A concerted action by the operator of the site allowed the implementation of a systematic assessment of energy performance certification (EBPD scheme) to most of the villas and multi-storey buildings (energy certification, C7). This has allowed the identification of solutions to improve performance, including the promotion of solar water heating and the potential for other renewable energy interventions (such as wind turbines and photovoltaic) on a global scale that can comprehensively reduce carbon intensity (C9).

In the water area, the global permeability of the venture has assured an important base for local water management, globally and individually (C20). This supports not only local water dynamics but also ecological aspects (C3) and habitats interconnection (C4), which are present globally but also in each villa and building.

In this venture, there was a commitment to optimise permeable areas and local green spaces that house over 150 species of plants and animals. There was also the commitment to sustain the proper integration of the buildings of the venture. In Resources, there was a clear bet on the management of local waters, namely the storage of runoff water to irrigate the golf course.

Over 75% of the materials used are local materials and more than 50% are low impact materials. It is also important to note the efforts for waste management, especially waste recycling. Considering these proposals as well as the global assessment made, LiderA certified "Belas Clube de Campo" with class A+.

## 5.3. Potential Improvement

Even with a good performance, Belas Clube de Campo has important opportunities to improve the performance in future developments, mainly in resources, like searching for near zero energy at the urban scale. Other improvements could consider closing the water cycle, through the reuse of rainwater and wastewater, consider an increased reuse of materials and also consider guaranteeing a more sustainable use. Also an important increase could be done with a consideration of life cycle cost and low impact mobility. In this case, the beginning is now (as explained in the following text).

***Increasing the Promotion of Low Impact Mobility***

Nowadays "Belas Clube de Campo" has a population of around 2000 inhabitants. In this improvement scenario, it is estimated that 75% of the current population uses a private vehicle during daily commutes and that the remaining population either does not own a car, uses public transports (figure 5-30), prefers to walk or cycle, or simply doesn't have the need to commute daily. This means that on a daily basis there are around 1250 cars circulating. It is assumed that each car has a 12700 km average annual mileage, consumes 7 l /100 km, and produces 200 g of $CO_2$/ km. This means that annual $CO_2$ emissions will sum up to 3175 tons of $CO_2$. If it can actually be guaranteed that 10% of the population that uses cars, opts to walk, cycle and use public transport, if another 10% opt to use exclusively public transports and 20% opt to buy a Hybrid or Electric vehicle, it will be able to reduce car circulation by 250 vehicles, and guarantee that 55% of the population of the neighbourhood does not use private cars for daily commutes. If people buy a Hybrid or Electric vehicle that produces 90 g of $CO_2$/ km, it will have insured that 250 cars have annual $CO_2$ emissions of 1143 Kg of $CO_2$ each.


Figure 5.30. "Belas Clube de Campo" – Hybrid or Electric vehicles.

As a result, it will have 1000 cars circulating daily, of which 250 are Hybrid or Electric vehicles. It will also have 55% of the population using low impact means of transport. This

means that annual $CO_2$ emissions will drop to 2190 tons, a reduction of 31,1% of the original value.

# 6. URBAN SUSTAINABILITY AND THE CREATION OF VALUE

## 6.1. Vision and Value

### *Creating a Vision*

One of the key points of LiderA (and other similar tools) is to clearly understand, within the search for sustainability, what is the current or future performance level. This allows understanding where a given project is heading, especially with the factorial scale, which can foresee and document broader and more ambitious goals. The LiderA approach not only contributes to assessing performance but also to creating a long-term vision. This implies, for example, that higher solar performance levels could be attained in buildings, if the urban planning process integrates a solar design approach to both new and existing urban environments (Amado & Poggi 2012).

### *Application at Different Scales*

Sustainable urban assessment creates the perspective and possibility of promoting sustainable and green infrastructure and buildings, both through a broader view and through specific criteria (e.g. C35 promote sustainable and green building).

"Belas Clube de Campo" (section 5.2), after applying LiderA at the urban scale, began to integrate LiderA principles and assessment in the development of new buildings and refurbishment of existing buildings. This process is showing that they use a system that could be applied to several scales (solution, buildings and urban zones).

In those applications there are aspects - such as energy, water or mobility - that interconnect different scales and promote an integrated choice for achieving a more efficient solution. In another perspective the application to different types of buildings at the municipal scale, such as in the Municipality of Santarém (section 2.7) generated experience and improved the solutions to be applied in each new development.

### *The Search for Urban Sustainability Creates Value*

At the buildings level, there is little EU-specific evidence that the sustainability performance of a building is reflected in its valuation, in other markets like the USA or Australia the valuation of this approach is more clear (SB Alliance, 2012:21).

The Prince's Foundation for the Built Environment (2007) in the UK, has made an assessment in order to estimate the value generated by three approaches to urban development ("old urbanism", "standard urbanism" and "sustainable urbanism"). The case-study areas were Aylesbury, Dorchester and Glasgow.

> "The different types of land use were measured for each, residential and commercial, and property values were attached to them. The value of each of the schemes was derived by calculating an average value across property types on each of the sites.

Values were obtained by using recent sale information from the land registry and were then grossed up based on the mix of properties. This provided a basic value expressed in terms of £s per hectare of the total site area, and of pounds (£s) per hectare of the built area only.

The figure below (6-1) shows the total market value of all the buildings per hectare of built land for each of the study areas. It includes the value of commercial property and affordable housing as well as residential and any other type of property built on the site."

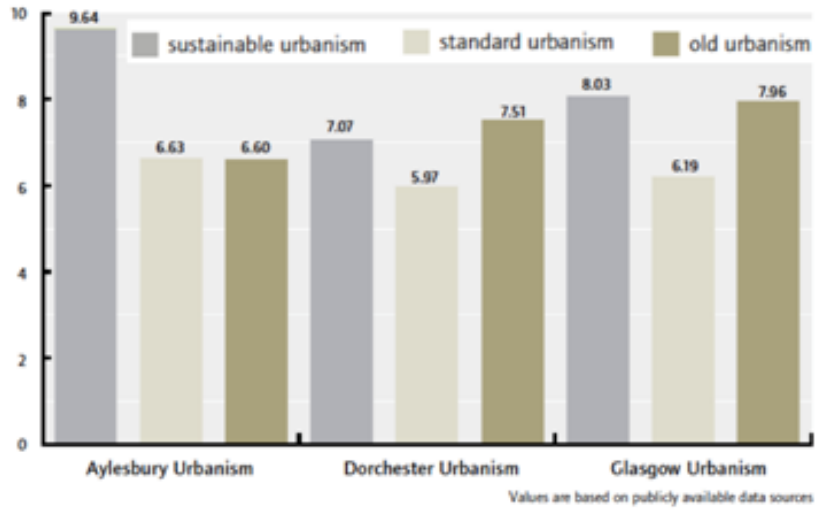


Figure 6.1. Total Market Value of Buildings per Hectare of Built Residential Land (Value £m) for each of the case study areas: Aylesbury, Dorchester and Glasgow (Source: Prince's Foundation for the Built Environment, 2007).

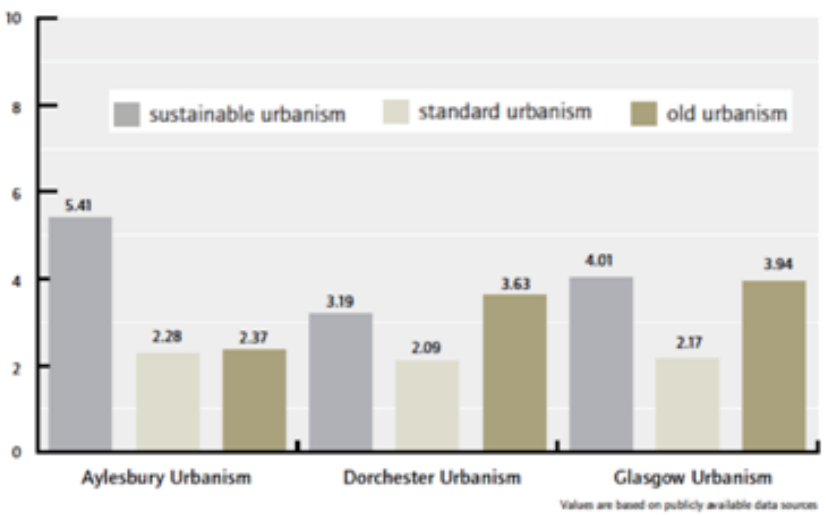


Figure 6.2. Residual Revenue per Hectare of Built Land (£m) for each of the case study areas: Aylesbury, Dorchester and Glasgow (Source: Prince's Foundation for the Built Environment, 2007).

The Prince's Foundation for the Built Environment (2007) study shows that areas that search for sustainable urbanism in Aylesbury, Dorchester and Glasgow Urbanism increase property value by 30%, in some cases.

In the same study (Prince's Foundation for the Built Environment, 2007), the comparison between the cost and financing, proper account of build costs and developer margins, shows that sufficient surplus revenue could be generated, after the developer margins are allowed, to fund substantial additional building costs, without the commercial viability of the sustainable model being threatened.

It could be discussed if there are other factors to be considered, besides the difference between "old urbanism", "standard urbanism" and "sustainable urbanism" but the difference in values is a point that must be researched.

The benefits of sustainability could be vast and today it is known (Birkeland 2009) that eco-retrofitting buildings and cities with appropriate design technology can pay for itself through lower health costs, productivity increases and resource savings.

There are also several other benefits of good design practices for sustainable urban communities (SUDA, 2013) "namely:

1. Improved affordability for housing;
2. Reduced private costs for transportation;
3. Less overall hardship for households;
4. Lower household expenditures enable better trade-offs between work and family life;
5. More efficient public infrastructure and lower infrastructure costs;
6. Reduced costs of servicing/maintaining public infrastructure;
7. More effective use of public facilities;
8. Enabling better transit services;
9. Higher revenue-to-cost ratios for public transit services;
10. Lower pressures on property taxes;
11. Higher municipal property tax revenues per gross hectare;
12. Reduced per capita energy consumption for public services;
13. More efficient delivery of water and wastewater services;
14. Buildable land supply time horizon expanded;
15. Improved profit margins for land developers;
16. Possibly less traffic congestion;
17. Greater potential for shared (public) parking and reduced requirements for property owners;
18. Household energy savings for HVAC;
19. Reduced HVAC costs for businesses;
20. Reduced impact of energy price shocks to public and private sectors;
21. Better mix and choice of residential accommodation;
22. More vibrant public/civic environment; improved social interaction;
23. Public safety/crime prevention (benefits of more "eyes on the street");
24. Diverse and walkable mixed communities attract businesses and enhance the creative and/or innovative spirit;
25. Improved viability of arts and culture;
26. Increased tourism;
27. Improved viability for small business;

28. Better access and choice of jobs and services within the community;
29. Larger, more diverse labour pool for businesses nearby;
30. Greater sense of community responsibility by business;
31. Improved personal health due to more walking and less driving;
32. Reduced per capita emissions of greenhouse gases;
33. Reduced per capita emissions of toxins from transportation and property maintenance;
34. Greater potential for the efficient delivery of energy;
35. Reduced storm water runoff;
36. Reduced consumption of material resources for the construction of buildings;
37. More rural and agricultural lands preserved; more habitats preserved for wildlife;
38. Improved personal health from less air pollution;
39. More consistent school enrolments;
40. Less school busing required;
41. Recognition for true political leadership and planning excellence in progressive, sustainable city-building;
42. Improved urban density management."

## 6.2. Other Benefits

***One Base But Not an Exclusive Approach***

The experience of other systems show that this type of system, as Garde (2009) comments when considering the LEED-ND rating system, should be one of several approaches guiding developers to promote sustainable development. But "*LEED-ND certification should not be mandatory for all neighbourhood development projects. Such a requirement would exclude other important approaches to sustainable development. Indeed, planners should go beyond LEED-ND and encourage projects that contribute positively to sustainability based on their own assessments of local conditions*".

***Creating Momentum (Leverage)***

The development of sustainable communities can be accelerated through local government leveraging of systems such as LEED for Neighbourhood Development - LEED-ND rating system (Criterion Planners 2012).

Garde (2009) states that projects aiming to achieve LEED-ND gold or platinum certification are more likely to incorporate green construction and technology criteria that improve the efficiency of their use of energy and water, as compared to projects that are trying to be LEED-ND certified or LEED-ND silver.

Criterion Planners (2012) explains that for communities, their infrastructure efficiencies, environmental footprint and general liveability can be substantially improved to the degree that larger amounts of incremental growth are ND-certified.

Greater political leadership, financial incentives and further research carried out on urban governance configurations, consumer preferences and the economic benefits of sustainable urban design are required (Dorset 2011) to ensure progress towards urban resilience.

***A Support to Efficient Application of Future Legislation***

After 2020, the recast of EPBD European energy performance building directive (Directive 2010/31/EU) will target progressively near zero energy initiatives. This challenges new building design and mainly building refurbishment to achieve a balance that could involve not only the building but also the urban zone, guaranteeing a better economic balance (Borlin et al. 2013). Sustainable search could be the base to better apply legal requirements such as these.

## 6.3. Sustainability Assessment and Search Is Also in the Beginning!

Nevertheless environmental and sustainable assessment and search has to be improved, as Frame & Cavanagh (2009) refer – "sustainability assessment is an awkward adolescence". Other authors also refer (Xing et al. 2009) that there is no single, robust methodology that can simultaneously quantify and assess all three dimensions (economic, social and environmental) of urban development.

Schweber (2013) explains, "There is a group of authors who support assessment methods as an integral part of any sustainability strategy a second group of scholars rejects current methods as inimical to genuine sustainability".

These second authors group "criticize the narrow environmental, technical and building focus of the tools which neglects the impact of buildings on their socio-ecological context and which precludes genuine stakeholder engagement and dialogue over value choices. "Most of these second authors groups emphasize the need for radical changes in the way in which people think. As Plessis and Cole (2011:448) say 'a shift in worldview is prerequisite to a paradigm shift'. "

***Mechanic Models?***

Schweber (2013) refers "as long as market signals remain the ideologically preferred mechanism by which to implement sustainability, assessment methods will continue to affirm technical, mechanistic models of sustainability. While this does not discount the contribution of such methods to environmental sustainability, it does raise questions about ways in which the existing panoply of methods and tools is locking in certain understandings. It also suggests that, to be successful, 'paradigm' change necessarily depends on a more systemic change, not just in the construction sector, but in broader modes of governance."

# CONCLUSION

During the past decade, sustainability has emerged as a dominant topic of interest among urban scholars but academics and urban planners have yet to make substantial inroads into the marketplace, which has almost fully accepted the superiority of these forms of development (Krause & Bitter 2012).

Since the early 1990's, modern societies have witnessed the widespread of environmental performance assessment systems across the globe, at the local and national level. Neighbourhood and urban sustainability assessment tools have become widespread since the

turn of the 21st century and many communities, mainly in the developed world, are utilising these tools to measure their success in approaching sustainable development goals (Sharifi & Murayama 2013).

One of these systems is the LiderA system - Portuguese acronym for Lead for the environment in search of sustainability in built environments. This chapter explains this less known (at the international level) sustainable assessment system. This chapter presented the LiderA approach from organisation to municipal application; the LiderA urban assessment version and its application in two distinct case-studies.

LiderA is a Sustainable Evaluation System that can be used to search for sustainability in plans or projects and be applied to urban environments or buildings, allowing them to be certified or recognised by the system's brand, according to different final purposes. LiderA is based on the concept of re-positioning the environment in urban environments, enterprises and buildings, according to a sustainable perspective, assuming itself as a leading system for an efficient search for sustainability. LiderA has had three different versions: the first was published in 2005, the second in 2010, and the third has been made available since 2012, mainly tackling the urban scale.

The LiderA Urban Scheme is based (as the general purpose version of the scheme) on six key principles/aspects that are divided into areas, which comprise the assessment criteria that allow the support of the search for sustainable buildings.

The key principles suggested for this search for sustainability are:

1. Enhancement of the local land dynamics and promotion of a proper integration;
2. Promotion of the efficient use of resources;
3. Reduction of the impacts of environmental loads (both in amount and toxicity);
4. Focus on the services provided by the built environment and its sustainability search;
5. Promotion of sustainable socioeconomic aspects;
6. And ensuring the best use of sustainable built environments, through environmental management and innovation.

In the LiderA Urban Scheme (as in the other schemes) the six main principles are subdivided into twenty-two areas and 43 criteria that are used in the process of search for sustainability and assessment.

The use of LiderA by municipalities has allowed the creation of a common vision between different municipal departments and stakeholders, contributing to create a dynamic search for sustainability. Cases like Santarem show the possibilities of this approach, with several buildings already certified and an urban regulation that reduces the licencing prices of urban projects (up to 25%), if they achieve LiderA certifications.

In this chapter, two urban applications of LiderA were presented. One in a new urban district in Lisbon, denominated "Alta de Lisboa". And another in the outskirts of Lisbon, in Sintra, in an area denominated "Belas Clube de Campo".

In "Alta de Lisboa" the level of sustainability shows that the search for sustainability has already been initiated, but is not yet integrated, achieving a low assessment level (Level C in LiderA means that the aggregate index weight has increased 13 % when compared with traditional urbanism). The study done proposed a full set of measures in order to plan, within the timespan of two decades, achieving a factor 3 improvement (A+).

"Belas Clube de Campo" is an urban development that since its inception has considered the search for sustainability, through a good environmental performance. "Belas Clube de Campo" assessment achieves a high level of sustainability (A+) in LiderA. The challenge now is to have a consistent performance in all the environmental and socioeconomic criteria, while assuring that the search for sustainability is integrated in the future development and refurbishment of buildings.

The applications presented in these two cases show that this system could be a base to support the search for sustainability, since it creates an integrated view of that search and allows the identification of different kinds of solutions to be applied in the short term and in the long term.

The benefits of these applications range from creating a vision that potentially contributes to involving stakeholders to creating value. Nevertheless, this approach has to be improved and deeper research is needed, since a full set of challenges namely the generation of a larger consensus and involvement have been identified, as a changing paradigm.

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