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Urban Quality of Life: Multidimensional Evaluation in Porto Alegre, Brazil (Qualidade de Vida Urbana: Avaliação Multidimensional em Porto Alegre, Brasil)

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URBAN QUALITY OF LIFE: MULTIDIMENSIONAL EVALUATION IN PORTO ALEGRE, BRAZIL

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ABSTRACT

Wesz, J. G. B. *Urban Quality of Life: Multidimensional Evaluation in Porto Alegre, Brazil*. 2021. Thesis (Doctor in Urban and Regional Planning) – Postgraduate Program in Urban and Regional Planning, UFRGS, Porto Alegre.

The social-cultural environment has great influence on the perception of Quality of Life (QoL), as well as the built environment. Choosing the location of housing is an important issue when it comes to housing policies. In this respect, converting vacant buildings to affordable housing is an opportunity but also a challenge in this process. From the 1970s onwards, the global concern with the environment has increased, especially due to the accelerated urbanization process of cities in developing countries and their socio-environmental problems. Hence, the need to evaluate the urban quality of life is directly related to this phenomenon. The aim of this study is therefore to propose a multidimensional method to evaluate the urban QoL in the context of the renovation of buildings for social housing in central urban areas. Design Science Research is the methodological approach adopted as it aims to propose an innovative method (artefact) to address a current problem. One important contribution of the study is related to the discussion on the nature of QoL, based on a systematic literature review, aiming for a better understanding of the multidimensional urban QoL approach, including its objective and subjective dimensions. This study argues that the multidimensional urban QoL should include the horizontal dimensions (objective and subjective dimensions) and vertical dimensions, including relevant aspects of the living conditions (such as urban services; the economy; culture and recreation; urban mobility; conviviality; security; and environmental comfort), that should be objectively (universal metrics) and subjectively (users' perception) assessed. The main contribution of this study is the proposal of a multidimensional urban QoL evaluation method, which includes three main steps: preparation for the evaluation; the evaluation itself; and communication of results and discussion. Other contributions are related to the application of the method with residents of four social housing buildings in the urban centre of Porto Alegre, Brazil, the proposal of a set of urban QoL indicators, the proposal of a subjective QoL index, and the data confrontation between the subjective and objective dimensions of QoL.

Keywords: multidimensional urban quality of life, urban indicators, objective indicators, subjective indicators, social housing, building renovation

RESUMO

WESZ, J. G. B. **Qualidade de Vida Urbana: Avaliação Multidimensional em Porto Alegre, Brasil.** 2021. Tese (Doutorado em Planejamento Urbano e Regional) – Programa de Pós-Graduação em Planejamento Urbano e Regional, UFRGS, Porto Alegre.

O ambiente sociocultural apresenta grande influência na percepção da Qualidade de Vida (QV), assim como o ambiente construído. A escolha da localização da moradia é uma questão relevante quando se trata de políticas habitacionais. Nesse contexto, converter edificações vazias ou subutilizadas em habitação social é uma oportunidade, mas também um desafio desse complexo processo. A partir da década de 1970, a preocupação global com o meio ambiente aumentou, principalmente devido ao processo acelerado de urbanização das cidades dos países em desenvolvimento e seus consequentes problemas socioambientais. Assim, a necessidade de avaliar a QV urbana está diretamente relacionada a esse fenômeno. O objetivo deste estudo, portanto, é propor um método multidimensional para avaliar a QV urbana no contexto de recuperação de edificações para habitação social em áreas urbanas centrais. *Design Science Research* é a abordagem metodológica adotada na medida em que este estudo visa propor um método inovador (artefato) para contribuir com um problema atual. Uma importante contribuição do estudo está relacionada à discussão sobre a natureza da QV urbana, a partir de uma revisão sistemática da literatura, visando uma melhor compreensão da sua abordagem multidimensional, incluindo suas dimensões objetiva e subjetiva. Este estudo argumenta que a QV urbana multidimensional inclui as dimensões horizontais (dimensões objetivas e subjetivas) e as dimensões verticais, ou seja, aspectos relevantes das condições de vida (como serviços urbanos; economia; cultura e recreação; mobilidade urbana; convivialidade; segurança; e conforto ambiental), que devem ser avaliados de forma objetiva (métricas universais) e subjetiva (percepção dos usuários). Como principal contribuição, portanto, este estudo propõe um método multidimensional de avaliação da QV urbana, que compreende três etapas principais: preparação para a avaliação; avaliação; e comunicação dos resultados e discussão. Outras contribuições estão relacionadas à aplicação do método com moradores de quatro edifícios de habitação social no centro urbano de Porto Alegre, Brasil, à proposta de um conjunto de indicadores de QV urbana, à proposta de um índice subjetivo de QV e ao confrontamento de dados das dimensões subjetiva e objetiva da QV.

Palavras-chave: qualidade de vida urbana multidimensional, indicadores urbanos, indicadores objetivos, indicadores subjetivos, habitação social, renovação de edificações

FIGURES

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ABBREVIATIONS

ABNT – Brazilian Association of Technical Standards (*Associação Brasileira de Normas Técnicas*)

ANATEL – National Telecommunications Agency (*Agência Nacional de Telecomunicações*)

ANEEL – National Electric Energy Agency (*Agência Nacional de Energia Elétrica*)

ATHIS – Assistance Program for Social Housing (*Assistência Técnica para Habitação de Interesse Social*)

CAIXA – Brazilian Federal Savings Bank (*Caixa Econômica Federal*)

CAU – Council of Architecture and Urbanism (*Conselho de Arquitetura e Urbanismo*)

CEP – Research Ethics Committee of UFRGS (*Comitê de Ética em Pesquisa da UFRGS*)

COMPESQ – Research Committee of UFRGS (*Comissão de Pesquisa da UFRGS*)

DLC – Cleaning and Collection Division (*Divisão de Limpeza e Coleta*)

DMAE – Municipal Department of Water and Sewage (*Departamento Municipal de Água e Esgotos*)

DMLU – Municipal Department of Urban Cleaning (*Departamento Municipal de Limpeza Urbana*)

DSR – Design Science Research

EPTC – Public Transport and Circulation Company (*Empresa Pública de Transporte e Circulação*)

FASC – Foundation for Social Assistance and Citizenship (*Fundação de Assistência Social e Cidadania*)

FEPAM – State Foundation for Environmental Protection (*Fundação Estadual de Proteção Ambiental*)

GIC – Global Interdisciplinary Centre

GIS – Geographical Information Systems

IBGE – Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*)

INPC – National Consumer Price Index (*Índice Nacional de Preços ao Consumidor*)

IPHAE - State Historical and Artistic Heritage Institute (*Instituto do Patrimônio Histórico e Artístico do Estado*)

IPHAN – National Historical and Artistic Heritage Institute (*Instituto do Patrimônio Histórico e Artístico Nacional*)

MHML – My House My Life Program (*Programa Minha Casa Minha Vida*)

MARGS – Museum of Art of Rio Grande do Sul

NAE – Statistical Advisory Nucleus (*Núcleo de Assessoria Estatística*)

NBR – Brazilian Standard (*Norma Brasileira*)

ObservaPOA – Porto Alegre City Observatory (*Observatório da Cidade de Porto Alegre*)

PDDUA – Master Plan for Environmental Urban Development (*Plano Diretor de Desenvolvimento Urbano Ambiental*)

POA – Porto Alegre

PMPA –Porto Alegre City Hall (*Prefeitura Municipal de Porto Alegre*)

PROPUR – Postgraduate Program in Urban and Regional Planning (*Programa de Pós-Graduação em Planejamento Urbano e Regional*)

QoL – Quality of Life

RLP – Residential Lease Program (*PAR – Programa de Arrendamento Residencial*)

RS – State of Rio Grande do Sul

SLR – Systematic literature review

SMAMUS – Municipal Department of Environment, Urbanism and Sustainability (*Secretaria Municipal de Meio Ambiente, Urbanismo e Sustentabilidade*)

SMC – Municipal Department for Culture (*Secretaria Municipal da Cultura*)

SMPAE – Municipal Planning Department (*Secretaria Municipal de Planejamento e Assuntos Estratégicos*)

SMSUrb – Municipal Department of Urban Services *(Secretaria Municipal de Serviços Urbanos*)

SNIS – National Sanitation Information System (*Sistema Nacional de Informações sobre Saneamento*)

UFRGS – Federal University of Rio Grande do Sul (*Universidade Federal do Rio Grande do Sul*)

UK – United Kingdom

Unicamp – State University of Campinas

UFRJ – Federal University of Rio de Janeiro

UFC – Federal University of Ceara

UFBA – Federal University of Bahia

USP – University of Sao Paulo

UFPR – Federal University of Parana

UEL – State University of Londrina, Parana

UFMG – Federal University of Minas Gerais

UFSCAR – Federal University of Sao Carlos, Sao Paulo

UFAL – Federal University of Alagoas

WHO – World Health Organization

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1 INTRODUCTION

This introductory Chapter presents the research motivation, background, and the research problem, where the knowledge gap is discussed based on the literature in the area. The research questions, aims and delimitation are then presented, and, finally, the structure of the study is briefly described.

1.1 MOTIVATION

The motivation for the development of this study has its origin in the researcher's participation in the Research Project entitled "Evaluation of the My House My Life Programme (*Programa Minha Casa Minha Vida*): users' perception of value in relation to design, urban integration, and constructive quality of buildings[1]" (School of Engineering – *Universidade Federal do Rio Grande do Sul*/UFRGS). On that occasion (2014 and 2015), it was possible to identify some current housing policies inconsistencies such as houses far from urban centres, located in unsafe neighbourhoods, and with insufficient urban infrastructure and public services, and the consequent lack of identification and appropriation of the spaces by the residents.

Additionally, this thesis project, entitled "Urban Quality of Life: Multidimensional Evaluation in Porto Alegre, Brazil" is linked to an existing collaboration between UFRGS (and other Brazilian universities [2]) and the University of Huddersfield, United Kingdom (UK), established through the group "Global Interdisciplinary Centre (GIC) for Innovation and New Product Development in Architecture and the Built Environment: UK - Brazil Collaboration[3]". The global literature highlights the fact that social housing initiatives fail to deliver lasting benefits to society. Thus, this research group aims to operate as a collaborative international research network and focus on developing innovative theory and applied research, as well as increase research capacity through researchers' interaction and knowledge exchanges between countries. The Built Environment Uses and Evaluation (user satisfaction, perceived value in the cities, and the effects of the built environmental in health) and the Urban Sustainability (urban design and evaluation, urban indicators, and healthy urban living) are among the main research themes of the GIC, which focuses on Social Housing, Design and Health, and Sustainable Urban Development.

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[1] Under the coordination of Prof Carlos Torres Formoso.
[2] UFC; UFBA; UEL; UFRJ; Unicamp; IMED; UFSCAR; UFAL; USP; USP São Carlos; UFPR; and UFMG.
[3] https://research.hud.ac.uk/institutes-centres/idl/currentresearchprojects/gic/

As part of the project, I was awarded a PhD exchange scholarship at the University of Huddersfield, from November 2018 to May 2019[4]. In this period, a systematic literature review aiming to better understand the quality of life (QoL) definitions, assessments and indicators was made. An initial version of the method to evaluate QoL was also proposed. Thus, the main intended outcome of this thesis is to present elements related to the multidimensional assessment of urban QoL (objective and subjective dimensions), especially regarding the location of social housing in the urban centres.

1.2 RESEARCH BACKGROUND

The city is a product of many agents that modify it in a continuous process, as a symbolic structure that influences social practices. Thus, the images of different parts of the city are alive in people's memory and are associated with diverse meanings (Lynch, 1960, p. 1). However, the image of certain parts of the city exists only when linked to a social practice, because it is produced socially from the existence of social relationships that take place there. Hence, the symbolism of an urban space can be determined from the analysis of its social appropriation (Castells, 1983, p. 310). People naturally perceive their relative position in space and feel the need to identify with the places they live in and pass through. This sense of identification is associated to the perception of their position in relation to the surrounding space (Cullen, 1971, p. 10).

In this regard, urban centres usually concentrate good infrastructure and historical-cultural references that structure the memory of the whole city, encompassing images of different historical periods amidst contemporary activities that currently help to create the memory of future generations (Castello, 2007, p. 152). This memory is linked to basic references of the continuity of history, life, and culture of a particular community (Castello, 2007, p. 152). Central urban areas comprise a district, or a set of consolidated districts, articulated (or not) around the original nucleus of the city, which concentrates different activities and people (Brasil, 2005, p. 12). They are areas equipped with urban infrastructure, a stock of buildings, public services and equipment, neighbourhood services, and job opportunities (Brasil, 2005, p. 12). These aspects are fundamental when it comes to choosing the location of buildings for social housing as the permanence of their residents can be encouraged by housing located in secure and well-lit urban areas, that also attract people from other neighbourhoods (Jacobs,

[4] Under the supervision of Dr Ioanni Delsante and Prof Patricia Tzortzopoulos Fazenda

2011, p. 513). Therefore, houses must be connected to: (a) urban infrastructure, such as water and sanitation, electrical energy, paved and illuminated streets, urban drainage; and (b) urban services, such as public transportation, solid waste collection, education, and health (Maricato, 1998, p. 42).

However, the housing shortage is a global problem nowadays: there is a lack of affordable, secure, and adequate well-located urban housing estimated at 330 million units, equivalent to 1.2 billion people (King et al., 2017, p. 1). The estimated Brazilian housing deficit in 2019 was 5.876 million, of which 85.8% were in urban areas (5.044 million) (Fundação João Pinheiro, 2021, p. 113). Nevertheless, there were 6.07 million vacant housing units in 2010 (IBGE, 2010). It is also estimated that in 2019 the housing deficit in the metropolitan region of Porto Alegre was 90,585 units (Fundação João Pinheiro, 2021, p. 114). In this context, the renovation of public empty buildings to provide social housing seems to be a viable option, and it can also provide work opportunities for the local population (Mullins & Sacranie, 2014).

In Brazil, a considerable part of the population lives in precarious settlements mainly because of the intense urbanisation process, low family income, speculative appropriation of urbanized land, and inadequate housing policies (Plano Nacional de Habitação, 2009, p. 9). The National Housing Plan (*Plano Nacional de Habitação*), introduced by the Brazilian Federal Government in 2009, proposed long-term strategies for the housing sector, with the aim of universalising access to adequate housing for the low-income population (Plano Nacional de Habitação, 2009, p. 9).

As a result, the Federal Government created the My House My Life Programme (MHML) in 2009, facilitating the purchase of housing through subsidies associated (or not) with the granting of credit (Brasil, 2013). It consists of a set of federal government measures provided for in Law 11,977 (June 2009), modified by Provisional Measure No. 510/2010, and converted into Law 12,424 (June 2011) (Ramos & Noia, 2016, p. 87). The programme aimed to meet the housing needs of the low-income population through land acquisitions, construction, and renovation of existing properties (Brasil, 2013). It was managed by the Ministry of Cities and operated by the Brazilian Federal Savings Bank, the *Caixa Econômica Federal* (CAIXA), which was also responsible for contracting the construction companies to carry out the projects (Brasil, 2013). In view of the economic global crisis scenario in 2008, these series of incentives for housing production and the expansion of the formal housing

market also aimed to promote the generation of jobs and economic growth (Brasil, 2013). By September 2020, 5,157,347 housing units had been delivered (Sishab, 2021[5]). Since August 2020, financing operations have been part of the *Casa Verde e Amarela* Programme, pursuant to Law 14.118/2021.

However, despite making federal resources available for the operationalization of the programme, the Federal Government transferred to the construction companies the task of developing the housing projects and the decision-making power (Nascimento & Braga, 2009, p. 107). Hence, the construction sector has defined technical, environmental, and quality aspects with a focus on financial profit (Nascimento & Braga, 2009, p. 107). In fact, the MHML Programme processes have often ignored the urban space (Maricato, 2015, p. 37). MHML Programme has also allowed private companies to decide the location of the land acquired for social housing, as well as important aspects related to the architectural design project. Thus, aiming to maximize profit, standardised buildings have been built, located in the outskirts of cities, where land is cheaper (Rolnik, 2015, p. 310), but health, education and culture facilities are scarce. This situation, added to the lack of public transportation, keeps its inhabitants isolated, especially young people, which increases tendency to urban violence (Maricato, 2015, p. 45). Therefore, quality of life seems to be negatively affected.

The Porto Alegre Master Plan for Environmental Urban Development (*Plano Diretor de Desenvolvimento Urbano Ambiental* - PDDUA) (2010, p. 36) establishes that housing must be provided with basic infrastructure, urban services, and community facilities. Thus, social housing aims to consolidate the right to quality of life standards and to provide access to urban and community public facilities, circulation and transport, urban cleaning, adequate physical housing conditions, and inclusion within the city's boundaries (PDDUA, 2010, p. 36). In this respect, permanence in the place of residence can be encouraged by housing integrated into a consolidated urban area and located in safe, diverse, and vibrant places (Jacobs, 2011, p. 513) as a study developed by Miron and Formoso (2010) stresses in a social housing project located in the central area of Porto Alegre (POA), state of Rio Grande do Sul (RS), Southern Brazil. This study shows that the attributes related to urban infrastructure and urban services presented the highest level of satisfaction among residents: more than 70% of the residents were satisfied with them (Miron & Formoso, 2010).

[5] http://sishab.mdr.gov.br/

In an attempt to improve the MHML programme, the National Housing Secretariat of the Ministry of Cities presented a study that aims to improve the location of housing projects (Brasil, 2017). Through estimated results from 3 hypothetical scenarios in different locations of a city (the first in the centre; the second 4 km from the centre; and the third 10 km from the centre), a *calculation of additional public expenditures* was presented, considering the provision of infrastructure, urban mobility and access to basic services, as well as their impacts on cities and municipal administrations over time (Brasil, 2017). The results showed that locating houses in consolidated urban areas (already equipped with infrastructure) generates savings for the local government, both at the time of implementation of the housing project and over time. In addition to improving access to services and opportunities in cities, it also represents gains for the residents' quality of life (Brasil, 2017, p. 43).

1.3 RESEARCH PROBLEM

Considering the research background presented in the previous section, convert under-utilised land and vacant buildings to affordable housing is an opportunity (King et al., 2017, p. 4) but also a challenge in order to manage this process. In fact, the stock of existing buildings, as well as related activities, has not been systematically analysed (Kohler & Hassler, 2002). Interventions in existing buildings are characterised as complex socio-technical projects (Saurin et al., 2013). Sometimes, due to the lack of an original design project, many interventions emerge after the initial diagnosis, so the execution stage requires design adjustments, generating a context of uncertainty (Oliveira et al., 2016). Among the main challenges, there is the lack of interest of private companies, due to the higher cost in recovering old structures (Bonates, 2008). Thus, it is necessary to expand the modalities of housing financing for the renovation of existing buildings located in consolidated urban spaces, especially in the urban centres, which can be used for low-income housing (Rolnik & Nakano, 2009, p. 2).

In Brazil, the housing policy Residential Lease Programme (RLP, *Programa de Arrendamento Residencial/PAR*), launched as Interim Measure 1,823, in 1999, and converted into Law 10,188, in 2001, was aimed at the low-income population, who lease the property for 15 years and have the option to purchase at the end of the contract (IPEA, 2007, p. 292). It is made available to people with a monthly family income of up to BRL 1,800.00, or BRL

2,400.00[6], in special cases, in large urban centres (Ministério de Desenvolvimento Regional[7], 2011). RLP was financed by the CAIXA in the form of leases between 1999 and 2009, the year in which the MHML Programme was created, which has included the RLP, as well as other Government programmes (Brito et al., 2011, p. 153). RLP offers the lease of the houses for 15 years, with a purchase option at the end of this period (Ministério de Desenvolvimento Regional, 2011), and while the purchase does not take place, the CAIXA remains the owner of the property (Bonatto, 2010). It has promoted urban renewal through the renovation of a few abandoned buildings for social housing in central urban areas (Bonates, 2008).

The renovation and conservation of old buildings can improve the urban space in a broader way (Projeto Reabilita, 2007, p. 122). The renovation of buildings for social housing in central areas can potentially contribute to improving QoL, due to the availability of public services and urban infrastructure in these consolidated urban areas. It should promote housing improvement for the low-income population: enhancing conditions of a given place but also preserving its original socio-cultural and environmental characteristics (Brasil, 2005). Moreover, it can potentially generate benefits to the urban centres since, despite the higher initial cost of implementation, it saves on infrastructure and urban mobility and contributes to the revitalization and appropriation of central urban areas.

Some countries have been dealing with housing renovation projects for some time now. Studies in New Zealand point out that the renovation of existing buildings has reduced national average costs to sustain housing services by 15% (Johnstone, 2001). In Europe, traditionally, two main aspects have driven research on building stock: research related to social housing, and interest in preserving the cultural heritage (Kohler & Hassler, 2002). Kemmer and Koskela (2014) identified some management practices for intervention in existing buildings, based on a study carried out within housing associations (non-profit organizations that aim to provide low-cost housing) in the UK: (a) providing more detailed designs to avoid revisions and disruptions; and (b) reducing the total execution time from the best sequencing and estimating time of each stage, which can be standardised.

However, these studies do not directly address the urban benefits of the renovation of these buildings nor the impact on the urban QoL. Most of the existing studies are too focused on improving production performance and control, and on construction cost and technologies

[6] USD 325.49 or USD 433.98 (on 18 November, 2021).
[7] https://www.gov.br/mdr/pt-br

(Anjaneyulu et al., 2004; Bonates, 2008; Brito et al., 2011; Chau et al., 2003; Galvão et al., 2015; Johnstone, 2001; Kemmer, 2018; Kemmer & Koskela, 2014). In addition, as the social-cultural environment has great influence on QoL perception, as well as the built environment and, ultimately, the location to be considered (Massam, 2002), the way that house is acquired might influence the appropriation of urban space and the QoL perception.

Quality of life (QoL), in turn, is a wide-ranging concept that can be approached more broadly, from an assessment of a given society's living conditions, to a more specific assessment of the living conditions of individuals, groups (Felce & Perry, 1995, p. 51), and neighbourhoods. QoL has been used to summarise aspects of the complex economic, social and environmental features of modern society (Abbate et al., 2001, p. 276). It can be considered a sum of the economic, environmental, scientific-cultural, and political conditions collectively constructed and made available to individuals so they can achieve personal fulfilment (Herculano, 1998). Different studies have reflected such conceptual variation (Felce & Perry, 1995, p. 51), so this is an important discussion in this research. Historically, the concept of QoL is linked to the ideas of social well-being, environmental quality, poverty, social inequalities, social exclusion, social vulnerability, sustainable development, and sustainability (Nahas et al., 2016, p. 2). Therefore, QoL indicators should be formulated from these approaches since social indicators aim to reveal aspects not captured by a strictly economic approach (Nahas et al., 2016, p. 2).

From the 1970s onwards, the global concern with the environment has increased, especially due to the accelerated urbanisation process of cities in developing countries and their socio-environmental problems (Nahas et al., 2016, p. 2). Hence the need to evaluate the *urban quality of life* is directly related to this phenomenon. Nahas et al. (2016, p. 3) points out the importance of three fundamental elements in the assessment of urban QoL: (a) equity of access (social and spatial) of the population to urban resources; (b) quality of the urban environment; and (c) sustainability of urban development (concern for future generations). Consequently, monitoring and evaluation of urban performance through indicators is fundamental to improve urban QoL (Alibegović & Villa, 2008, p. 64). The use of urban indicators can be a learning, communication, and management tool for different users such as local government, citizens, researchers, and the private sector (Alibegović & Villa, 2008, p. 66) and can support the identification of social inequalities deriving from different levels of the satisfaction of needs and will provide a background for the elaboration of strategies to improve well-being (Mora, 1997, p. 66), such as public policies for local development.

However, QoL should not be studied only in its numerical or quantitative standards (objective dimension) (Abbate et al., 2001, p. 277). It is necessary to investigate the level of people's satisfaction regarding personal relationships and self-realisation, that is, a more subjective dimension, which goes beyond the material conditions of life (Abbate et al., 2001, p. 276). Moreover, the experience produced in the interaction process of the user ("observer") with the urban environment, which is considered a complex social organism, also affects QoL (Rheingantz, 1990, p. 13). QoL is thus determined by the interaction between life conditions (objective dimension) and personal life satisfaction (subjective dimension) weighted by individual's perception (Felce & Perry, 1995, p. 58).

Measuring QoL requires a multidimensional range of indicators, that is, several dimensions that should be considered simultaneously, and a single metric that should allow simple aggregation across dimensions (Stiglitz, 2009, p. 144; Ülengin et al. 2001, p. 362), that is, a QoL index. The measures of a single dimension (such as per capita Gross National Product) are too limited to fully capture QoL, hence its ideal measure should consider a set of measurable attributes that can be weighted by a specific metric, including subjective as well as objective dimensions (Zhu, 2001, p. 263). Thus, a key step in implementing any multidimensional measure is to select a set of dimensions to be considered (Ravallion, 2011, p. 5). Hence, the concept of QoL is broader than material aspects, economic production, or living standards: it is a multidimensional concept as it includes a variety of factors that people value in life (Rogge & Van Nijverseel, 2019, p. 766).

In this respect, recent studies point to the users' value perception as an important source of evidence in the evaluation of social housing projects and their location in the city (Bonatto, 2010; Bonatto et al., 2011; Brito et al., 2011; Delsante & Miron, 2017; Formoso & Miron, 2008, 2017; Granja et al., 2009; Kowaltowski et al.; 2006; Kowaltowski et al., 2013; Marques, 2015; Miron, 2008; Monteiro, 2015, 2020). In fact, a series of studies have been carried out in this area, evolving from the evaluation of social housing projects (Miron, 2008), to the evaluation of a neighbourhood improvement programme (Miron & Formoso, 2010), in order to propose a value evaluation method based on the perception of users (Monteiro, 2015), to understand value generation in complex urban regeneration projects (Formoso & Miron, 2017), to analyse urban growth, regeneration and social inclusion (Delsante & Miron, 2017), and to assess the QoL on the neighbourhood scale (Monteiro, 2020).

Value perception can be understood as a comparative evaluation between benefits, which includes satisfaction in use, and inconveniences (sacrifices) that are perceived in relation to the built environment (Thomson et al., 2003) while experiencing the city. The built environment, in turn, can be defined as the facilities built by human beings in a defined space, and their interactions with the surrounding environment, society, and the community as a whole (Anjaneyulo et al., 2004, p. 75). The perception of value, therefore, seems to be able to contribute to the assessment of the urban QoL, considering the importance of including its subjective dimensions, that is, the assessment of a multidimensional urban QoL (objective and subjective QoL).

Therefore, as a research gap, it seems fundamental to understand other aspects related to the multidimensional assessment of urban QoL on the neighbourhood scale, especially regarding the urban integration of social housing, and the benefits generated to the urban centres, thus contributing to the improvement of future projects and housing policies. Urban integration can be understood as the way that single-family or multi-family housing units are articulated in the urban space, considering their location, their adequacy to the topography, their connections with infrastructure, and the provision of public services (Abiko & Ornstein, 2002, p. 9).

Furthermore, people's needs should be significant in urban development proposals, including aspects related to vitality, safety, sustainability, and health (Gehl, 2013, p. 6). In this respect, architecture and urbanism practice should seek to better understand the renovation of buildings for social housing. It is necessary to make an in-depth evaluation of social housing projects, also considering urban aspects and those related to their implementation (Abiko & Ornstein, 2002, p. 5). This assessment can indicate the paths to be followed in new projects, through a continuous feedback process (Abiko & Ornstein, 2002, p. 5). Therefore, studies are needed to deepen knowledge in this context and to identify benefits for the cities and their users (Kohler & Hassler, 2002).

From the above, a research problem to be investigated can be identified, represented by the need to assess the impact of the built environment (aspects of the neighbourhood and housing environment) on the QoL of its residents, and by the lack of an instrument to assess the urban QoL that combines objective indicators and the perception of users (subjective indicators). Thus, new contributions in proposing multidimensional methods to assess the urban QoL, including both objective and subjective dimensions, especially in the context of renovated

buildings for social housing in urban centres, are needed. It seems necessary to identify, analyse, and evaluate the urban factors that impact quality of life and social development (social policies on housing, education, health, leisure, culture, and public transport) (Martucci & Basso, 2002, p. 289) to support QoL and housing research, as well as housing policies.

1.4 RESEARCH QUESTIONS

Based on the presented research problem, the following research question is proposed: *How to evaluate the QoL in the context of the renovation of buildings for social housing in urban centres?*

The following secondary questions originated from the main research question to help in the development of the study:

a) How to measure the urban QoL?

b) How to consider the users' perceptions in this evaluation?

1.5 RESEARCH AIMS

The aim of this study is to *propose a multidimensional method to evaluate the urban QoL in the context of the renovation of buildings for social housing.*

The specific research aims are:

a) To propose a set of QoL indicators, considering the context of urban centres.

b) To propose the inclusion of the users' perceptions in the assessment of the urban QoL (subjective QoL indicators).

1.6 RESEARCH DELIMITATION

This research delimitations are as follows:

a) The QoL assessment method developed in this study was applied to residents of renovated buildings for social housing in the central area of Porto Alegre, specifically in the Historic Centre and the Floresta district. This delimitation was performed with

the aim of evaluating the QoL in this context. It is understood that the method structured in this research can contribute to the identification of strengths and weaknesses in this context, to assist decision making for possible interventions that will promote the quality of life of social housing residents;

b) In addition, the method proposed in this research includes a set of QoL dimensions and indicators selected according to the local urban context, in the central area of POA. Thus, the method must be adapted when applied to other urban contexts; and

c) Another important delimitation of the research is its development in the context of the COVID-19 pandemic, which imposed social restrictions from March 2020 in Brazil, the year planned for data collection with residents in the central area of POA. Thus, there were many restrictions to access residents, and interviews were adapted to digital format due to the impossibility of conducting in-depth interviews.

1.7 SUMMARY OF THE RESEARCH OUTLINE

Design Science Research is the methodological approach adopted in this study as it aims to propose a QoL evaluation method in the context of the renovation of buildings for social housing in urban centres. Thus, data collection was made with residents of four renovated buildings for social housing in the central area of Porto Alegre.

The literature review was made at different moments throughout the study. The research outline includes three main stages: comprehension, development, and analysis. These three stages had three cycles of repetition throughout the development of the study, characterising Stages 1, 2 and 3:

a) *Stage 1* focuses on the theoretical and practical understanding of the research problem. It includes a systematic literature review aiming to better understand QoL definitions, QoL assessment, and QoL indicators. Its results are presented in Section 3. By the end of the systematic literature review, a first version of the method to evaluate QoL was proposed. This stage was partially carried out during the PhD scholarship period at the University of Huddersfield, United Kingdom (from November 2018 to May 2019);

a) *Stage 2* focuses on the proposal of the data collection protocol and data collection with social housing residents of four buildings in the central area of POA – *20 de*

Novembro Settlement (Floresta district), Autonomous Community Utopia e Luta (Historic Centre), Sul América Building (Historic Centre), and *Bento Gonçalves Building (Historic Centre)* – to identify their QoL perception of living in a central urban area, that is, their subjective QoL. The subjective data analysis and the QoL assessment method validation were also carried out, with specialists from PROPUR/UFRGS; and

b) *Stage 3* focuses on the QoL assessment method refinement, subjective QoL index proposal, multidimensional subjective QoL analysis, and the identification of objective QoL indicators (from census, administrative data, and local observations). The comparison between the subjective and objective indicators of QoL was then made. Finally, after data analysis, the final version of the QoL evaluation method was proposed and assessed, based on its utility and applicability.

1.8 THESIS CONTENT

This thesis is structured into six chapters. This introductory chapter presents the origins of this study and its initial motivation, as well as the research background and problem, that is, the identified knowledge gap. From this discussion, the research aims are presented.

Chapter 2 and 3 present the literature review. Chapter 2 discusses aspects related to the renovation of buildings for social housing in urban centres as an opportunity that benefits cities and people, enhancing QoL. It also presents the concept of value perception and its relation to the QoL evaluation. In Chapter 3, a systematic literature review on QoL concepts and existing methods to assess QoL is presented. Then QoL concepts, evaluation methods, and the main indicators are discussed and proposed.

Chapter 4 presents the research method. Initially, the Design Science Research and its framework are described. Based on this, its steps are detailed, and a research timetable is presented. A conceptual framework with the QoL indicators is also presented. These are the basis of the questionnaire presented in Appendix 2. Moreover, the case studies of this research area described, four social housing buildings in the urban centre of Porto Alegre (POA), Brazil: (a) 20 de Novembro Squat; (b) Autonomous Community Utopia e Luta; (c) Sul América Building; and (d) Bento Gonçalves Building.

Chapter 5 presents the research results, including the proposal of the multidimensional urban QoL evaluation method, which includes three main steps: preparation for the evaluation; evaluation; and communication of results and discussion. This chapter also presents the results of the application of the method with residents of four social housing buildings in the urban centre of POA, the proposal of a subjective QoL index, and an analysis between the subjective and the objective dimensions of QoL. Finally, the assessment of the proposed multidimensional urban QoL method with public managers is carried out, and the final version of the method is presented.

Chapter 6 presents the main conclusions and theoretical contribution of this study, as well as the main results. Finally, in order to contribute to research on the urban quality of life, suggestions for future research are indicated.

2 SOCIAL HOUSING AND VACANT BUILDINGS IN URBAN CENTRES: AN OPPORTUNITY

This chapter discusses the renovation of buildings for social housing in urban centres as an opportunity that benefits cities and people, enhancing urban QoL. It concludes with a discussion of the value perception concept as an approach to assess QoL in this context.

2.1 SOCIAL HOUSING IN BRAZILIAN URBAN CENTRES

Dimensions, distances, different construction periods and dwellers are important elements of identity and legibility of contemporary cities (Secchi & Pedro, 2006, p. 90). In fact, the city is a privileged place for the coexistence of different cultures, people, public equipment, architectural languages, activities, among other elements (Secchi & Pedro, 2006, p. 90). Jane Jacobs (2011, p. 14) highlights the good social indicators and the atmosphere of well-being in areas where diversity exists, with a range of uses providing a mutual and continuous support between them and the maintenance of the original activities of each place generating positive and complementary social-economic interactions, contributing to vibrancy and safety in public spaces (Jacobs, 2011, p. 19).

Moreover, urban spaces are not only passive scenarios where culture expresses itself but are rather active agents produced and appropriated by people under certain social relations (Maricato, 1998, p. 42). The diversity of uses on city sidewalks and improvised, but continuous, activities guarantee the liveliness of the streets and generates the interest of people, being an invitation to the appropriation of public spaces. Jacobs (2011, p. 66, p. 196) points out some of the conditions that produce urban diversity and generate economically efficient uses, enhancing local characteristics: (a) a diversified mixture of uses; (b) small blocks, which facilitate people's mobility; (c) the preservation of old buildings amid new buildings; and (d) a large concentration of people. These characteristics, although sometimes not being potentially used, are present in the urban centres of several Brazilian cities such as the central area of POA.

Conversely, there are critical problems related to social segregation in large cities such as richer people living in neighbourhoods surrounded by walls, and poor people living in peripheral areas of the city and excluded by social development (Ascher, 2010, p. 73). Urban segregation derives from a dispute for locations between diverse social groups or classes,

which generates the organization of urban space into zones of strong internal social homogeneity, resulting in with strong social disparity between them and differentiated land prices (Villaça, 1998, p. 148). Hence, the attempt to redevelop the city through the proposal of low-income, standardized, and isolated housing complexes often generates centres of delinquency, vandalism, and social hopelessness (Jacobs, 2011, p. 6). Housing, understood in its broadest sense as part of the concept of "habitat", integrates the internal environment of the housing unit and the surrounding external environment, that is, all the elements that this urban space can offer (installed urban infrastructure and a network of urban services) (Martucci & Basso, 2002, p. 272). It is one of the important dimensions of the set of basic needs of individuals and families that public policy aims to meet (IPEA, 2007, p. 279).

Jacobs (2011, p. 353) points out that the current urban renewal laws, which transform informal settlements into housing complexes far from the original location, cause deprivation and social disintegration. Reversing the process of urban expansion can contribute to the reduction of social and spatial segregation, and it can improve the possibilities of integrating different income classes into the economy and urban life (Brasil, 2005, p. 9). The better equipped the urban sector in which the housing unit is located, the better the conditions for using the housing (Martucci & Basso, 2002, p. 272).

In Brazil, the problem of housing as a social issue arose at the end of the 19th century, after the abolition of slavery, when urban growth increased, and the main Brazilian cities became denser (Maricato, 1998, p. 31). Subsequently, the rural exodus, leveraged by job hunting in the large Brazilian cities during the period of greater industrialization after 1930, also contributed to urban growth (Maricato, 1998, p. 35). The more concentrated urbanization process of the 20th century played a decisive role in increasing the growth of informal settlements (Abramo, 2007, p. 27). Faced with high rental prices, irregular housing, and self-construction of informal housing in urban peripheries became housing options for migrants. This expansion, however, was not accompanied by urbanization (paving, water, sewage, lighting, etc.) (Maricato, 1998, p. 35). Thus, the "logic of necessity" drove the process of popular occupation of urban land at the beginning of the 20th century, and, after the rapid urbanization of the 1950s, it became the main way of access for the poor to urban land in many Latin American countries (Abramo, 2007, p. 27).

Between 1964 and 1986, the Brazilian government helped to finance 4 million homes, implemented by the National Bank of Housing (*Banco Nacional da Habitação*) through the

Housing Financial System (*Sistema Financeiro da Habitação*) (Rolnik, 2015, p. 281). Thus, impersonal, and low-quality housing complexes, which isolated people on the outskirts of cities, caused a profound transformation of the urban space (Maricato, 1998, p. 48). Additionally, the difficulty of urban mobility kept its residents, especially young people, in a kind of isolation, which increased urban violence (Maricato, 2015, p. 45). In 1986, the National Bank of Housing was wound up by presidential decree, and its functions were transferred to the Brazilian Federal Savings Bank CAIXA (IPEA, 2007, p. 282).

The world became predominantly urban from the beginning of the 21st century, bringing new characteristics to society, such as the increase in poverty (Maricato, 2015, p. 17). The decline of Brazilian economic growth and the retraction of public investment in social policies between 1980 and the beginning of the 21st century resulted in the negligence of three structural urban public policies: transportation, housing, and sanitation (Maricato, 2015, p. 29). Between 1980 and 2010, the homicide rate, which is one of the indicators that shows this negligence, increased 259% in Brazil (Maricato, 2015, p. 29). Conversely, home ownership can contribute to well-being by inducing social stability, greater involvement of individuals in communities, and desirable social behaviour in adults and young people (IPEA, 2007, p. 279).

The social housing policy is justified by the following factors: (a) family spending on rents determines the consumption of other goods necessary for their survival; (b) housing is not only the physical structure of the property, it also represents the choice of the family for the community where it is situated, due to the proximity of work, schools, markets and other public and private structures; and (c) the social character of housing, which justifies that, despite being a private good, it is financed for a certain segment of the population by taxes paid by the entire population of the country (IPEA, 2007, p. 279). From 1995 to 2001, based on the aims of the National Housing Policy (*Política Nacional de Habitação*), in particular universal access to housing, the main programmes of the current housing policy were created in Brazil: Letter of Credit, Housing Production Support Programme, Pro-Housing, Live Brazil, Residential Lease Programme (*Carta de Crédito, Programa de Apoio à Produção de Habitação, Pró-Moradia, Habitar Brasil, Programa de Arrendamento Residencial/PAR*) (IPEA, 2007, p.283).

More recently, the Federal Law n.10.257/2001 (City Statute - *Estatuto da Cidade*), which was created to regulate the Urban Policy chapter of the Federal Constitution (1988), can be considered a legal milestone that give new directions to the Brazilian housing policies (Ramos

& Noia, 2016, p. 79). The Brazilian Federal Constitution (1988), in its Article 6, included housing among the basic social rights, providing for the promotion of housing and basic sanitation programmes by the three levels of government (federal, state and municipal) (Morais, 2002, p. 109). Law n.10.257/2001 requires municipalities to plan the occupation of urban land with buildings that meet the social function of property and structures that further better living conditions in cities (Ramos & Noia, 2016, p. 80). Since then, municipal governments have gained more management power over urban policy, especially over the rules for organizing the use of urban land through the Master Plan, a requirement for all municipalities with more than 20,000 inhabitants (IPEA, 2007, p. 283).

Furthermore, the creation of a set of entities, such as the Ministry of Cities (*Ministério das Cidades*), in 2003, and the national secretariats for housing, urban mobility and environmental sanitation have collaborated with urban development in Brazil (Maricato, 2015, p. 35). Furthermore, in 2007, the federal government launched the Growth Acceleration Programme (*Programa de Aceleração do Crescimento*), focused on infrastructure projects, and in 2009, as previously mentioned, the MHML Programme, a social housing programme.

Housing costs and income determine the level of well-being of the majority of the Brazilian population. Housing is the largest item of family expenditure and therefore is a determining factor in spending on food, health, education and leisure (IPEA, 2007, p. 280). Thus, a vulnerable family can be defined as one that does not have enough income to cover the costs of housing and other goods necessary for the minimum level of adequate consumption (IPEA, 2007, p. 280). This is reflected in Brazil's high housing deficit, estimated at 5.876 million in 2019 (Fundação João Pinheiro, 2021, p. 113).

The main component of the housing deficit in Brazil in 2019 was the excessive burden of urban rent (Fundação João Pinheiro, 2021, p. 118). In all, 3.035 million households, whose household income was less than three minimum wages, used more than 30% of it on rent, which represents 51.7% of the country's total deficit (Fundação João Pinheiro, 2021, p. 118). Then came precarious housing, with 1.482 million units, which corresponds to 25.2% of the deficit, and, finally, cohabitation, with 1.358 million homes, equivalent to 23.1% of the total deficit (Fundação João Pinheiro, 2021, p. 118). Between 2016 (5.657 million) and 2019 (5.876 million), there was an increase of 1.3% in the indicator (Fundação João Pinheiro, 2021, p. 146).

The MHML Programme made very significant resources available in housing production and established direct and explicit subsidy mechanisms, as proposed by the National Housing Policy, expanding the service to income groups previously served in a restricted manner (Krause et al., 2013, p. 45). Despite this, the housing conditions of the Brazilian population are still quite precarious, especially among the poorer classes. In the MHML Programme, the urban space was disregarded in a broader way (Maricato, 2015, p. 37), similar to what happened in the Housing Financial System between 1964 and 1986. It does not seem to change the geography that explains the process of Brazilian urbanization, that is, the settlement of the poorest people in the distant outskirts of cities, with the individual burden of obtaining the other means for the reproduction of life (public equipment, accessibility, work opportunities, leisure, etc.) (Krause et al., 2013, p. 48). Such considerations are important to understand the current situation of social housing in Brazil and its historical evolution.

In a country of continental dimensions, with deep regional, social, economic differences and enormous cultural diversity, in the MHML Programme, sometimes the different Brazilian realities were not considered to better face the housing deficit (Krause et al., 2013, p. 46). It was created with the purpose of generating housing demand and boosting the financial market, without proposing a solution to the problem of socio-spatial segregation and the issue of land, which represent obstacles to Brazilian urban policy (Ferreira et al., 2019). Many of these problems are related to, on the one hand, the supporting role currently played by the government (a mere facilitator of private actions), and, on the other hand, the leading role played by the private sector in land purchase decisions, and, consequently, in defining the location of projects (Aguiar, 2014, p. 30). This can be identified in the standardization of housing units (companies' interests in order to rationalize the proposition of projects), in the disregard of the specificities of different cities, in the low connection with housing needs, and in the location of houses in places without the minimum urban conditions (Krause et al.,2013, p. 47).

Hence, it seems fundamental to rescue the role of the government as a driver in the implementation of MHML projects since the prevailing pattern of housing location that has been adopted – in distant locations with insufficient infrastructure and lack of urban equipment – reinforces the segregated city model (Aguiar, 2014, p. 30). Likewise, it is necessary to examine the MHML's own focus on its target audience, especially the lower-income population, in order to measure the degree to which the programme serves the population in a situation of housing deficit, as well as the sustainability of the projects

produced, to be evidenced, for example, by the adequate location in the city, and by the permanence and socioeconomic integration of the families (Krause et al., 2013, p. 48). In this regard, the renovation of underutilized buildings in central urban areas, as well as a better understanding of buildings renovation for social housing, can contribute to Brazilian housing policies.

2.2 RENOVATION OF BUILDINGS IN URBAN CENTRES

Urban revitalization can be understood as the process to reverse the decline in urban centres, characterized by continuing population loss, higher levels of poverty, increasing unemployment, declining environmental quality, and the overall physical deterioration of the existing physical infrastructure (Anjaneyulu et al., 2004, p. 76). It should meet the overall collective neighbourhood objectives by improving QoL, considering social, economic, political, and cultural factors (Anjaneyulu et al., 2004, p. 76). In this regard, the renovation of the existing building stock is an alternative to meet the demand for housing and commercial development (Anjaneyulu et al., 2004, p. 78).

There is great potential in recovering the abandoned buildings, and converting them into marketable uses that can attract people back to historically significant urban centres (Anjaneyulu et al., 2004, p. 75). The renovation of vacant buildings for social housing, a practice adopted in the UK and in several European countries, contributes to the revitalization of urban spaces, mainly in central areas, aiming to keep the local population (Projeto Reabilita, 2007). Likewise, the revitalization of the central areas contributes to the preservation of the existing heritage, giving uses to these buildings and improving living experiences in central areas (Projeto Reabilita, 2007).

The study of Anjaneyulu et al. (2004, p.79) highlights the housing need and opportunity for the existing building stock revitalization in several cities in the USA such as Detroit and New York. Despite the high cost of recovering some old buildings, the need for housing, the ageing building stock, and the decline of some urban centres, there are calls for measures to achieve sustained economic growth to support this revitalization (Anjaneyulu et al., 2004, p. 79). The study shows, however, that despite the higher initial cost in the renovation of existing buildings, this is offset by the positive impact on the surrounding urban revitalization, adding new resources that promote the rebirth of the declining inner city (Anjaneyulu et al., 2004, p. 83). In addition, it gives a new aesthetic to the declining urban centre, thereby inviting new

residents to the neighbourhood, which can represent an increase in usage of the available infrastructure and services, such as transportation networks, and recreational and cultural centres (Anjaneyulu et al., 2004, p.84).

The housing deficit in Brazil mainly affects families with incomes of less than five minimum wages. The renovation of empty buildings in central urban areas contributes to the inclusion of these people in the formal city, provided with all infrastructure and workplaces (Brasil, 2005, p. 9). These families can also save on transportation, have greater access to urban services (schools, medical centres, day-care centres, etc.) and make time, previously spent on long bus trips to the outskirts of cities, available for other activities such as recreation (Brasil, 2005, p. 9). The renovation of the vast number of empty buildings, therefore, is an opportunity for the recovery of the cultural, leisure, commercial, and housing vocation (Brasil, 2005, p. 9). According to the Municipal Social Housing Plan[8] (2009), developed by the POA Municipal Housing Department, the aim of the municipality's housing policy is to provide access to land and housing in the urban context, including basic infrastructure and community services. The location of social housing in consolidated urban areas avoids the expansion or adaptation of roads, as well as the extension and reinforcement of public transport lines and also saves on local public expenses over time with the operation and maintenance of new structures (Ministério das Cidades, 2017, p. 26).

Article 182 of the Brazilian Federal Constitution (1988), which aims at stimulating the development of the city's social functions and guaranteeing the well-being of its inhabitants, encourages the adequate use of undeveloped or underutilized urban land. Describing the central area of São Paulo, Brazil, Maricato (2015, p. 61) highlights its potentialities such as the availability of public transportation, more job offers, and the existence of museums, universities, health facilities, governmental organizations, in fact, a social patrimony made up of years of public and private investment.

In the post-occupation evaluation study carried out by Galvão and Ornstein (2016), in a renovated building in the central area of São Paulo, more than 80% of the interviewees were satisfied with the external appearance of the building and the security to prevent the entrance of strangers and thefts. Residents pointed to the following aspects as benefits of living in a central urban area: proximity to the urban services (45% of respondents) and ease of access and availability of public transportation (33% of respondents). Consequently, only 54% of the

[8] http://lproweb.procempa.com.br/pmpa/prefpoa/demhab/usu_doc/diagnstico_porto_alegre.pdf

residents own vehicles. Moreover, 19% perceive no disadvantage in living in the centre. However, the main disadvantage was related to pollution, dirt, the presence of homeless people on the streets, and urban violence (56% of respondents), factors that can be improved as a larger area receives the benefits of the renovation of buildings (Galvão & Ornstein, 2016).

In this regard, the study of Galvão et al. (2015), developed in the urban centre of São Paulo, presents a method for the analysis of older apartment buildings, diagnosing their strengths and limitations in adapting to both the Brazilian regulatory requirements, and the contemporary domestic demands. It includes aspects regarding the functionality, accessibility, comfort, fire safety, structural elements, installations, and location and relationship with the urban infrastructure (Galvão et al., 2015, p. 8-10). The method evaluates whether there are adequate urban services within a 400 m radius of the building (such as medical centre, fire department, laundromat, pharmacy, police station, restaurant, supermarket and post office), and within 800 m, areas that encourage the practice of physical activities, such as squares or parks, bus stops, and metro stations (Galvão et al., 2015, p. 10). However, discussions of the results were not extended, especially with regard to urban location.

Despite Brazil's high housing deficit (5.876 million in 2019), in 2010, there were 6.07 million vacant homes in Brazil (IBGE, 2010). Empty private households in POA in 1991, 2000 and 2010 were, respectively, 9.9%, 10.9% and 11.34% of total private households (IBGE, 2010). Despite being one of the lowest rates in the great Brazilian cities, it has been steadily increasing. Moreover, the housing deficit of POA in 2019 was 90,585 households (Fundação João Pinheiro, 2021, p. 16) while the total number of vacant homes was 98,343 (Fundação João Pinheiro, 2005). The urban population living in favelas increased 23.03%, from 10.53% (143,292 people) of the population in 2000 to 13.68% (192,843 people) in 2010 (IBGE, 2010). Likewise, the number of precarious dwellings increased from 37,480 in 2000 to 55,994 in 2010, representing an increase of 22.71%. However, only 0.10% (127 dwellings) are in the central area of the city (IBGE, 2010).

Deteriorating built environment factors such as a declining infrastructure and an old building stock can contribute to the outwards migration from urban centres (Anjaneyulu et al., 2004, p. 75). Although the central area of POA contains some degraded areas, and many people have gone to live in other neighbourhoods in recent years, it has maintained a number of residential zones and its cultural events. However, problems such as noise, visual and air pollution can be

pointed to as aspects that contribute to the migration of people to other areas of the city (Brasil, 2005).

In this context, the Residential Lease Programme (RLP) - Renovation (*Programa de Arrendamento Residencial – Reforma*) housing policy has stimulated urban revitalization and the restoration of historical sites through the renovation of old buildings for residential use. RLP, a federal programme created in 1999 through Provisional Measure 1823, converted into Law 10188 in 2001, aimed to produce housing units for the low-income population in urban centres with more than 100,000 inhabitants. RLP - Renovation, in turn, aimed to improve the habitability of buildings in the central area through the renovation of obsolete buildings that no longer meet the minimum housing requirements. The lease system included the payment of a monthly fee less than the rental rate normally charged in the neighbourhood. At the end of 15 years, families have the option of buying the housing unit (Brasil, 2004).

However, certain challenges can be pointed out in this process. From the perspective of the construction industry, it is simpler to build a new building than to recover an existing one as the renovation works involve a certain complexity (Maleronka, 2005, p. 62) that requires a better planned and controlled process. Additionally, the resources made available by the federal government were limited, offering a low profit margin for construction companies (Maleronka, 2005, p. 87). The main difficulties encountered for RLP implementation were: (a) most of buildings in central areas are private and expensive; (b) the inadequacy of the available buildings for such housing; and (c) the lack of interest of private companies, due to the high cost of recovering old structures (Bonates, 2008).

Although the amounts allocated are still quite low in relation to the demand, the RLP is well structured, showing a good performance in relation to the resources invested (IPEA, 2007, p. 292). Since the units built to be leased are kept as the fiduciary property of the CAIXA, which manages the programme, the builder does not bear the risk of sale (IPEA, 2007, p. 292). Another factor of the efficiency of the programme is that the planning of new units follows a demand previously identified in the cities, metropolitan regions, and cities with a population above 100,000 inhabitants, according to the resources allocated to each state of the Federation (IPEA, 2007, p. 292). The housing unit complies with the basic model proposed by CAIXA (minimum 37 m² of usable area), and the monthly lease fee is between BRL 100.00 and BRL

250.00[9] (IPEA, 2007, p. 292). The RLP offers good prospects for intervention in consolidated urban areas as it includes the possibility of renovating existing buildings for housing purposes (Maleronka, 2005, p. 2), thereby filling a historical gap in Brazilian housing and urban policies, contributing to the repopulation of urban centres, and reducing the segregation of the poorest in the outskirts of the city (Maleronka, 2005, p. 2).

In the specific context of POA, according to IBGE data, its urban centre lost a large number of people from 1991 (44,192 people) to 2000 (37,273 people), but recovered population in 2010 (39,602 people), despite not having returned to the original level of 1991. When analyzing the evolution of the stock of permanent private households from 2000 to 2010, it can be seen that the housing stock grew more than the population. In the centre, the situation was the opposite as the stock grew 3.1% while the population grew 6% (IBGE, 2010). According to IBGE data, the vacancy rate (vacant residential real estate stock) in the central area of POA was 16% in 2000 and 10% in 2010. POA is different to other Brazilian cities as its *old centre* is its *functional centre* (a location that concentrates the highest density of attractive activities and services), that is, it has a central urban area which stands out from the rest of the city (Cavalcanti et al., 2016, p. 10).

As presented in **Figure 1**, at least four abandoned buildings have been renovated for social housing under the RLP in the central area of POA (309 housing units) (CAIXA, 2008), between 2003 and 2009 : Sul América (Borges de Medeiros Avenue, 417, Historic Centre); Bento Gonçalves e Charrua (Avenida Senador Salgado Filho, 140, Historic Centre), Arachã (Avenida Senador Salgado Filho, 254, Historic Centre); and Umbu (Avenida Farrapos, 282, Floresta district). The RLP allowed for the renovation of privately owned buildings (either by the proposing construction company or not) and in properties owned by the government (Maleronka, 2005, p. 37).

[9] USD 43.29 and 108.22, considering the value of the US dollar as of December 2001 (USD 1.00 = BRL 2.31)

Figure 1 Four buildings renovated for social housing under the RLP - Renovation in the central area of POA (Source: Google Street View and the researcher, 2020)

The study developed by Leite (2005, p. 84) includes a satisfaction survey with residents of the Sul America building, one of the renovated buildings for social housing under the RLP in the central area of POA (also one of the buildings considered in this study). The focus of the study was to evaluate the housing units, but aspects related to the urban integration of the building in the Historic Centre (*Centro Histórico*) of POA emerged in the respondents' answers. The location of the building was identified as a positive aspect by 93% of respondents, who also highlighted the ease of getting around the city, the proximity of services, and the accessibility of public transport (Leite, 2005, p. 144). RLP was mentioned as a good opportunity by 33% of respondents, who highlighted the importance of revitalizing the urban centre, the ease of acquiring a home, and the lease price, which is lower than the average rental value of the district (Leite, 2005, p. 144). A negative point was that 38% of respondents indicated external noise as one of the aspects of greatest dissatisfaction, especially related to noise caused by taxi drivers, noise of people in the streets at night, and political demonstrations that take place on the Democratic Corner (corner of Avenida Borges de Medeiros and Rua Andradas), one of the busiest corners in the neighbourhood (Leite, 2005, p. 146). This study, however, does not clearly consider aspects related to the urban environment, nor aspects related to urban QoL.

The study developed by Bonatto (2010, p. 84), which proposes a model for evaluating social housing from the perception of end customers, has as one of the case studies the Utopia e Luta building (also one of the buildings included in this study). However, Bonatto's study does not clearly consider aspects related to the urban environment nor aspects related to urban QoL. Some positive perceptions, however, emerged in the interviews regarding the urban integration of the building in the Historic Centre of POA such as easy access to transport and urban equipment. Conversely, the presence of homeless people, dirt on the pavements, and the absence of nature were perceived as the most negative characteristics of the surroundings

(Bonatto, 2010, p. 90). Moreover, the noise of vehicles on the street was the negative characteristic most mentioned by the interviewees, which negatively impacts the well-being of residents within the housing units (Bonatto, 2010, p. 96).

The study developed by Brito (2009) – which analyses complaints made by residents during the use stage of RLP projects in the state of RS in order to provide feedback to the housing product development process – considered the perception of residents so as to add value to the buildings proposed in future projects and better satisfy the demands of the end customer (value perception). The results show that it is possible to analyze the complaints, and generate subsidies for designers, financing housing programme agents, executing companies, and companies managing the projects (Brito, 2009, p. 137). Thus, the perception of residents is an important source of evidence to be considered in the assessment of social housing, and, ultimately, in the assessment of the multidimensional QoL, as discussed in the next sections.

2.3 VALUE PERCEPTION AND THE BUILT ENVIRONMENT

A number of studies point to users' *value perception* as an important source of evidence in the evaluation of social housing projects (Brito, 2009; Hentschke, 2014; Hentschke et al., 2014; Marques, 2015) and their integration in the urban space (Bonatto, 2010; Bonatto et al., 2011; Formoso & Miron, 2009; Granja et al., 2009; Kowaltowski et al.; 2006; Kowaltowski et al., 2013; Miron, 2008; Monteiro, 2015), although the concept is still little explored on the neighbourhood scale (Silva, 2014), specially to assess QoL (Monteiro, 2020). These studies seek to understand the perception of value from marketing studies, from organizations that aim to generate and deliver value to their customers (Woodruff, 1997). In the studies on the built environment and urban QoL assessment, customers can be considered as users of the city and its habitants.

Value is an ambiguous (Salvatierra-Garrido et al., 2012) and complex concept (Drevland et al., 2018). It is influenced by several areas of knowledge, such as economics and psychology (Szafir-Goldstein & Toledo, 2001). In the marketing theory, the concept of value, often associated with perception, can be also designated as *customer value* (Woodall, 2003; Woodruff, 1997) and *perceived value* (Sánchez-Fernández & Iniesta-Bonillo, 2007), which is the value of something for the perceiver, thus, the evaluation of a product or service by someone depends on his/her values and previous knowledge (Drevland et al., 2018, p. 39). Woodruff (1997) presents a certain consensus when it comes to the definition of customer

value: (a) it is linked to the use of a product or a service; (b) it is not objectively defined, that is, it is subjectively perceived by people; and (c) this subjective perception includes a trade-off between what is received, such as quality and benefits, and what she or he gives up to acquire and use a product or service, such as price and other sacrifices (value = benefits/sacrifices) (Monroe, 1990).

According to Drevland et al. (2018, p. 38), value is the result of an evaluative judgment, based on previous knowledge, and on comparing two or more alternatives in a given context. Holbrook (2006, p. 5) defines the consumer value as an interactive experience, that is, an evaluation of a certain object (product, service, social cause, and so on) by a certain subject (customer, end user). Value is relative due to its comparative, personal, and situational nature (Holbrook, 1999). Hence, value is considered a subjective dimension (Drevland et al., 2018, p. 40). Other authors highlight the multidimensional nature of the value concept, in which a variety of aspects, such as perceived price, quality, benefits, and sacrifice, are considered (Babin et al., 1994; Holbrook, 1999; Mathwick et al., 2002).

As presented in **Figure 2**, Sánchez-Fernández and Iniesta-Bonillo (2007, p. 430) summarize the nature of customer value in two dominant approaches. On the one hand, the *one-dimensional perceived value,* which includes economic (price-based studies) (Monroe, 1990) and utilitarian aspects (means-end theory) (Gutman, 1982; Zeithaml, 1988). This approach can already be considered limited as perceived value is a broader and richer construct than a mere trade-off between "utility" and "price" (Sánchez-Fernández & Iniesta-Bonillo, 2007, p. 429).

On the other hand, the *multidimensional perceived value,* which includes, in addition to the economic aspects, the psychological and hedonic aspects (Sánchez-Fernández & Iniesta-Bonillo, 2007, p. 430), that is, several interrelated dimensions that constitute a holistic representation of a complex phenomenon (Babin et al., 1994; Holbrook, 1999; Mattsson, 1991; Sweeney & Soutar, 2001; Williams & Soutar, 2000). Considering the multidimensional perceived value, Woodruff and Gardial (1996) adapted the "means-end model" – that originally described how customers categorize information about products (Gutman, 1982) – to a "customer value hierarchy", which provided a framework for managers to organize their thinking about customer value (Sánchez-Fernández & Iniesta-Bonillo, 2007, p. 435), which is presented as follow.

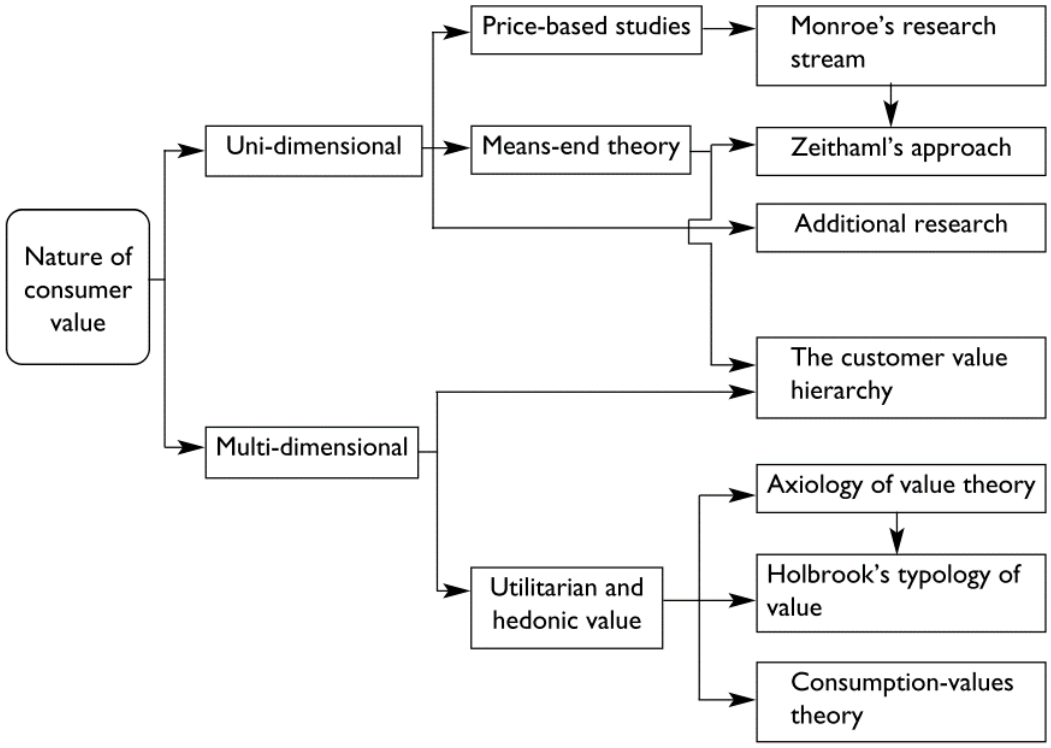

Figure 2 Research streams on perceived value (Sánchez-Fernández & Iniesta-Bonillo, 2007, 2007, p. 430)

2.3.1 Means-end Chain Model and Customer Value Hierarchy

Jonathan Gutman (1982) proposed the *means-end chain model* to connect perceived product attributes (concrete and tangible attributes) with people's values (abstract and intangible objectives). In this model, *means* are objects (products) or people's activities (e.g., running and reading), and *ends* are "valued states of being such as happiness, security, accomplishment" (Gutman, 1982). This model helps to understand the role of a product or service in the achievement process of people's desired end states of existence, that is, valued states (Gutman, 1982). It associates product-in-use features with the motivations that lead to consumption (Hentschke et al., 2014).

Additionally, Gutman (1982) highlights that customers' actions have *consequences*, which can be defined as the direct and indirect results of using a product or service. In this sense, people tend to choose products and services to produce desired consequences (benefits) and minimize the undesired ones (sacrifices), that is the reason why the link between consequences and products attributes are important in this model (Gutman, 1982). Therefore,

"consumer values give consequences valence and importance" and are influenced by the context (Gutman, 1982).

Products and services create value through the consequences and experiences that they provide in a use situation, that is, they help people to accomplish a desired purpose (Woodruff & Gardial, 1996, p. 54). Woodruff and Gardial (1996, p. 56) define value as the result of the trade-off between perceived positive consequences (benefits or desired outcomes) and perceived negative consequences (sacrifices and costs). People's judgments (value judgment), in this regard, are based on a product or service, in a use situation, with a goal, that is, a user's value (**Figure 3**).

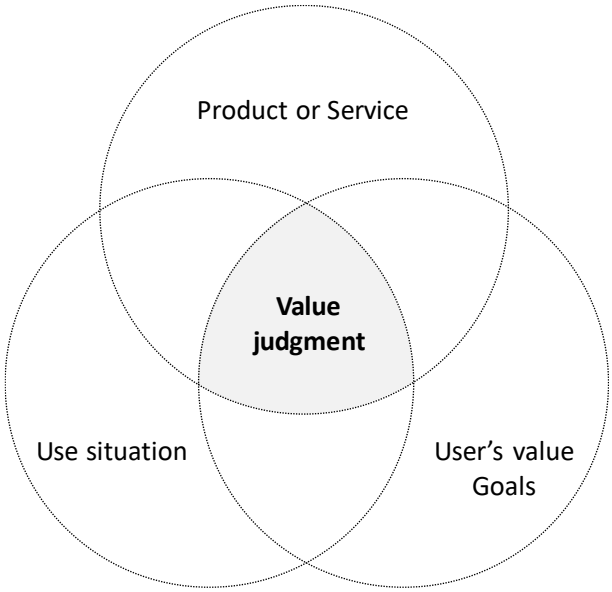

Figure 3 Value judgment - the triangulated perspective considering the product/service, the situation, and the user, adapted from Woodruff and Gardial (1996, p. 60)

The means-end theory proposes a hierarchical representation of how people perceive products and services in three interconnected levels, gradually increasing the level of abstraction, subjectiveness and importance at each level (Woodruff & Gardial, 1996, p. 64-71):

a) *attributes* (means) describe the product/service at the most concrete and objective level, such as features, component parts and activities;

b) *consequences* (means) describe the user and product/service interactions in a more subjective perspective of the consequences in use (positive and negative), that is, the outcomes and what the product/service does for the user; and

c) *user's values* or *desired end-states* (ends) describe the goals of a person on the most abstract level of the value hierarchy, that is, the user's values, such as security and family love. These are the individual's fundamental motivators in life. *Values* are considered more stable than *attributes* and *consequences* although they are more difficult to identify and measure as they are more abstract.

In this model, *attributes of a product/service* (A) are sequentially linked to *consequences of product in use* (C) and to *individuals' personal values* (V). This A-C-V sequence is the *means-end chain*, also called *ladder* (Zinas & Jusan, 2012). Olson and Reynolds (1983) in Valette-Florence and Rapacchi (1991) refined the means-end chain model by proposing the following six levels, presented in **Figure 4**:

a) concrete attributes (can be directly perceived, tangible attributes, *e.g.*, price and colour);

b) abstract attributes (cannot be perceived by the senses, e.g., style and quality);

c) functional consequences (the utility of the product or service in a specific use situation, e.g., practical benefits);

d) psychosocial consequences (the ability of a product or service to satisfy intrinsic objectives that are symbolic, self-oriented or other-oriented, *e.g.*, projecting an image and social considerations);

e) instrumental-external values (intangible goals related to behaviour to achieve the ends, *i.e*., accomplishment); and

f) terminal-internal values (desired and end states, e.g., happiness, security, self-esteem).

Laddering is the qualitative technique proposed by Reynolds and Gutman (1988) to understand the way customers translate attributes of products/services into values. An individual in-depth interview will aim to identify linkages across the A-C-V sequence (association networks or ladders), through the question: "Why is that important to you?" (Reynolds & Gutman, 1988). Data collection interpretation allows for a better understanding of people's motivation regarding a specific product or service (Reynolds & Gutman, 1988).

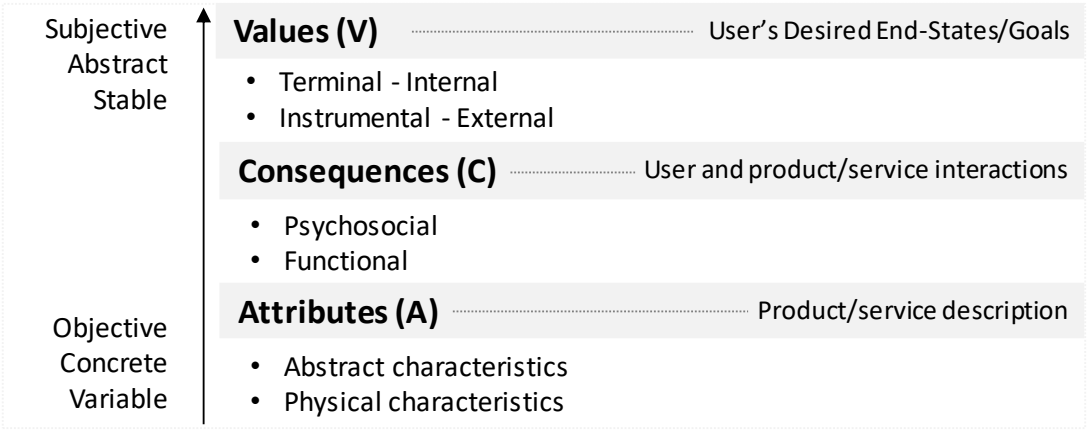

Figure 4 Value hierarchy, adapted from Olson & Reynolds (1983)

Thomson et al. (2003), based on value perception concepts, point to the importance of reaching a common understanding of quality and value in architectural and design solutions. For this purpose, it is necessary to have a better understanding of what people need from the built environment in order to be satisfied, regarding functional, physical, and symbolic characteristics (Thomson et al., 2003). They also (2003) relate value generation and the assessment of design quality by identifying personal values and match them with product attributes. Mismatches would provide feedback to the design process and future solutions (Thomson et al., 2003).

According to Tillmann and Miron (2020), different studies highlight important concepts from marketing and their application to the built environment (Bonatto et al., 2011; Drevland & Lohne, 2015; Drevland et al., 2018; Miron & Formoso, 2010; Rooke et al., 2010). Tillmann and Miron (2020) discuss key contributions of value generation and value management in the Lean Construction literature and their implications for project management in construction. The study highlights the fact that generating value means satisfy customers' needs (Levitt, 1960), that is, delivering what the customers want (Tillmann & Miron, 2020). Hence, it is important to emphasize that value, as perceived by the customers, is different from values. Holbrook (2006, p. 8) distinguishes: (a) *value* (singular), the outcome of an evaluative judgment (summary valuation), from (b) *values* (plural), that typically refers to standards, rules, criteria, norms or ideals on the basis of which evaluative judgments are made (underlying evaluative criteria).

Values can be viewed as sociological values (Rooke et al., 2010) or personal values (Rokeach, 1973; Woodruff, 1997). From social psychology, Rokeach (1968) defines values (plural) as an

enduring belief that guides action and judgments across specific situations in someone's life (Rokeach, 1968). In this regard, according to Thomson et al. (2003, p. 337), values (plural) are subjective as they frame the way someone sees the world, and they include the built environment. Value (singular), in turn, is a perception since it is an evaluation of an object or service based on beliefs and expectations (Thomson et al., 2003).

However, different discussions on the objective and subjective nature of value perception are found in the literature in the area. According to Thomson et al. (2003, p. 337), value can be subjective if it remains internalized within an individual or an organization, or objective, if it is expressed and negotiated in a common language (universal metrics) by individuals and organisations within a project[10]. Nevertheless, as highlighted by Rooke et al. (2010, p. 16), "objective and subjective, rather than being mutually exclusive categories, are more like points on a continuum in which objectivity is socially established from the stream of our perceptions", that is, the perceived value understood as an *intersubjective phenomenon*: a collective perception of the value of an object, existing in the shared imagination of a representative number of people. Therefore, customers' personal values will influence their perception of value (Gutman, 1982; Woodruff, 1997). However, values are related to core beliefs, morals and ideas (Thomson et al., 2003); and perceived value is related to a judgement of an object by a subject (Tillmann & Miron, 2020).

Customer satisfaction, another concept extensively studied in marketing research, can be understood as an output of the disconfirmation-type satisfaction model: desired value (before the acquisition of a product) is compared to received value (after the use of the product) and confirm or disconfirm their expectations, resulting in satisfaction or dissatisfaction (Oliver et al., 1994). Both concepts, namely *customer satisfaction* and *customer-perceived value*, describe evaluative judgements about a product in a use situation (Woodruff, 1997). Hence, value perception can be also understood as a comparative evaluation between benefits, which includes satisfaction in use, and inconveniences that someone perceives in relation to the built environment during their use (Thomson et al., 2003).

As pointed out by Tillmann and Miron (2020), various studies have related satisfaction and perceived value (Bonatto et al., 2011; Lima et al., 2009; Miron & Formoso, 2010; Morais et al., 2014). Lima et al. (2009) and Miron and Formoso (2010) proposed conceptual models that

[10]These considerations on the objective and subjective nature of value perception are connected with objective and subjective QoL in Chapter 3.

included the ratio between benefits and sacrifices, and the value hierarchy within the set of benefits. Bonatto et al. (2011), based on the hierarchical perspective, proposed a method for assessing value generation. Miron's (2008) study discussed the perceived value from the perspective of different users and institutions involved in the process of development and occupation of social housing. The study connects the attributes of the housing product, the consequences of use, and the expected objectives (Miron, 2008). As consequences of use, Miron (2008) identified the concepts of satisfaction and retention (staying in the place of residence) as important aspects for assessing the housing product.

2.4 RELATING VALUE AND PERCEPTION OF QUALITY OF LIFE (QoL)

Hernández Aja (2009) highlights three important dimensions of urban QoL: environmental quality, well-being, and appropriation. These dimensions are closely connected with the subjective perception of urban spaces and, ultimately, to the value perception. The following sections discuss quality in planning and the appropriation of urban spaces as important aspects regarding urban QoL evaluation.

2.4.1 Quality in planning as a measure of urban Quality of Life (QoL)

Quality can have different meanings depending on the considered context. Regarding quality measurement, first it is important to define quality within a particular product or service, considering the users' needs (Carmona & Sieh, 2004, p. 22). More widely used definitions of quality include the characteristics of something as an objective reality, and its level of excellence (high and low quality), that is, what people's think about this objective reality, in a more subjective approach (Carmona & Sieh, 2004, p. 14). In this sense, the subjective perception, and judgements of the quality of different aspects of the built environment is closely related to the individual and collective sense of value (Carmona & Sieh, 2004, p. 14).

Quality assessment contributes to forming judgements and understanding different dimensions of quality (Carmona & Sieh, 2004, p. 15). Garvin (1987, p. 104) suggests eight dimensions to measure quality in tangible goods (products), organised into three main categories: (a) dimensions that require objective judgements: performance, features, reliability, conformance, and durability; (b) dimensions that require objective and subjective

judgements: serviceability; and (c) dimensions that require subjective judgements: aesthetics and perceived quality.

Urban planning can be defined as the complex management of changes in the built environment (Carmona & Sieh, 2004, p. 15). Planning is also about assessing the quality of the relation between people and space, and the effect of decisions on people's QoL (QAAHE, 2002). Therefore, the evaluation of the proposed interventions in the urban space by different population groups is an important stage of urban planning, as it should provide feedback to future decisions (Friedmann, 1987, p. 37-38).

The quality of public services, however, is more complex to measure mainly because of is intangible nature (Carmona & Sieh, 2004, p. 18), which combines explicit and implicit service. The latter includes the psychological benefits that the customer may sense (Fitzsimmons & Fitzsimmons, 2004) and represents a subjective perception. Individual perception can generate different interpretations of the quality of urban space (Vargas et al., 2016, p. 2). For instance, as pointed out by Vargas et al. (2016, p. 2), understanding the subjective experience of pedestrians within the built environment can contribute to proposals for active modes of travel as it can give feedback to the actions of planners and designers. Thus, despite the greater difficulty to evaluate it, public service must be measured and proven in order to deliver value to citizens (Carmona & Sieh, 2004, p. 8).

In this regard, the post-occupancy assessment considers a set of performance assessment methods and techniques applied during the use stage of different products of the built environment (housing, schools, hospitals, office buildings, squares, parks, subway stations, among others), aiming to assess and establish diagnoses that take into account the experts' perceptions and the needs (and/or levels of satisfaction) of the end users of these environments (Abiko & Ornstein, 2002, p. 7). These methods and diagnoses, based on systematic knowledge, can be considered quality control instruments for the production process and use of the built environment (Abiko & Ornstein, 2002, p. 8).

2.4.2 Appropriation as a measure of urban Quality of Life (QoL)

Recent Brazilian housing policies have negatively modified the urban landscape by building standardized houses in the urban fringe. In most cases, these neighbourhoods are characterized by a lack of urban equipment and insecurity, contrasting with the existence of

public transportation, schools, street lighting, and urban greenery in central areas (Maricato, 1998, p. 43). Thus, the demands for housing are met impersonally, disconnected from the idea of "belonging" to the place of residence. This situation results in the consequent lack of appropriation of the urban space by people.

Appropriation can be understood as the degree of intervention of individuals in the environment they live in, including social participation, occupation of public spaces, and satisfaction of the subjective needs of the citizens (Paramo et al., 2016). Appropriation includes what the individual is and does in relation to society, in other words, it can be considered the *opposite of alienation* (Allardt, 1976). In this regard, to better understand the concept of appropriation, it is important to consider the definition of alienation proposed by the philosopher Rahel Jaeggi (2014, p. 31), who defines *alienation* as a state of "powerlessness and relationlessness with respect to oneself and to a world experienced as indifferent and alien. Alienation is the inability to establish a relation to other human beings, to things, to social institutions […]. An alienated world presents itself to individuals as insignificant and meaningless, […], as a world that is not one's own, […], a world in which one is not at home and over which one can have no influence". Therefore, QoL in cities is closely related to the use and appropriation of the urban space (Paramo et al., 2016) and is an important aspect of QoL measurement.

Appropriation can also be related to the concept of *conviviality*. Illich and Lang (1973, p. 11) defines conviviality as the autonomous and creative relationship between people and their environment. Contemporary studies (Gilroy, 2004, 2006) use the concept of conviviality to respond to diverse challenges related to individual or collective identities present in society (Costa, 2019, p. 22). It is the articulation and negotiated coexistence of differences in daily life (Costa, 2019, p. 23). In any society where conviviality is reduced below a certain level, some people's needs are not met (Illich & Lang, 1973, p. 11). Thus, conviviality refers to the relational dimension of social life and the convivial interactions, based on cooperation but also on conflicts (Costa, 2019, p. 16).

Furthermore, small-area spatial data enables the effective identification of urban problems since global indicators can often generate a vague and superficial idea of a problem they address and quantify (Martínez, 2009). Although objective indicators from census and administrative data are effective in measuring indirect and derived needs, they fail to measure people's self-expressed needs (Martínez, 2009). Areas that have greater availability of urban

infrastructure, traditionally central urban areas, may include isolated groups that perceive this reality differently, and thus mapping expressed needs can help the identification of these individual needs (Martínez, 2009).

2.5 CONSIDERATIONS ON CHAPTER 2

Initially, in this chapter, the issue of the Brazilian housing deficit, a brief history of housing policy in Brazil and the location of social housing in the city were addressed, focusing on its implementation in consolidated urban areas, provided with urban infrastructure and diversity of use. It is important to highlight that housing also integrates the surrounding external environment (Martucci & Basso, 2002, p. 272). In this regard, the renovation of underutilized buildings in urban centres was presented as an opportunity that can positively impact the urban QoL, as well as help in the revitalization of urban centres. Thus, a number of Brazilian experiences were presented, especially linked to the RLP - Renovation.

Moreover, the concept of value perception was addressed with the aim of understanding the importance of including the perception of users when evaluating the urban environment, especially when considering its multidimensional approach, which includes several interrelated dimensions that constitute a holistic representation of a complex phenomenon. Different studies point to users' value perception as an important source of evidence in the evaluation of social housing projects and their integration in the urban space, although the concept is still little explored on a neighbourhood scale (Silva, 2014), especially to assess QoL (Monteiro, 2020).

As for value perception, urban QoL is also a multidimensional concept as it includes a variety of factors that people value in life (Rogge & Van Nijverseel, 2019, p. 766), and its assessment should therefore consider different dimensions. Chapter 3 presents concepts and methods for evaluating the multidimensional urban QoL, which include the objective and subjective dimensions, proposed in this study as horizontal dimensions of the urban QoL. The next chapter also explores how the perception of value can contribute to the assessment of multidimensional urban QoL, especially in its subjective dimension.

3 QUALITY OF LIFE (QoL)

Quality of life (QoL) is an elusive concept (*i.e.*, difficult to tie down) (Felce & Perry, 1995, p. 51), and it does not have a generally accepted definition (Dissart & Deller, 2000, p. 136). Many studies point to the diversity of the QoL definitions in the literature (Baker & Intagliata; 1982; Berhe et al., 2014; Cummins et al., 1994; Dissart & Deller, 2000; Felce & Perry, 1995; Gomes et al., 2010; McCrea et al., 2006; Sirgy et al., 2006). Thus, a systematic literature review (SLR) was carried out, aiming for a better understanding of the nature of QoL, as well as the identification of its objective and subjective dimensions.

Therefore, in this chapter the SLR results are initially presented. Then the urban QoL concepts, its methods of evaluation, and a set of urban indicators are discussed. Finally, a multidimensional urban QoL approach is introduced, including what is identified as its horizontal dimensions (objective and subjective dimensions) and its vertical dimensions, which includes various aspects of the urban living conditions such as urban services, the economy, urban mobility, culture and recreation, conviviality, security, and environmental comfort. The vertical dimensions, therefore, are evaluated by the horizontal dimensions, that is, they are objectively and subjectively evaluated.

3.1 SYSTEMATIC LITERATURE REVIEW RESULTS: ASSESSMENT OF QUALITY AND RELEVANCE OF THE STUDIES

The five most relevant studies of the SLR, which were considered to have high quality on the *overall quality* (D) criteria, are briefly described as follows (Berhe et al., 2014; Gomes et al., 2010; Martínez, 2009; McAslan et al., 2013; Sawicki & Flynn, 1996). Sawicki and Flynn (1996) defend the importance of proposing local indicators as a means of identifying neighbourhood improvement opportunities and designing policies to address them, highlighting the importance of including people's perceptions (subjective dimension). The study of Martínez (2009) discusses QoL conditions and distributions of opportunities in the urban space. Using a case study in Argentina, it combines the use of urban indicators and Geographical Information Systems (GIS) as a valid diagnostic to generate policy relevant information on the complex and multidimensional aspects of spatial inequalities. McAslan et al. (2013), who collected both objective and subjective (through household surveys) urban

QoL indicators in eight cities on the US-Mexico border region, propose a QoL index based on economic, social, environmental, and emotional well-being (happiness) indicators.

Gomes et al. (2010) present a review on the concept of QoL and the relevant domains when analyzing and measuring it. The study highlights the importance of developing urban QoL indicators that can be measured both in their objective dimension (i.e., a top-down approach) and in their subjective dimension (the perception of users to local level in a bottom-up approach). The study of Berhe et al. (2014), carried out in Ethiopia, discusses QoL indicators related to housing, access to public services and family income. It uses the *welfare model* proposed by Zapf (1979, p. 769), which combines both objective living conditions and subjective perception of living conditions, to investigate the reasons for inconsistencies (mismatches) between them. The discussion on the objective and subjective dimensions is extensive in the research on urban QoL. These concepts are further discussed in Sections 3.3 and 3.4.

Table 1 shows the main subjects addressed in the articles and the assessment of quality and relevance of the 26 studies, classified as low, medium or high, according to the Weight of Evidence A, B, C and D used in this SLR (see Table 15 in Section 4.2.1.1).

Table 1 Quality and relevance assessment of the 26 studies

	Studies	Main subjects	(A)	(B)	(C)	(D)
1	Abbate et al. (2001)	Urban services (QoL).	medium	high	high	medium
2	Alibegović and Villa (2008)	Environmental; Economic; Governance; Management.	high	medium	high	medium
3	Archibugi (2001)	City effect point of view (positive/negatives categories).	high	high	low	medium
4	Bagstad and Shammin (2012)	Sustainability indicators: The Economy; Environmental; Social.	low	low	low	low
5	Berhe et al. (2014)	Housing; Access to public services; and Family income (resignation/dissonance).	high	high	high	high
6	Bielinskas et al. (2018)	Economic; Social; Physical; Environmental.	high	medium	high	medium
7	Coulton and Korbin (2007)	Local indicators (child well-being). Subjective indicators.	medium	medium	medium	medium
8	Gomes et al. (2010)	QoL: objectives and subjective indicators.	high	high	high	high
9	Hernández Aja (2009)	Urban QoL: Environmental quality; Wellness; Identity.	high	medium	high	medium
10	Kaklauskas et al. (2018)	Sustainability indicators (QoL): Economic; Environmental; Social.	high	medium	low	medium
11	Labonte et al. (2001)	Subjective indicators.	low	medium	medium	low
12	Marsal-Llacuna (2017)	ISO 37120 + Subjective indicators.	medium	medium	medium	medium
13	Martínez (2009)	Inequality aspects: QoL conditions and distributions of opportunities.	high	high	high	high
14	Martinez-Baldares and Cordero-Montero (2017)	Urban indicators; Integral density centralities.	medium	low	low	low
15	McAslan et al. (2013)	Objective indicators; Subjective indicators (satisfaction surveys).	high	high	high	high
16	Mohamed et al. (2017)	Urban indicators on an agricultural road.	low	low	low	low
17	Oliveira et al. (2017)	Crime.	low	low	low	low
18	Paramo et al. (2016)	ONU: The Economy; Environmental; Social.	medium	medium	medium	medium
19	Piovano and Mesa (2017)	Access to sunlight.	low	low	low	low
20	Santos and Martins (2007)	QoL: quantitative and qualitative approach.	medium	high	high	medium
21	Sawicki and Flynn (1996)	Local indicators.	high	high	high	high
22	Sharifianpur and Faryadi (2014)	Environmental quality.	low	low	low	low
23	Siche et al. (2007)	Discussion: index and indicator.	low	low	low	low
24	Tovar and Bourdeau-Lepage (2013)	Well-being.	medium	high	medium	medium
25	Vaca Ruiz et al. (2014)	The Economy	low	low	low	low
26	Van Herzele and Wiedemann (2003)	Accessibility; Attractive (green spaces).	high	medium	medium	medium

Table 2 shows the SLR rating, based on the Weight of Evidence framework (see Table 15 in Section 4.2.1.1). By examining 26 studies included in this review, the following can be highlighted:

a. Only five studies (19%) achieved high quality on the *overall quality* (D). Thus, these are the most relevant studies in this SLR;

b. The high quality of *methodological soundness* (A) (42%) was higher than the high quality of *overall quality* (19%). These are also considered relevant studies in this SLR;

c. *Adequacy to the review question* (B) (35%) and *focus/context of study* (C) (38.5%) categories was higher than the high quality of *overall quality* (19%). This suggests that the emergent criteria "(A) and/or (B) categories of analysis, but (C), could lower the *overall quality* (D)" have made the analysis more accurate (as this SLR aims to understand the different ways of evaluating QoL from a broader approach, not limited to a specific context). Thus, when specific issues are significant to the review, they are more likely to reduce than increase the overall quality assessment (Gough, 2007).

Table 2 SLR rating

	Methodological soundness (A)	**Adequacy to the review question (B)**	**Focus/context of study (C)**	**Overall quality (D)**
High quality	42% (11/26)	35% (9/26)	38,5% (10/26)	19% (5/26)
Medium quality	27% (7/26)	35% (9/26)	23% (6/26)	46% (12/26)
Low quality	31% (8/26)	30% (8/26)	38,5% (10/26)	35% (9/26)

Figure 5 shows the high-quality studies in each quality assessment category and the relationship between them, numerically represented, as shown in **Table 3**. In the main intersection area (D) are the five most relevant studies in this SLR (Berhe et al., 2014; Gomes et al., 2010; Martínez, 2009; Mcaslan et al., 2013; Sawicki & Flynn, 1996). It can be noticed that 12 studies had no high quality in any category.

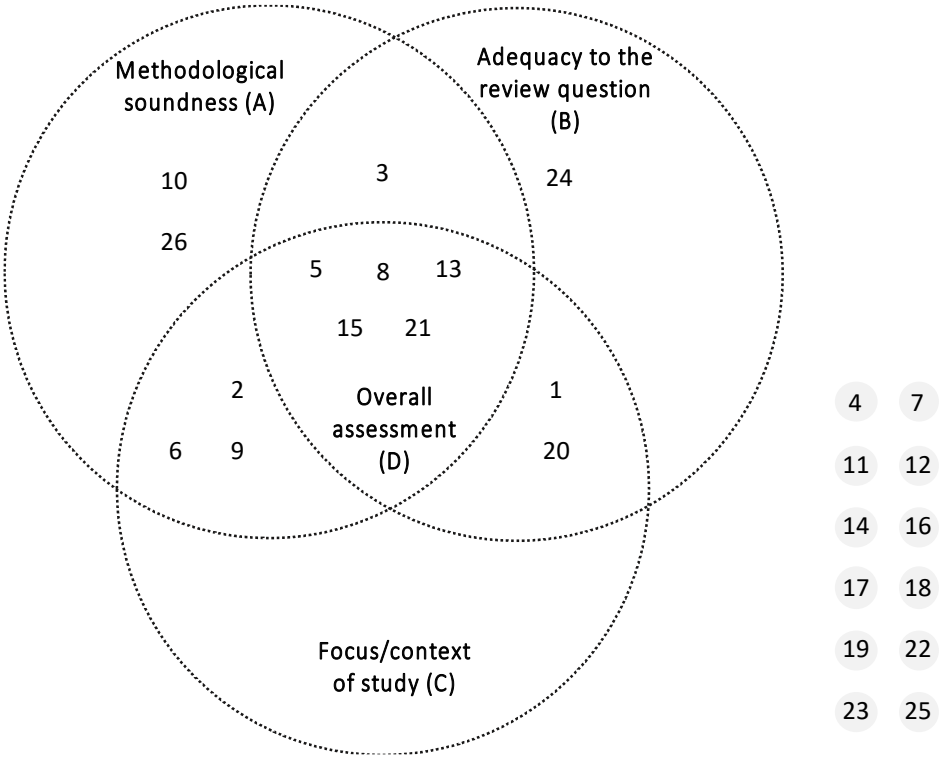

Figure 5 High quality studies in each quality assessment category, numerically represented, as shown in Table 1

Table 3 shows a Weight of Evidence framework (A, B, and D), in which 81% (21/26) of the studies present similar *adequacy to the review question* and *overall quality* (B=D), whereas 73% (19/26) of the studies present similar *methodological soundness* and *overall quality* rates (A=D). Therefore, it can be inferred that *adequacy to the review question* (B) had greater influence on the *overall quality* (D) than *methodological soundness* (A). When A=D, 16% present higher *adequacy to review question* than *methodological soundness* (A<B), and 84% present similar rates (A=B). When B=D, 29% present higher *methodological soundness* than *adequacy to the review question* (A>B), and 71% present similar rates (A=B).

Table 3 Weight of Evidence framework (A, B and D)

	A > B	A = B	A < B	Total
A > D	86% (6/7)	14% (1/7)	-	27% (7/26)
A = D	-	84% (16/19)	16% (3/19)	73% (19/26)
B = D	29% (6/21)	71% (15/21)	-	81% (21/26)
B > D	-	20% (1/5)	80% (4/5)	19% (5/26)

In addition, only 27% (7/26) of the studies present higher *methodological soundness* than *overall quality* (A>D), and only 19% (5/26) of the studies present higher *adequacy to the*

review question than *overall quality* (B>D), confirming the greater influence of B on D than A. When A>D, 86% present higher *methodological soundness* than *adequacy to the review question* (A>B), and 14% present similar rates (A=B). When B>D, 80% present higher *adequacy to the review question* than *methodological soundness* (A<B), and 20% present similar rates (A=B).

3.1.1 Systematic Literature Review: synthesis and findings by answering the review question

SLR provided a better understanding of the QoL concept and the main evaluation methods presented in the literature. These findings are presented below and in the following sections.

Table 4 and **Figure 6** present ten specific categories of analysis that contribute to the discussion on QoL presented in Sections 3.3, 3.4 and 3.5:

a) *QoL concept review* is presented in 19% of the studies. As QoL is a complex concept, past research discussed a variety of approaches;

b) *Secondary data* are considered by 54% of the studies, while 31% of the studies developed empirical studies and collected *primary data*, specially through interviews and surveys;

c) *Objective indicators*, obtained from census and other administrative data sources, are included in most existing studies (81%). *Subjective indicators* are shown in 54%, and two other studies point to the non-identification of subjective indicators as an important limitation, suggesting it as a topic for future research. Both *objective and subjective indicators* are considered in 42% of the articles analyzed. **Figure 7** shows the relationship between the studies and the type of indicators included (numerically represented, as shown in Table 4). These indicators are discussed in Section 3.4;

d) The *regional scale* unit of analysis is included in 31% of the papers, while the *local scale* is used by 46%; and

e) *QoL indicators* are proposed by 58% of the studies, while *QoL index* is incorporated by only 11%.

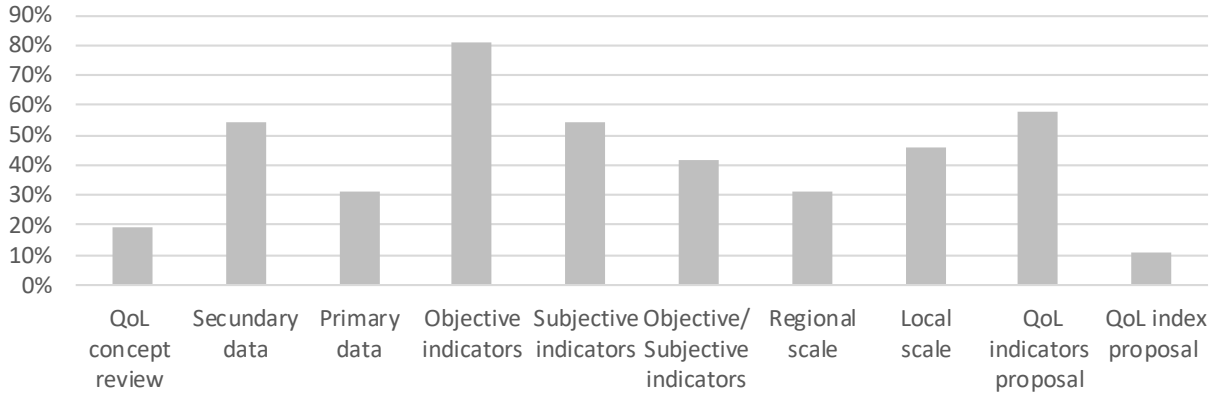

Figure 6 Summary of the SLR specific categories of analysis

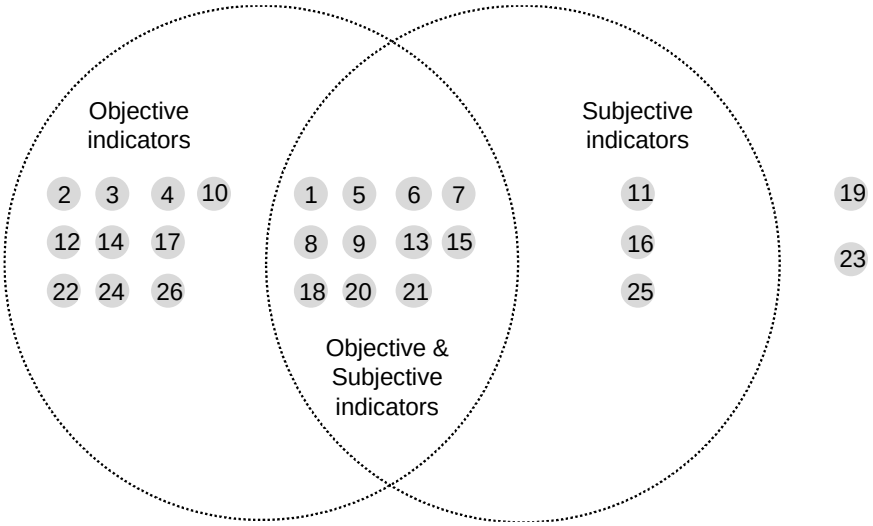

Figure 7 Relationship between studies and type of indicators considered, numerically represented, as shown in Table 4

Table 4 The SLR specific categories of analysis that contributed to the discussion on QoL

	Studies	QoL concept	Secondary data	Primary data	Objective indicators	Subjective indicators	Regional scale	Local scale	QoL indicators	QoL index
1	Abbate et al. (2001)	*	*	*	*	*		*	*	*
2	Alibegović and Villa (2008)				*		*		*	
3	Archibugi (2001)				*		*		*	
4	Bagstad and Shammin (2012)		*		*		*			
5	Berhe et al. (2014)	*		*	*	*		*	*	
6	Bielinskas et al. (2018)		*		*	*				
7	Coulton and Korbin (2007)				*	*		*		
8	Gomes et al. (2010)	*			*	*		*		
9	Hernández Aja (2009)	*			*	*		*	*	
10	Kaklauskas et al. (2018)		*		*		*			
11	Labonte et al. (2001)	*		*		*		*	*	
12	Marsal-Llacuna (2017)		*		*			*	*	
13	Martínez (2009)		*	*	*	*		*	*	
14	Martinez-Baldares and Cordero-Montero (2017)				*		*			
15	McAslan et al. (2013)		*	*	*	*	*		*	*
16	Mohamed et al. (2017)			*		*		*		
17	Oliveira, Bastos-Filho and Menezes (2017)		*		*					
18	Paramo et al. (2016)		*		*	*			*	
19	Piovano and Mesa (2017)									
20	Santos and Martins (2007)		*	*	*	*		*	*	
21	Sawicki and Flynn (1996)				*	*		*	*	
22	Sharifianpur and Faryadi (2014)		*		*				*	
23	Siche et al. (2007)									
24	Tovar and Bourdeau-Lepage (2013)		*		*	Future research	*		*	*
25	Vaca Ruiz et al. (2014)		*			*	*			
26	Van Herzele & Wiedemann (2003)		*	*	*	Future research		*	*	
	Total	19%	54%	31%	81%	54%	31%	46%	58%	11%

3.2 THE URBAN QUALITY OF LIFE (QoL) CONCEPT

The urban QoL concept is discussed in five of the 26 papers (19%) analyzed in the SLR, and their main contributions are presented below. The study of Abbate et al. (2001, p. 276) points to the use of QoL in social science, in order to summarize the complex economic, social, environmental, and relationship problems characterizing modern society (Abbate et al., 2001, p. 276). It also highlights the fact that QoL is related, on the one hand, to *material* and *non-material* aspects, and, on the other hand, to *individual* and *collective* living conditions (Abbate et al., 2001, p. 276). This explains the evolution of a general political debate that moves from economic growth as the main theme to increased concern with the analyses of social changes, and the inclusion of subjective indicators to investigate the satisfaction levels towards not only the material conditions of life but also non-material ones, such as relationships, achievements, expectations and needs (Abbate et al., 2001, p. 277).

Berhe et al. (2014) present concepts identified in the literature on QoL, considering that QoL combines both objective living conditions (existent secondary data) and the subjective perception of living conditions (the level of satisfaction of households). The study proposes seven QoL domains (housing, access to public services, family income, access to green space, safety, family life, and neighbourhood satisfaction) and investigates the reasons for inconsistencies (mismatches) between objective and subjective dimensions in the city of Mekelle, Ethiopia, based on the *welfare model* proposed by Zapf (1979, p. 769) (Berhe et al., 2014).

Likewise, Gomes et al. (2010, p. 577) present a review of the concept of QoL and propose the following definition: urban QoL is an individual perception of the socio-territorial environment, that should consider the subjective (primary data on the perception of users in a bottom-up approach) and objective dimensions (secondary data in a top-down approach), including individual and collective preferences and behaviours related to the urban environment. This study highlights the importance of developing urban QoL indicators that can measure both dimensions, especially when considering a local scale analysis.

According to Hernández Aja (2009, p. 87), urban QoL is the embodiment of QoL in the urban space, which can be considered a social construct formed by three basic dimensions: environmental quality, well-being (individual satisfaction), and identity (appropriation and participation). This study argues that the urban QoL implies the idea of sustainability,

highlighting the importance of rehabilitating and conserving existing neighbourhoods rather than creating new ones (Hernández Aja, 2009, p. 85). It also points that urban QoL should include environmental aspects and their relationship with the human needs (Hernández Aja, 2009, p.85).

Despite not presenting a QoL concept, Labonte et al. (2001, p. 2) make a brief review of the urban QoL, highlighting the importance of the identification of well-being across urban space, especially by analyzing social phenomena and the attractiveness of the places, aiming to give feedback to urban policies.

These studies, and the QoL concepts they propose, introduce this section and are summarized in **Table 5**. Further ideas are presented in Section 3.3.1 in order to better delimit the concept of multidimensional urban QoL, especially in relation to its dimensions of objective and subjective analyses.

Table 5 QoL concepts

	Studies	**QoL concept**
1	Abbate et al. (2001, p.276)	"QoL refers to two interconnected concepts: the relationship between material and non-material aspects of welfare and the tie between the individual and collective life conditions".
5	Berhe et al. (2014)	QoL combines both objective living conditions (existent secondary data) and the subjective perception of living conditions (people's satisfaction).
8	Gomes et al. (2010, p.577)	QoL was assumed in this study to be "as an individual perception of the socio-territorial contexts, evaluating quantitatively or qualitatively aspects of a subjective or objective nature which, from a perspective of territorial analysis, is expected to encompass the individual or collective manifestation of preferences and behaviours revealed in the presence of the intrinsic characteristics of the place".
9	Hernández Aja (2009)	QoL introduces environmental aspects into the intersection with human needs. Quality of urban life is the embodiment of QoL in the urban space, which can be considered as a social construction formed by three basic dimensions: environmental quality, well-being (individual satisfaction), and identity (appropriation and participation).
11	Labonte et al. (2001)	The study makes a brief review of the urban QoL, highlighting the importance of the identification of well-being across urban space, especially by analysing social phenomena and the attractiveness of the places, aiming to give feedback to urban policies.

3.2.1 The Multidimensional Quality of Life: objective and subjective dimensions

The lack of a clear definition has led to the interchangeable use of the term quality of life with other concepts, such as well-being, welfare, way of life, life satisfaction, and happiness (Dissart & Deller; 2000, p. 136). As presented in the extensive study of Sirgy et al. (2006, p. 367), which traces the history of the social indicators and QoL research movement up to today, early QoL research already connected the concept with the standard of *living conditions* and people's satisfaction with them. Based on Felce and Perry (1995, p. 55), writing about the mental health field, QoL can be determined by the interaction between life conditions (an objective approach) and personal life satisfaction (a subjective approach) weighted by individual's scale of values (*i.e.*, scale of importance), as presented in **Figure 8**.

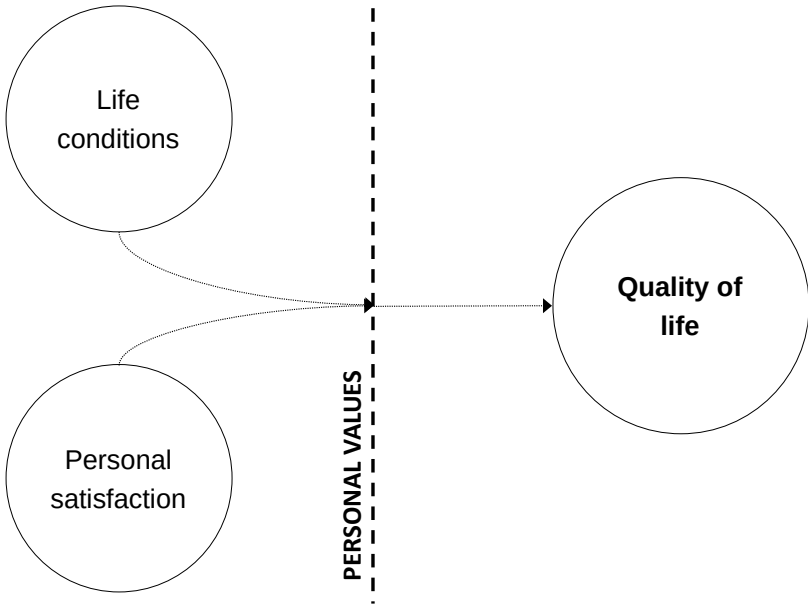

Figure 8 Conceptualisation of QoL adapted from Felce and Perry (1995)

Constanza et al. (2007) define QoL as the way that different life domains are perceived by individuals or groups and their level of satisfaction or dissatisfaction with these domains, that is, how well human needs are met. Therefore, according to Clark (2000), the enhancement of QoL depends on firstly recognizing personal and societal needs, and then acting individually and collectively to satisfy these needs. Erik Allardt (1976) points out that *welfare*, meaning the state of need-satisfaction in a population, is often described by a system of social indicators related to good and bad life conditions, in which each explicitly value-oriented indicator refers to different aspects of welfare. There is no universal set of needs applicable to

all situations, and thus the identification of welfare needs requires continuous study and the measure of life conditions and people's activities in society (Allardt, 1976). Allardt (1976) suggests three categories of basic needs related to the satisfaction of individual needs, including both objective and subjective dimensions:

a) *having*: needs associated with material resources;

b) *loving*: needs associated with relationships, companionship, and solidarity (how people relate to each other); and

c) *being*: needs associated with self-actualization and the obverse of alienation (what the individual is and does in relation to society).

Results show that unlike the *loving* category, the *having* and *being* categories are related, indicating a positive relationship between the level of living conditions and alienation (Allardt, 1976), that is, the better the living conditions, the lower the alienation. As described in Section 2.4.2, alienation can be considered the opposite of appropriation (Allardt, 1976), an important aspect of urban QoL measurement.

Felce and Perry (1995, p. 62) propose a model of overall QoL, which comprises objective life conditions and subjective evaluations (level of satisfaction) of physical, material, social, and emotional well-being, and the extent of personal development and purposeful activity. These different dimensions are then weighted by personal values and aspirations, that is, "an individual ranking of the relative importance of each domain" (**Figure 9**). The three elements (objective life conditions, subjective feeling of well-being, and personal values) continuously interact. Felce and Perry (1995, p. 62) argue that "changes in some objective condition of life may change satisfaction or one's personal values (or both). Similarly, changes in values may change satisfaction and precipitate change in some objective circumstance, and a change in a sense of satisfaction may lead to the reappraisal of values and lifestyle (Felce & Perry, 1995, p. 62). It can be inferred that this QoL model is multidimensional as it presents three horizontal (objective, subjective and personal values) and five vertical dimensions of QoL (physical, material, social, and emotional well-being, and the extent of personal development and purposeful activity).

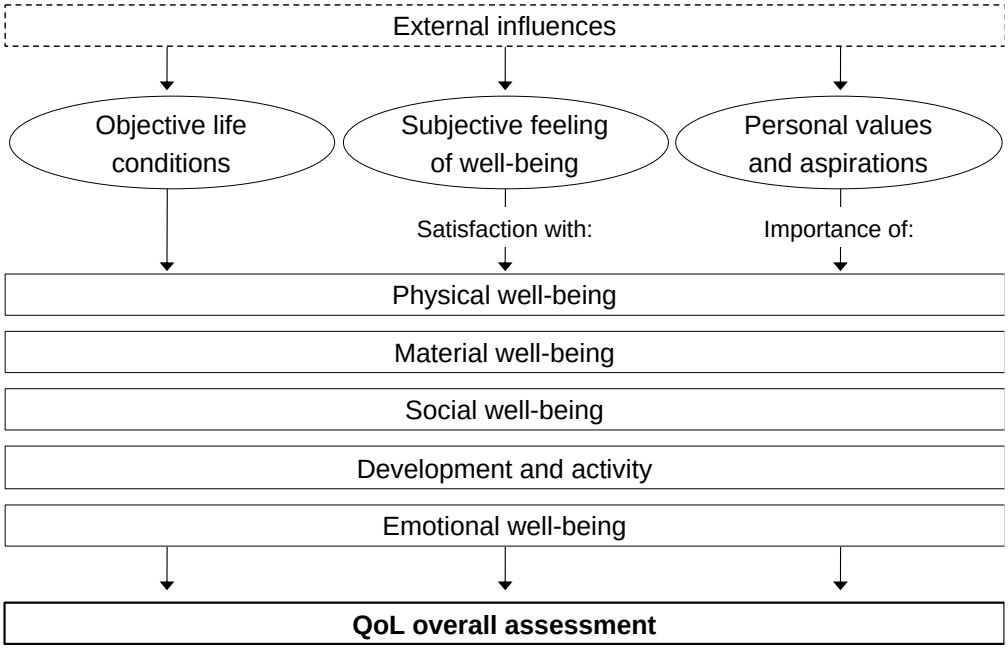

Figure 9 QoL overall assessment adapted from Felce and Perry (1995)

Cummins (2000) also believes that QoL encompasses both the objective and subjective dimensions, each including various aspects such as material well-being, health, safety, community (a sense of belonging to one's local community), productivity, intimacy (relationships), and emotional well-being (Cummins, 2000).

The o*bjective dimension*, which includes culturally relevant measures of objective well-being (Cummins, 2000), is related to the exogenous facts of a person's life (external conditions) (Dissart & Deller; 2000) and is usually expressed by quantitative data from statistics that evaluate concrete aspects of QoL (Santos & Martins, 2007). Such concrete aspects include the environmental, economic, or social conditions of a specific place of analysis (Santos & Martins, 2007).

The *subjective dimension* comprises the level of satisfaction with these domains, weighted by their importance to the individual (Cummins, 2000), and is the endogenous perception a person has of these facts and of herself/himself (internal mechanism) (Dissart & Deller; 2000). It is mostly qualitative, includes the subjective interpretations of living conditions, and may be based on field surveys (Santos & Martins, 2007).

The study of Dissart & Deller (2000), which reviews the QoL literature of concepts and methods from a variety of disciplinary perspectives (philosophy, sociology, economics, health and medicine, marketing, and management), reinforces this definition by adding that the

objective dimension is related to the *exogenous facts* of someone's life, and the *subjective dimension* is related to the *endogenous perception* of these factors. Evans (1994, p. 53), in this regard, defines the

a) *Objective QoL* as the individual's standard of living, represented by verifiable conditions inherent in the given cultural unit; and the

b) *Subjective QoL* as the degree to which the individual's life is perceived to match some implicit or explicit internal standard.

In this regard, various studies argue that QoL is a multidimensional concept, and, as it is a complex concept, a multidimensional structure is advantageous when measuring it (Diener et al. 1985; Dissart & Deller; 2000; Matarrita-Cascante, 2010; Potter et al., 2012; Rogge & Van Nijverseel, 2019; Veenhoven 1997). Hence the concept of QoL is broader than material aspects, economic production, or living standards: it is a multidimensional concept as it includes a variety of factors that people value in life (Rogge & Van Nijverseel, 2019, p. 766). The multidimensional QoL concept is therefore closely aligned with the concepts of *perceived value* that were presented in Chapter 2, especially that highlighted by Rooke et al. (2010, p. 16): "objective and subjective, rather than being mutually exclusive categories, are more like points on a continuum in which objectivity is socially established from the stream of our perceptions". Additionally, as pointed out by Thomson et al. (2003, p. 337), value can be subjective if it remains internalized within an individual or an organization, or objective if it is expressed and negotiated in a common language (universal metrics) by individuals and organisations within a project.

Thus, based on this relation with the perceived value literature, in terms of multidimensional QoL definition and assessment, it can be inferred that:

a) *Objective QoL* is related to a universal metrics expressed and understood by the individuals of a society – the exogenous living conditions, and

b) *Subjective QoL* is related to the endogenous perception of these living conditions (level of satisfaction).

These universal metrics can be expressed by QoL indicators, which should be based both on objectively observable facts and on people's own subjective assessment of their life (Szalai, 1980). Cultural norms and ranges may provide a standard of reference (Felce & Perry, 1995,

p. 59). Therefore, a person's QoL depends on both objective and subjective dimensions (Dissart & Deller; 2000, p. 136).

Table 6 presents the main concepts identified in the literature related to QoL, and to the objective and subjective dimension of QoL.

Table 6 Main concepts related to QoL, and to the objective and subjective dimensions of QoL

QUALITY OF LIFE	*Material* and *non-material* aspects *Individual* and *collective* life conditions *Objective dimension* (life conditions) and *subjective dimension* (personal life satisfaction)
Objective dimension of QoL	Exogenous facts of a person's life External conditions Quantitative indicators Tangible/objective/concrete measurement
Subjective dimension of QoL	Endogenous individual's perception Internal mechanism Qualitative indicators Subjective measurement/people's perception

Based on this literature review, this study considers QoL a multidimensional concept. Thus, it can be inferred that the multidimensional urban QoL encompasses *horizontal dimensions* (objective and subjective dimensions) and *vertical dimensions*, that include relevant aspects of the living conditions and should be objectively and subjectively assessed. In this sense, it can be inferred that objective and subjective dimensions have different assessment methodologies of certain living conditions: *they are different perspectives of the evaluation of living conditions (external and internal evaluations)*. All dimensions are considered equally relevant in the assessment of QoL. **Figure 10** shows the QoL concept proposal design.

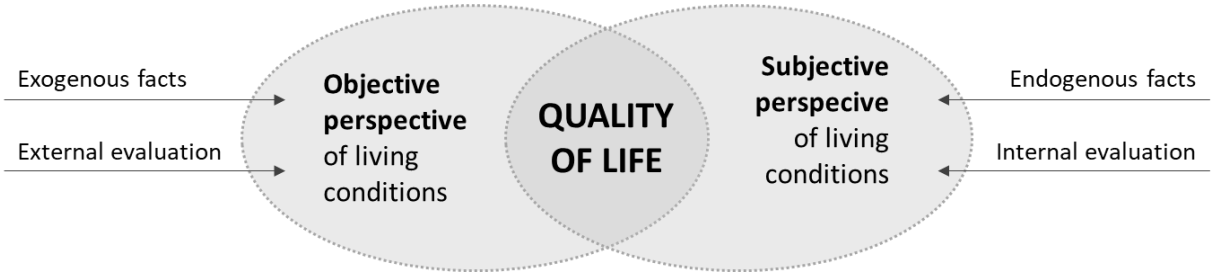

Figure 10 The concept of QoL proposed in this study

QoL is also affected by the way people experience the space they live in (Senlier et al., 2009). From 1970 onwards, the debate on the urban QoL grew, motivated by the process of expansion of cities all over the world, particularly in developing countries (Nahas et al., 2016, p. 2). Therefore, faced with problems related to the accelerated urbanization process, the need to assess the urban QoL emerged (Nahas et al., 2016, p. 2), and this is discussed in the next section.

3.3 THE EVALUATION OF THE URBAN QUALITY OF LIFE (QoL)

Urban QoL refers to the QoL in the living environment, taking into account the interaction between people and the built environment (Das, 2008, p. 299). Monitoring and the evaluation of urban performance through indicators is necessary to improve urban QoL (Alibegović & Villa, 2008, p. 64). Therefore, the urban indicator can be defined as a parameter or a value used to describe and communicate complex realities regarding the individual features and the environmental system (Delsante, 2016, p. 8). The indicators should provide reliable information (Johnston & Carley, 1981). According to Diener and Suh (1997, p. 192), social indicators provide societal measures that reflect people's objective circumstances in a given cultural or geographic unit.

Recent studies show the importance of considering both objective and subjective approaches to assess QoL (Abbate et al., 2001; Berhe et al., 2014; Coulton & Korbin, 2007; Cummins, 2000; Dissart & Deller; 2000; Gomes et al., 2010; Hernández Aja, 2009; McAslan et al., 2013; Paramo et al., 2016; Santos & Martins, 2007; Zapf, 2000). However, urban policies rarely include subjective indicators in the urban planning process by disregarding people's wishes and requirements, and this can generate shortcomings regarding decision making, (Paramo et al., 2016). Satisfaction responses should be considered as reliable and valid data although "the nature of the underlying construct of subjective experience can only ever be inferred" (Cummins, 2000). In addition, QoL can change over time, and it is influenced by external elements such as social, economic, and political variables. Thus, in order to capture QoL it is important to assess these three elements simultaneously: objective living conditions, satisfaction with living conditions, and the importance of these living conditions in people's life (Felce & Perry, 1995).

Therefore, a bottom-up approach seems an appropriate method to evaluate QoL in urban environments (Gomes et al., 2010). Residents' perceptions of the neighbourhood environment

are important indicators of well-being, and they should be considered together with objective indicators that can be obtained from census and other administrative data sources (Coulton & Korbin, 2007). The concomitant consideration of these two categories is problematic both in theory and in practice, especially in relation to the mismatches identified between objective and subjective indicators (Zapf, 1979, p. 767).

Wolfgang Zapf (1979, p. 769-771) proposes a *welfare model* which comprises both the objective living conditions and the subjective perception of these living conditions. The combination of both can generate two *consistent* welfare types:

a) *well-being*, referring to the person in good objective and subjective conditions; and

b) *deprivation*, referring to the person in bad objective and subjective conditions.

It also can generate two *inconsistent* welfare types:

c) *dissonance*, referring to the person whose perceived QoL does not correspond to their rather good objective living conditions, that is, a "dissatisfaction dilemma"; and

d) *resignation*, referring to the person whose unfavourable objective living conditions are not subjectively rated equally unfavourably, that is, a "satisfaction paradox".

Table 7 presents these four welfare types proposed Zapf (1979, p. 769-771).

Table 7 Welfare types, adapted from Zapf (1979)

		Objective living conditions	
		Good	Bad
Subjective perception of living conditions	Good	**Well-being** (Consistent welfare type)	**Resignation** (Satisfaction paradox)
	Bad	**Dissonance** (Dissatisfaction dilemma)	**Deprivation** (Consistent welfare type)

Certain studies have analysed the mismatches between objective and subjective indicators (Abbate et al., 2001; Allardt, 1976; Cummins, 2000). A challenging aspect, highlighted by Tovar and Bourdeau-Lepage (2013), is that a subjective perception may lead to overestimating satisfaction in relation to a real and objective situation because individuals tend to adapt their preferences to what they think they can obtain and therefore may be

satisfied with lower achievements. Moreover, the worse living conditions are, the less people are able to express what they would like in a better situation because they tend to have their peers as a reference group (Allardt, 1976).

People tend to maintain normal levels of subjective QoL even in face of adverse environmental conditions, and this can explain possible low correlations between objective and subjective QoL indicators (Cummins, 2000). However, although humans have a high adaptive capacity, once the adaptation limit is exceeded, poor objective living conditions begin to negatively influence QoL (Cummins, 2000). In this sense, the correlation between objective and subjective QoL indicators tends to increase as objective living conditions decrease to low levels (Cummins, 2000). However, as QoL intends to embrace a wide range of human life conditions, both dimensions must be included (Allardt, 1976; Cummins, 2000).

On the one hand, a structured method provides a framework for the determination of indicators (Alibegović & Villa, 2008). On the other hand, a participatory process enables consensus on priorities and values (Alibegović & Villa, 2008). Additionally, indicators are more effective when understood by the local community (Alibegović & Villa, 2008). It can be inferred that each QoL domain should be measured in both objective and subjective dimensions (Gomes et al., 2010), and the latter has both a cognitive and an affective component that can be measured by questions concerning satisfaction (Hagerty et al., 2001 in Gomes et al., 2010). Assessment of the individual level of satisfaction is usually made through interviews and surveys that aim to reach explicit and implicit standards related to welfare and life conditions (Santos & Martins, 2007).

Abbate et al. (2001) aimed to assess aspects of QoL by measuring the satisfaction of the citizen towards the main urban services in Palermo, Italy, by comparing objective data with the subjective perception of interviewees and identifying implicit, explicit, and latent needs. Results show some divergences between objective and subjective data, e.g., respondents are not satisfied with the public transportation offered, mainly in relation to the overcrowding and non-functional itineraries, despite the good objective indicators, such as number of buses per citizen (Abbate et al., 2001). Santos and Martins (2007) shows that Porto, Portugal, is a safe city considering the objective indicator of crime (registered number of crimes per 1000 inhabitants); however, “urban insecurity” and “crime” was the most negative aspect of QoL perceived by residents in this study (Santos & Martins, 2007).

The study of Berhe et al. (2014) in Ethiopia aimed to understand the main reasons implicit in the mismatch between objective living conditions, usually identified by public policies, and subjective perception of QoL by citizens and communities that results in *resignation* and *dissonance* (Zapf, 1979). Thus, some respondents have unaffordable housing conditions, i.e., they spend more than 30% of their total family income on housing, which is considered a bad objective indicator (Berhe et al., 2014). However, they are satisfied with it (good subjective indicator), and therefore they are *resigned to this condition* (Berhe et al., 2014). The main reasons for mismatch are related to the prioritization of a good location, a strong connection with neighbours and neighbourhood (sense of belonging and appropriation), and access to basic services and housing ownership (Berhe et al., 2014). The main reasons of *dissonance* regarding affordable housing conditions (good objective indicator) are related to the dissatisfaction with basic infrastructure and mismatch with desired living style, such as the lack of a garden (bad subjective indicator) (Berhe et al., 2014). Moreover, "proximity", as a positive measure of access to public services, is not reflected in a positive perception of accessibility by the residents (Berhe et al., 2014). This study suggests that the combination of objective living conditions and subjective QoL (people's perception) is useful to identify reasons for *resignation* and *dissonance*, thus it can refine QoL indicators to match the real concerns of local communities (Berhe et al., 2014).

Sawicki and Flynn (1996) point out the importance of building neighbourhood-level indicators to identify and understand local problems and designing policies to solve them so QoL can be a tool to improve people's lives. They also claim that it is essential to specify the geographic unity of analysis. Unlike a city subarea, which implies only spatial boundaries, the term *neighbourhood* includes physical and social environments that affect the lives of their inhabitants for better or worse. Additionally, life conditions vary widely within a given society, so it is important to assess the QoL of a defined interest group and compare these data with total population data and so identify social inequalities, in order to provide standard references (Felce & Perry, 1995) and feedback for urban planning.

Labonte et al. (2001) highlight two main purposes often identified in QoL research: to rank places according to their liveability or attractiveness, and to analyze social phenomena in space to identify aspects that improve or decrease QoL, which includes the subjective assessment of people's satisfaction. This study in the city of Saskatoon, Canada, that describes how different neighbourhood characteristics influenced QoL, includes measures of perception of happiness, changes in life satisfaction, satisfaction with people's own

neighbourhood, and satisfaction with their own city (Labonte et al., 2001). Respondents within low socio-economic neighbourhoods expressed a much higher level of satisfaction with the city than they did with their own neighbourhood. It suggests that not only the way people feel about themselves influences the perception of QoL but also the urban place in which they live (Labonte et al., 2001).

Table 8 summarizes the methods to evaluate QoL identified in the SLR studies. Of a total of 26 studies 15 proposed a set of QoL indicators.

Table 8 Methods used in the SLR studies to assess QoL

	Studies	QoL evaluation methods
1	Abbate et al. (2001) *	Proposal of a model to evaluate the quality of services, measuring the judgement of the citizen towards of the main services (Palermo, Italy).
2	Alibegović and De Villa (2008) *	To assess the European urban environment, 55 indicators are selected for 51 European cities.
3	Archibugi (2001) *	Proposal of a model (indicators framework) to evaluate the QoL in France, Germany, UK and Italy (comparable indicators).
4	Bagstad and Shammin (2012)	Secondary data analysis (1990–2005) of the state of Ohio, USA (Sustainability indicators: Economic; Environmental; Social)
5	Berhe et al. (2014) *	A mixed method approach was developed and applied in the city of Mekelle, Ethiopia, to measure objective and subjective QoL and to understand the divergence between them (adaptation and dissonance).
6	Bielinskas et al. (2018)	Evaluation tool proposal: Analysis of 20 neighbourhoods based on the 18 criteria that influence the perception of QoL by citizens (Lithuania).
7	Coulton and Korbin (2007)	Child well-being at the level of the neighbourhood: highlighted the importance of considering both objective and subjective indicators was highlighted.
8	Gomes et al. (2010)	QoL concept definition for future application in Portugal: selection of social indicators, to understand the perception of QoL from the perspective of residents.
9	Hernández Aja (2009) *	Analysis of existing indicators in Spain and proposal for new indicators.
10	Kaklauskas et al. (2018)	Analysis of comparable data from the 2012-2016 QoL surveys in European Cities.
11	Labonte et al. (2001) *	Comparative intra-urban QoL research in Saskatoon, Canada: Social / Subjective indicators.
12	Marsal-Llacuna (2017) *	Proposal to include 10 socio-cultural indicators in ISO 37120.
13	Martínez (2009) *	Presents a framework on how to formulate indicators and proposes interesting cross-analyses, considering self-expressed needs.
14	Martinez-Baldares and Cordero-Montero (2017)	Proposal of urban indicators at regional level - No case study/implementation. Lack of accuracy and specificity.
15	McAslan et al. (2013) *	QoL assessment: Collection of objective and subjective data in 8 US-Mexico border cities + Index based on economic, social, and environmental indicators, and assessment of happiness (satisfaction) and social well-being.
16	Mohamed et al. (2017)	Proposed indicators to assess QoL - Method is not clear.
17	Oliveira et al. (2017)	Proposal of a method to assess the spatial concentration of crime (secondary data from US and UK). Lack of accuracy and specificity.
18	Paramo et al. (2016) *	Proposal of a framework that integrates quantitative and qualitative indicators to assess the quality of the public space (based on data available on the web). However, it does not contribute in an innovative way to their implementation.
19	Piovano and Mesa (2017)	Despite presenting urban indicators as a key word, this study is not about urban indicators, but rather amount of sunlight. Lack of transparency, accuracy, and specificity.
20	Santos and Martins (2007) *	QoL monitoring system: quantitative (statistical indicators) and qualitative (based on citizens' perception of QoL) approach.
21	Sawicki and Flynn (1996) *	Discussion on the importance of measuring neighbourhood indicators – local scale, participatory process, people's perception.
22	Sharifianpur and Faryadi (2014) *	Urban environmental quality evaluation model in the city of Isfahan.
23	Siche et al. (2007)	Discussion about the meaning of the words index and indicator + sustainability.
24	Tovar and Bourdeau-Lepage (2013) *	Proposal for a well-being indicator to identify socio-spatial differences between cities. Lack of precision.
25	Vaca Ruiz et al. (2014)	Proposed indicators to predict the economic capital of cities. Outdated economic indicators - Argues that it is cheaper to estimate from data extracted from social media (than census) – Questionable.
26	Van Herzele and Wiedemann (2003) *	Good method: mapping secondary data (maps, existing surveys), accessibility assessment (GIS-model software distances and barriers); evaluation of attractiveness (map and field observation - subjective). Negative point: no interviews/ questionnaires with users.

* Studies that propose a set of QoL indicators (15/26)

3.3.1 Urban Quality of Life indicators

Census data frequently does not match local residents' perceptions, and urban indicators should therefore consider changes related to both people and places, mainly because place-based policies often focus too much on place changes and can lead to the misspecification of the target people, with QoL becoming secondary (Sawicki & Flynn, 1996). The International Standard *ISO 37120:2014 Sustainable development of communities: Indicators for city services and quality of life* is the first international standard on city indicators and contains a set of standardised indicators for urban services and QoL in the following areas: economy, education, energy, the environment, finance, fire and emergency response, health, recreation, safety, shelter, solid waste, telecommunications and innovation, transportation, urban planning, wastewater, and water and sanitation. These indicators can be used to measure the performance of city services and QoL, and to make a comparison between different cities (BS ISO 37120: 2014, p. 10). This standard thus presents a uniform approach to what is measured and how the measurement is performed. However, its application depends on whether its indicators are compatible with the legislation of different countries and whether the data are available. The standard was published in Brazil in 2017 and was amended with minor changes in 2021 (ABNT NBR ISO 37120:2021 - *Desenvolvimento sustentável de comunidades - Indicadores para serviços urbanos e qualidade de vida*).

Table 9 shows these dimensions (themes) related to their main indicators, as well as the number of core (total of 46) and supporting indicators (total of 54), comprising a total of 100 indicators. Although ISO 37120 may represent a step forward in terms of standardized QoL assessment, it does not consider subjective indicators or indicators related to social-cultural aspects, which have a great effect on QoL. Social-cultural indicators could include the number of free cultural events, the number of cultural activities and facilities (international conferences, fairs, exhibitions held per year), the number of workers in the culture market (Abbate et al., 2001; Archibugi, 2001; Gomes et al., 2010; Hernández Aja, 2009; Paramo et al., 2016; Santos & Martins, 2007), the number of public libraries and museums (Santos & Martins, 2007; Sawicki & Flynn, 1996), and the percentage of budget devoted to cultural activities (Marsal-Llacuna, 2017). In this sense, Marsal-Llacuna (2017) recommends the revision of the NBR 37120 (2017) standard by including ten indicators that incorporate more social-cultural aspects such as *the municipal budget to protect vulnerable groups and to promote cultural activities*, in order to better assess social sustainability of cities.

Table 9 NBR 37120:2017 Sustainable development of communities: Indicators for city services and quality of life

Dimensions		Main indicators	Core indicator	Supporting indicator
1	Economy	Unemployment rate Percentage of population living in poverty	3	4
2	Education	Percentage of school-aged population enrolled in school Percentage of students completing primary/secondary education	4	3
3	Energy	Total residential electrical energy use per capita Percentage of total energy derived from renewable sources	4	3
4	Environment	Air quality Noise pollution	3	5
5	Finance	Debt service ratio	1	3
6	Fire and emergency response	Number of firefighters per 100 000 population Response time for emergency response services from initial call	3	3
7	Governance	Percentage of voter participation in last municipal election Percentage of women employed in the city government workforce	2	4
8	Health	Average life expectancy Number of in-patient hospital beds per 100 000 population Suicide rate per 100 000 population	4	3
9	Recreation	Square meters of public indoor/outdoor recreation space per capita	0	2
10	Safety	Number of police officers/homicides per 100 000 population Response time for police department from initial call	2	3
11	Shelter	Percentage of city population living in slums Number of homeless per 100 000 population	1	2
12	Solid waste	Percentage of city population with regular solid waste collection Percentage of the city's solid waste that is recycled	3	7
13	Telecommunications and innovation	Number of internet connections per 100 000 population Number of cell phone connections per 100 000 population	2	1
14	Transportation	Kilometres of public transport system per 100 000 population Annual number of public transport trips per capita Number of personal automobiles per capita Kilometres of bicycle paths and lanes per 100 000 population	4	5
15	Urban planning	Green area (hectares) per 100 000 population Jobs/housing ratio	1	3
16	Wastewater	Percentage of city population served by wastewater collection Percentage of the city's wastewater that has received no treatment	5	0
17	Water and sanitation	Percentage of city population with potable water supply service Total domestic water consumption per capita (litres/day) Average annual hours of water service interruptions per household	4	3
		Total	**46**	**54**

Table 10 presents the QoL indicators identified in the SLR studies.

Table 10 The main QoL indicators identified in the SLR studies

	Studies	QoL indicators
1	Abbate et al. (2001)	Urban services (QoL): Environment; Education and cultural activities; social activities; public transportation.
2	Alibegović and De Villa (2008)	Environmental indicators; Economic indicators, Governance and Management indicators.
3	Archibugi (2001)	City effect indicators: Economy; Number of firms births per capita; Social-cultural diversity; Public service; Education; Subjective contentment/Degree of satisfaction.
4	Bagstad and Shammin (2012)	Sustainability indicators: Economic; Environmental; Social.
5	Berhe et al. (2014)	Housing; Public services; Adequate family income
6	Bielinskas et al. (2018)	Economic; Social; Physical; Environmental.
7	Coulton and Korbin (2007)	Local indicators (child well-being). Subjective indicators.
8	Gomes et al. (2010)	Housing; transportation; leisure, media and culture; social and political participation; education; working conditions; income, health; environment; public safety and total life situation (Noll, 2002).
9	Hernández Aja (2009)	Economic indicators; Environmental indicators; Social indicators; Urban indicators.
11	Labonte et al. (2001)	Cluster analysis; Subjective indicators; Social Cohesion; Satisfaction: External Structures, Personal Relationships and Neighbourhood.
12	Marsal-Llacuna (2017)	No. of NGOs dedicated to solidarity per 100,000 inhabitants; % of municipal budget to providing means to different beliefs, to cultural activities, and to vulnerable groups (disabled, children, and the elderly); % surface in municipal buildings to citizens to perform civic activities; existence of ‘‘citizens’ inbox’’; % of adult population enrolled in training and educational programs; % of population suffering from malnutrition; Transparency of the municipal budget.
13	Martínez (2009)	Conditions of quality-of-life; Accessibility.
15	McAslan et al. (2013)	Objective indicators of QoL: population, economy, education, health, housing, public safety. Subjective indicators of QoL: personal quality of life (overall satisfaction).
18	Paramo et al. (2016)	Environmental quality; urban mobility; public services; culture; public safety, government dynamics; social dynamics; economy; infrastructure.
20	Santos and Martins (2007)	Objective indicators/Quantitative assessment (data): Environmental Conditions; Collective Material Conditions; Economic Conditions; Social dimension and the participation of citizens. Subjective indicators/Qualitative assessment (open questions).
21	Sawicki and Flynn (1996)	No. of supermarkets, public housing units, employers, jobs, libraries, public elementary schools, and police precincts; distance to downtown core and mayor employment centres; No. of infant deaths.
22	Sharifianpur and Faryadi (2014)	Environment; Health, Safety; Education; Economy; Urban facilities; Transportation; Housing; Culture, Art, Recreation.
24	Tovar and Bourdeau-Lepage (2013)	Well-being as freedom: education, social environment, urban mobility. Choice of freedom: proportion of the population that has the right to vote. Well-being as realisations: income, housing conditions, employment.
26	Van Herzele and Wiedemann (2003)	Parameters for evaluation of the attractiveness of urban green spaces: Spaces; Culture and history; Quietness; Facilities.

Based on the 15 studies, which are those in the SLR that propose a set of QoL indicator (as presented in Table 4, Section 3.1.1), the most widely considered indicators were identified and grouped by general dimensions, also based on NBR 37120 (2017) dimensions (main themes):

a) *Economy* (14/15 studies) is the most identified theme. It mainly includes unemployment rate, income and retail sale area per capita;

b) *Education* and *Governance* are tied for second place (12/15). *Education* mainly includes number of schools and percentage of school-aged population enrolled in school. *Governance* mainly includes voter participation and the possibility of holding political, religious and artistic manifestations, which require the existence of formal spaces for popular participation;

c) *Transportation* and *Health* are tied for third place (11/15). *Transportation* mainly includes public transportation availability and travel time. *Health* mainly includes access to health centres (in metres) and infant mortality;

d) *Urban planning* and *Shelter* are tied for fourth place (10/15). *Urban planning* mainly includes accessibility to green areas, heritage conservation, and quality of urban space (existence of urban facilities/equipment). *Shelter* mainly includes housing affordability and conditions and overcrowding.

e) *Culture* comes in fifth (9/15) and mainly includes the number of free culture events and the number of cultural facilities;

f) *Environment* and *Safety* (8/16), in sixth place, mainly includes air quality and noise pollution, and the number of crimes; and

g) The following themes complement the above themes: *Water and sanitation* (6/15); *Recreation* (6/15); *Solid waste* (5/15); *Wastewater* (4/15); *Telecommunications and innovation* (3/15); *Energy* (2/15); *Finance* (1/15); and *Fire and emergence response* (1/15).

Figure 11 presents the QoL main dimensions in order of importance, based on the 15 studies in the SLR that propose a set of QoL indicators. It is important to highlight the *Culture dimension* as the only one not considered in the NBR 37120 standard (2017).

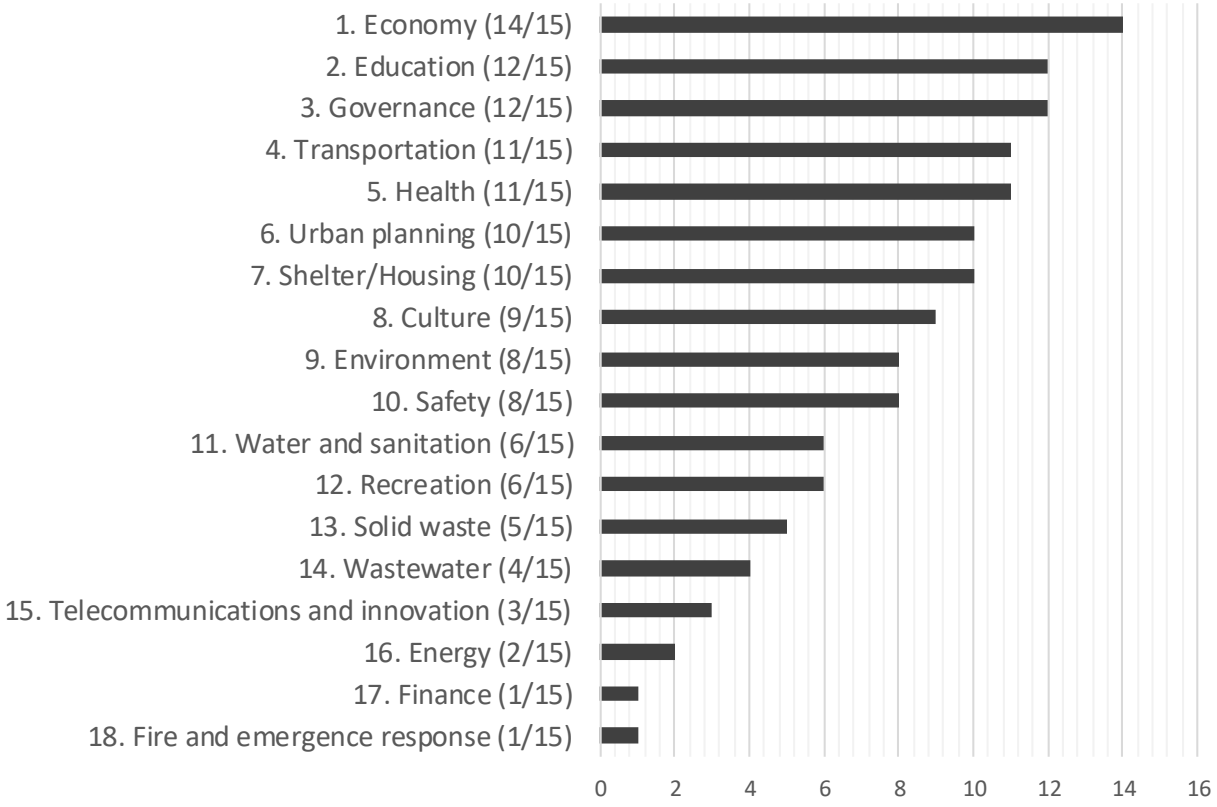

Figure 11 The main QoL dimensions and the number of studies that considered these dimensions

Table 11 presents the main QoL dimensions (economy, education, governance, transportation, health, urban planning, shelter/housing, culture, and the environment) and indicators in order of relevance, based on the 15 studies in the SLR that propose a set of QoL indicators.

It is also important to highlight that, as Potter et al. (2012, p. 784) pointed out, the effect of creating indices from combining multiple indicators can be of great benefit when predicting complex and multidimensional variables such as QoL. Additionally, it seems necessary to develop a more systematic approach to assess the multidimensional urban QoL, especially in terms of its subjective dimension (Sirgy et al., 2006, p. 399). In this regard, the translation of the findings of subjective QoL research into practical applications, and the development of an

index of subjective QoL indicators can help to complement the existing indicators already in use by social policymakers (Sirgy et al., 2006, p. 399).

Table 11 QoL main dimensions and indicators

1	**Economy**	(14/15)	Unemployment rate Income Retail sale area per capita
2	**Education**	(12/15)	Number of schools Percentage of school-aged population enrolled in school
3	**Governance**	(12/15)	Voter participation Number of formal spaces for popular participation
4	**Transportation**	(11/15)	Public transportation availability Travel time
5	**Health**	(11/15)	Access to health centres (in meters) Infant mortality
6	**Urban planning**	(10/15)	Accessibility to green areas Heritage conservation Urban space quality (existence of urban facilities/equipment)
7	**Shelter/Housing**	(10/15)	Housing affordability Housing conditions Housing overcrowding
8	**Culture**	(9/15)	Number of free culture events Number of cultural facilities
9	**Environment**	(8/15)	Air quality Noise pollution
10	**Safety**	(8/15)	Number of crimes

Based on the SLR on urban QoL and on the NBR 37120 (2017), it can be inferred that the multidimensional urban QoL encompasses *horizontal dimensions* (objective and subjective dimensions) and *vertical dimensions*, that includes relevant aspects of the living conditions that should be objectively and subjectively assessed. Therefore, based on the literature review, which helped to identify the main dimensions used in the assessment of the QoL, the following dimensions can be highlighted as relevant when assessing the multidimensional urban QoL:

a) *Urban services*: includes aspects related to education, health, water and sanitation, solid waste, telecommunications and innovation, and energy;
b) *Economy*: includes aspects related to employment, cost of living, economic and tourist activities;

c) *Urban mobility*: includes aspects related to means of transport, and ease of displacement;
d) *Culture and recreation*: include aspects related to opportunities to take part in leisure, sports, green areas and cultural activities;
e) *Conviviality*: includes aspects related to respect and coexistence between people, and participation in community activities;
f) *Security*: includes aspects related to safety, crimes, policing, and public lighting; and
g) *Environmental comfort*: includes aspects related to noise and air pollution, climate comfort, cleanliness, and wastewater.

They are proposed in this study as vertical dimensions of the urban QoL and are described below. The vertical dimensions should be evaluated by the horizontal dimensions, that is, they should be objectively and subjectively evaluated.

3.4.1.1. Urban services

Urban services can be better understood when differentiated from the concepts of urban infrastructure, which is the physical network itself (e.g., water pipe network), and urban equipment, which are buildings and facilities (e.g., schools and hospitals). Hospitals have regional influence, while the radius of influence of health centres and general practitioner are 500 m and 1000 m, respectively (Guimarães, 2004). Universities have regional influence, while the radius of influence of day-care centres, elementary schools and high schools are 300 m, 1500 m, and 3000 m, respectively (Guimarães, 2004).

Urban services, in turn, comprise management, maintenance and pricing related to infrastructure and urban equipment (Abiko, 1995, p. 4). The existence of urban services and its facilities support economic development and human settlements (Goudard et al., 2008, p.99). Public service can be considered a means for improving the population's QoL, especially in terms of health and hygiene. Furthermore, the adequate provision of public services is part of an income redistribution policy as it also serves a portion of the population with insufficient income (Abiko, 1995, p. 3). Thus, the lack of urban services can reveal social inequalities (Goudard et al., 2008, p. 99).

3.4.1.2. The Economy

Economic development is directly linked to urban economies as they are the starting point of the creation of a diversified economic base capable of generating employment opportunities (Habitat, 2004, p. 21). The Economic Promotion Strategy of the Porto Alegre Urban Environmental Development Master Plan (*Plano Diretor de Desenvolvimento Urbano Ambiental* – PDDUA) aims to establish policies that seek to boost the city's economy and improve the quality of life and citizenship, through direct actions with the community and productive sectors (PDDUA, 2010, p. 32). Some implementation measures such as encouraging traditional street commerce and the operation of shops and services at night have been implemented in the central area, contributing to the revitalization of these areas, in addition to promoting the generation of jobs close to residential locations (PDDUA, 2010, p. 32).

3.4.1.3. Culture and recreation

Paramo et al. (2016, p. 14) point out the importance of cultural dynamics in the assessment of QoL, considering aspects such as the number of free cultural activities and the amount of cultural heritage identified and preserved. NBR 9284 (1986, p. 2) classifies libraries, cultural centres, convention centres, cinemas, acoustic shells, botanical gardens, zoos, museums, and theatres as *cultural spaces*, and parks, public swimming pools, marinas, gymnasiums, sports clubs, fields and sports tracks as *recreation and sporting spaces*.

The Porto Alegre PDDUA (2010) aims to qualify the municipal territory, through the enhancement of the environmental heritage (cultural and natural heritage) (PDDUA, 2010, p. 26). Cultural heritage includes buildings, ambiences, parks, landscapes, and cultural manifestations (PDDUA, 2010, p. 26). Some implementation measures include the identification and valorisation of the environmental heritage as diversified spaces in the occupation of the territory, thereby constituting elements for the strengthening of cultural identities and contributing to the enhancement of the landscape and the structuring of public spaces (PDDUA, 2010, p. 27).

Open public spaces for recreation can increase the QoL in urban centres as they allow meetings, moments of relaxation, and social and sports practices (Oliveira & Mascaró, 2007, p. 60). In addition, the vegetation present in these spaces benefits the well-being of people, the

biodiversity, and the microclimate (by decreasing the temperature, increasing the relative humidity of the air, and absorbing pollutants) (Oliveira & Mascaró, 2007, p. 60). Also, cities with greater diversity are more likely to have successful parks (Jacobs, 1961, p.111). The POA PDDUA (2010) aims to promote the potential of the territory through permanent actions to implement and maintain parks and plant trees on the pavements (PDDUA, 2010, p. 27).

3.4.1.4. Urban mobility

Mobility is associated with people and goods. It corresponds to the different responses given by individuals and economic agents to their displacement needs, considering the dimensions of the urban space and the complexity of the activities carried out therein (Brasil, 2004, p. 13). The social and economic needs of people require their movement in space, which can be done on foot or by means of motorized (collective and individual) or non-motorized transport vehicles (bicycles, horses etc.) (Vasconcellos et al., 2011).

The Brazilian law NBR 12.587 (2012), which institutes the guidelines of the National Policy on Urban Mobility, defines *urban mobility* as a condition in which the displacement of people and goods in the urban space takes place (Article 4 II). This law establishes the Urban Mobility Plan as the instrument for implementing the principles, guidelines, and objectives of this policy. Its application is mandatory for all Brazilian municipalities with more than 20 thousand inhabitants. It has as important guidelines the priority of active transport modes over motorized ones and public transport services over individual transport; the mitigation of environmental, social, and economic costs (external costs or externalities) of urban displacements, especially road traffic; in addition to encouraging scientific-technological development and the use of less polluting renewable energies (Brasil, 2017, p. 14). Some contents to be covered by the Plan are public transport services; road circulation; infrastructure of the urban mobility system; accessibility for people with mobility restrictions; integration of public, private, and non-motorized transport modes; parking areas; and the systematic periodic evaluation of the Plan every ten years or less (Brasil, 2017, p. 14).

In developing economies such as that of Brazil, people who live in cities make two movements a day on average, corresponding to half of the displacements of people in developed countries (Vasconcellos et al., 2011). Thus, in large cities in Brazil with a population of 3 million people, 6 million trips per day are made (Vasconcellos et al., 2011, p. 7). These displacements are made with a greater or lesser level of comfort according to the

specific conditions in which they are carried out and imply the consumption of time, space, energy, and financial resources, and the generation of negative externalities such as air pollution, traffic accidents, and congestion (Vasconcellos et al., 2011, p. 7). Due to the intense urban growth in Brazil from the 1960s onwards, many cities – and metropolitan regions – started to present low-quality and high-cost mobility systems, with negative impacts on people's lives and with economic and environmental costs for society. Thus, the study of the effective conditions of mobility (by social strata), consumption and associated externalities is essential to assess the quality of urban life (Vasconcellos et al., 2011, p. 8).

3.4.1.5. Conviviality

Illich and Lang (1973, p. 11) defines *conviviality* as the autonomous and creative relationship between people and with their environment. Conviviality represents the individual freedom realized in personal interdependence (Illich & Lang, 1973, p. 11) and involves the analysis of "living together" in society, including life between human beings and between humans and the places, animals, artefacts, etc. (Costa, 2019, p. 16). The sum of many brief public sidewalk (pavement) contacts builds a feeling for the public identity of people and a web of public respect and trust (Jacobs, 2011, p. 56). A good city street neighbourhood allows a balance between people's privacy, social life, and help from the people around (Jacobs, 2011, p. 59).

Contemporary studies (Gilroy, 2004, 2006) use the concept of conviviality to respond to diverse challenges related to individual or collective identities present in society (Costa, 2019, p. 22). According to Gilroy (2006, p. 40), conviviality is a social situation in which the racial, linguistic, religious, and others particularities of different metropolitan groups that live close to each other do not generate discontinuities of experiences, nor insuperable communication problems. It is the articulation and negotiated coexistence of differences in daily life (Costa, 2019, p. 23). In any society where conviviality is reduced below a certain level, some people's needs are not met (Illich & Lang, 1973, p. 11). Thus, conviviality refers to the relational dimension of social life and the convivial interactions, based on cooperation but also on conflicts (Costa, 2019, p. 16). As it is related to the context of analysis, its categories of analysis can vary according to each case study conducted (Costa, 2019, p. 27).

3.4.1.6. Security

A sense of *security* is a social and psychological need for people in public spaces (Carr et al., 1992, p. 232). The greater the number people on the street, the greater the potential for a city to be safe (Gehl, 2013, p. 6). A cohesive urban structure that requires only short walking distances and contains attractive and diversified public spaces can increase people's activities and feeling of security on the streets (Gehl, 2013, p. 6). Hence, a secure city is one that has safe streets and sidewalks (Jacobs, 2011, p. 30). Crime is a reality and a common concern in many cities and must be considered when analyzing the quality of public space (Carr et al., 1992, p. 232).

As pointed out by Jacobs (2011, p. 30), cities are full of strangers, and a good city to live in is one where a person feels safe on the street, even amongst strangers. Hence, the streets must have three main qualities: (a) a clear definition of public space; (b) buildings oriented to the streets (doors and windows); and (c) people on the streets (Jacobs, 2011, p. 35). Consequently, good cities are more suitable for children, who need a variety of places and opportunities to play and to learn, under the supervision of adults on active city sidewalks (Jacobs, 2011, p. 81). Safety can also be increased by other features such as space management policies, the use of personnel to ensure the security of users, and design features to avoid barriers to visibility (e.g., fenced parks) (Carr et al., 1992, p. 232). Street lighting is also an important factor but no more so than the presence of people on the streets (Jacobs, 2011, p. 42).

3.4.1.7. Environmental comfort

Environmental comfort is related to the external setting of the human experience, encompassing light, noise, the environment, colour, temperature, and natural and built elements (Mussi, 1996, p. 258). Comfort is a basic need for people in public spaces (Carr et al., 1992, p. 231), and hence environmental conditions play a role in the way people use and appropriate public spaces (Serdoura, 2007, p. 153). For instance, balancing access to the sun and relief from the sun is an important factor in the urban environment. Shade from trees or some form of shelter is thus required to increase thermal comfort (Carr et al., 1992, p. 231).

Environmental perception can be understood as a sensory experience of the individual and as an experience characterized by the set of information and values that the individual has about

the environment (Reis & Lay, 2006, p. 23). Hence, environmental comfort research has become increasingly important for improving the quality of living in cities and encouraging people spend more time on outdoor activities (Peng et al., 2021, p. 1). The assessment of comfort in the built environment must include tangible aspects of the built environment such as temperature, lighting, noise levels, quality of materials but also must consider the users' perceptions of these aspects (Freitas Filho et al., 2018, p. 54).

Air quality is a measure of the level of air pollutants to which a population is exposed (WRI[11], 2021, p. 3). Air pollution is a major challenge for cities throughout Brazil, accounting for more than 51,000 deaths annually, according to a report published by the Pan American Health Organization (OPAS, 2018), which relates the incidence of premature deaths, pulmonary and cardiovascular diseases, strokes, disposition to cancer and diabetes, in addition to impaired cognitive development in children and dementia in the elderly (WRI, 2021, p. 2). In the transport sector, road transport is the main culprit for local pollution (transport of cargo and of passengers, by trucks and automobiles) (WRI, 2021, p. 2).

Environmental noise pollution, defined as an unwanted sound, is also a threat to health and well-being (Goines & Hagler; 2007, p. 287) and can cause sleep, cardiovascular and mental health disturbances, hearing impairment, and interference with spoken communication, concentration, and recreation (Goines & Hagler; 2007, p. 289). The Environmental Qualification Strategy of the POA PDDUA aims to promote the potential of the territory, and overcome conflicts related to pollution, environmental degradation, and sanitation (PDDUA, 2010, p. 26). Implementation measures include the promotion of sanitation and pollution monitoring.

3.4 CONSIDERATIONS ON CHAPTER 3

The SLR shows that a QoL concept review is made in 19% of the studies, and a conceptualization of QoL is suggested as a result. Secondary data are considered by 54% of the studies, while 31% of the studies developed empirical studies and collected primary data, especially through interviews and surveys. Objective indicators are considered by most of the studies (81%), and subjective indicators are included in 54% of the studies. Both objective and subjective indicators are considered in 42%. The regional scale unit of analysis is

[11] https://wribrasil.org.br/sites/default/files/wri-o-estado-da-_qualidade-do-ar-no-brasil.pdf

considered by 31% of the studies, while the local scale is considered by 46%. QoL indicators are proposed by 58% of the studies, while the QoL index is put forward by only 11%. Furthermore, based on the criteria quality of study execution (A), adequacy of the study to the review question (B), and adequacy of the study to the focus of the review (C), only 5 studies (19%) achieved high quality in the overall rating (D). This analysis contributes to understanding the nature of QoL.

Another important finding of this SLR is the following set of themes and QoL indicators, identified from the 15 studies in the SLR that propose a set of QoL indicators: Economy (unemployment rate, income, and retail sale area per capita); Education (number of schools and the percentage of school-aged population enrolled in school) and Governance (voter participation and the existence of formal spaces for popular participation); Transportation (public transportation availability and travel time) and Health (access to health centres and infant mortality); Urban planning (accessibility to green areas, heritage conservation, and quality of urban space) and Shelter (housing affordability, conditions and overcrowding); Culture (number of free culture events and number of cultural facilities); and the Environment (air quality and noise pollution) and Safety (number of crimes). All these themes except Culture are included in the Standard *ABNT NBR ISO 37120:2017 - Sustainable development of communities: Indicators for city services and quality of life*. This study points to the importance of the inclusion of indicators related to social-cultural aspects, which have a great effect on QoL, as an important area when assessing QoL.

A number of studies support that QoL encompasses both objective and subjective dimensions (Abbate et al., 2001; Berhe et al., 2014; Coulton & Korbin, 2007; Cummins, 2000; Dissart & Deller; 2000; Felce and Perry, 1995; Gomes et al., 2010; Hernández Aja, 2009; McAslan et al., 2013; Paramo et al., 2016; Santos & Martins, 2007; Zapf, 1979, 2000), each including various aspects of living conditions (such as material well-being, health, safety, relationships, and emotional well-being). However, urban policies rarely include subjective indicators in the urban planning process, and this can generate shortcomings regarding decision making by disregarding the wishes and requirements of people (Paramo et al., 2016).

The o*bjective dimension* comprises culturally relevant measures of objective living conditions (Cummins, 2000) and is related to the exogenous facts of a person's life (external conditions) (Dissart & Deller, 2000). It is usually expressed by quantitative data from statistics that evaluate concrete aspects of QoL (Santos & Martins, 2007), which include environmental,

economic, or social conditions of a specific place of analysis (Santos & Martins, 2007). The *subjective dimension* comprises the level of satisfaction with these domains, weighted by their importance to the individual (Cummins, 2000) and is the endogenous perception a person has of these facts and of herself/himself (internal mechanism) (Dissart & Deller; 2000). It is mostly qualitative, including subjective interpretations of living conditions (Santos & Martins, 2007).

In this regard, various studies argue that QoL is a multidimensional concept, and, as it is a complex concept, a multidimensional structure is advantageous when measuring it (Bramston et al.; 2002; Diener et al. 1985; Dissart & Deller; 2000; Matarrita-Cascante, 2010; Potter et al., 2012; Rogge & Van Nijverseel, 2019; Veenhoven 1997). The multidimensional QoL concept, therefore, is closely aligned with the concepts of *perceived value*. As pointed out by Thomson et al. (2003, p. 337), value can be subjective, if it remains internalized within an individual or an organization, or objective, if it is expressed and negotiated in a common language (universal metrics) by individuals and organisations within a project. Thus, based on this relation with the perceived value literature, in terms of the multidimensional QoL definition and assessment, it can be inferred that:

a) the *objective QoL* is related to universal metrics understood by the individuals of a society – the exogenous living conditions; and

b) the *subjective QoL* is related to the endogenous perception of these living conditions by people (e.g., level of satisfaction).

These universal metrics can be expressed by QoL indicators, which should be based both on objectively observable facts and on people's own subjective assessment of their life (Szalai, 1980).

Based on this literature review, this study considers the urban QoL to be a multidimensional concept, and it can be inferred that the multidimensional urban QoL encompasses *horizontal dimensions* (objective and subjective dimensions) and *vertical dimensions*, including relevant aspects of the living conditions, and should be objectively and subjectively assessed. In this sense, it can be inferred that the objective and subjective dimensions have different assessment methodologies for certain living conditions: *they are different perspectives of the evaluation of living conditions (external and internal evaluations)*. All dimensions are considered equally relevant in the QoL assessment. Thus, it is important to simultaneously

assess these three elements to capture the QoL: objective living conditions, satisfaction with living conditions, and the importance these living conditions in people's lives (Felce & Perry, 1995).

Moreover, the reasons for mismatches between objective living conditions and people's subjective perception of their living conditions should be addressed as it can contribute to a better understanding of the relevant aspects of QoL. Finally, the following vertical dimensions are proposed to assessing the multidimensional urban QoL: urban services; economy; culture and recreation; urban mobility; conviviality; security; and environmental comfort. However, vertical dimensions can vary according to the specific cultural aspects of each location to be analyzed.

4 RESEARCH METHOD

This chapter describes the development of the study in all its stages, aiming to answer the questions initially put forward. Initially, the research strategy is presented, and its design is described, in order to provide an overview of the study. The stages of the study are then described in detail. Finally, the case studies in the central area of POA are presented.

4.1 RESEARCH STRATEGY

Design Science Research (DSR) is the methodological approach adopted in this study as it aims to develop an innovative artefact to help with a real problem (Holmström et al., 2009). These may be innovations proposed by researchers or developed from pre-existing theories (Kasanen et al., 1993). According to Kasanen et al. (1993), DSR is prescriptive research as it aims to solve a real problem and usually mixes quantitative and qualitative data. Hence, *artefacts* are the DSR outputs (products) and can be classified into four types (March & Smith, 1995, p. 256-258):

a) *Constructs*: concepts that represent the vocabulary of a specific domain, used to describe problems and to specify their solutions;

b) *Model*: a set of propositions expressing the relation between constructs; it can be also viewed simply as a description or representation of how things are;

c) *Methods*: a set of steps necessary to perform a task, based on a set of underlying constructs and/or on a model; thus, methods can be tied to particular models, having their steps as input of the model; and

d) *Instantiation*: the implementation of an artefact in its environment.

These artefacts must be submitted to an empirical implementation and evaluation to verify their performance in practice (Holmström et al., 2009). In DSR, an artefact is built for a specific purpose, and its performance is assessed (testing the proposed solutions in the environment in which it operates), based on established criteria (March & Smith, 1995), and thereby contributing to the practice and theory of the discipline in which it is applied (Kasanen et al., 1993; Lukka, 2003).

This study therefore includes both qualitative and quantitative data from multiple sources of evidence, discussed later in this chapter, and proposes an *urban QoL multidimensional assessment method* in the context of the renovation of buildings for social housing in central urban areas, aiming to contribute to the urban QoL research field. The proposed method had as its starting point the *welfare model* proposed by Zapf (1979, p. 769-771) (see Section 3.3), which includes the objective and subjective dimensions of QoL, widely discussed in the QoL literature. At the end of the empirical study, a discussion was carried out on the theoretical and practical contributions of the proposed method.

According to Holmström et al. (2009), the knowledge production cycle of a research project can comprise the following four main phases:

a) Solution incubation: elaborate the problem and develop a potential solution;

b) Refinement of the solution: refine the solution elaborated in the previous phase as it is tested in practice;

c) Proposition of a substantial theory: establish the theoretical relevance of the solution, which can be generalized to the empirical context under study; and

d) Proposition of a formal theory: generalizing the established theory beyond the context under study.

The first two phases are exploratory ("a" and "b") and the last two are explanatory ("c" and "d") (Holmström et al., 2009). As performed in this research, studies involving phases "b" and "c" can include both the refinement of the artefact, obtaining practical results, as well as considerations on the first theoretical level (Holmström et al., 2009). This study includes phases "a", "b", and "c".

4.2 RESEARCH DESIGN

The literature review was made at different moments throughout the study, addressing themes related to the following subjects: social housing, underutilized buildings in urban centres and the opportunity to renovate them for social housing, perception of value, multidimensional urban QoL (concepts and its assessment methods), subjective and objective QoL, and urban indicators. **Figure 12** presents an overview of the research process carried out in this study, which includes three main stages:

a) *Stage 1 – comprehension*: focuses on the theoretical and practical understanding of the research problem, that is, understand how urban QoL can be assessed. By the end of the systematic literature review (SLR), a model to evaluate the urban QoL, based on Zapf's (1979) welfare model (which includes both objective and subjective QoL), was proposed. Stage 1 was developed from March 2017 to June 2019.

b) *Stage 2 – development*: focuses on the proposal of a conceptual framework to evaluate the multidimensional urban QoL and data collection with social housing residents (of four buildings in the central area of POA) to identify the subjective QoL. A multidimensional method to evaluate the urban QoL was then proposed. Stage 2 was developed from July 2019 to July 2021.

c) Stage 3 – *analysis*: focuses on the identification of objective QoL indicators (secondary data), and on the comparison between the subjective and objective QoL. The final version of the multidimensional method to evaluate the urban QoL was proposed. It was then assessed, based on its *utility* and *applicability*. Finally, a cross-analysis of the results at the different stages of the study was carried out, and their practical and theoretical contributions were analyzed. Stage 3 was developed from August 2021 to November 2021.

Each stage contains steps of a DSR process, based on Lukka (2003) and Kasanen et al. (1993), and represents cycles of repetition throughout the development of the study (comprehension, development, and analysis), allowing for the refinement of the proposed method:

a) Find a relevant research problem;

b) Understand the problem from the theoretical and practical points of view;

c) Collect data;

d) Develop and implement an innovative solution idea to solve the problem (artefact);

e) Test the solution and assess its practical contribution (exam the scope of the applicability of the solution); and

f) Assess the theoretical contribution of the solution.

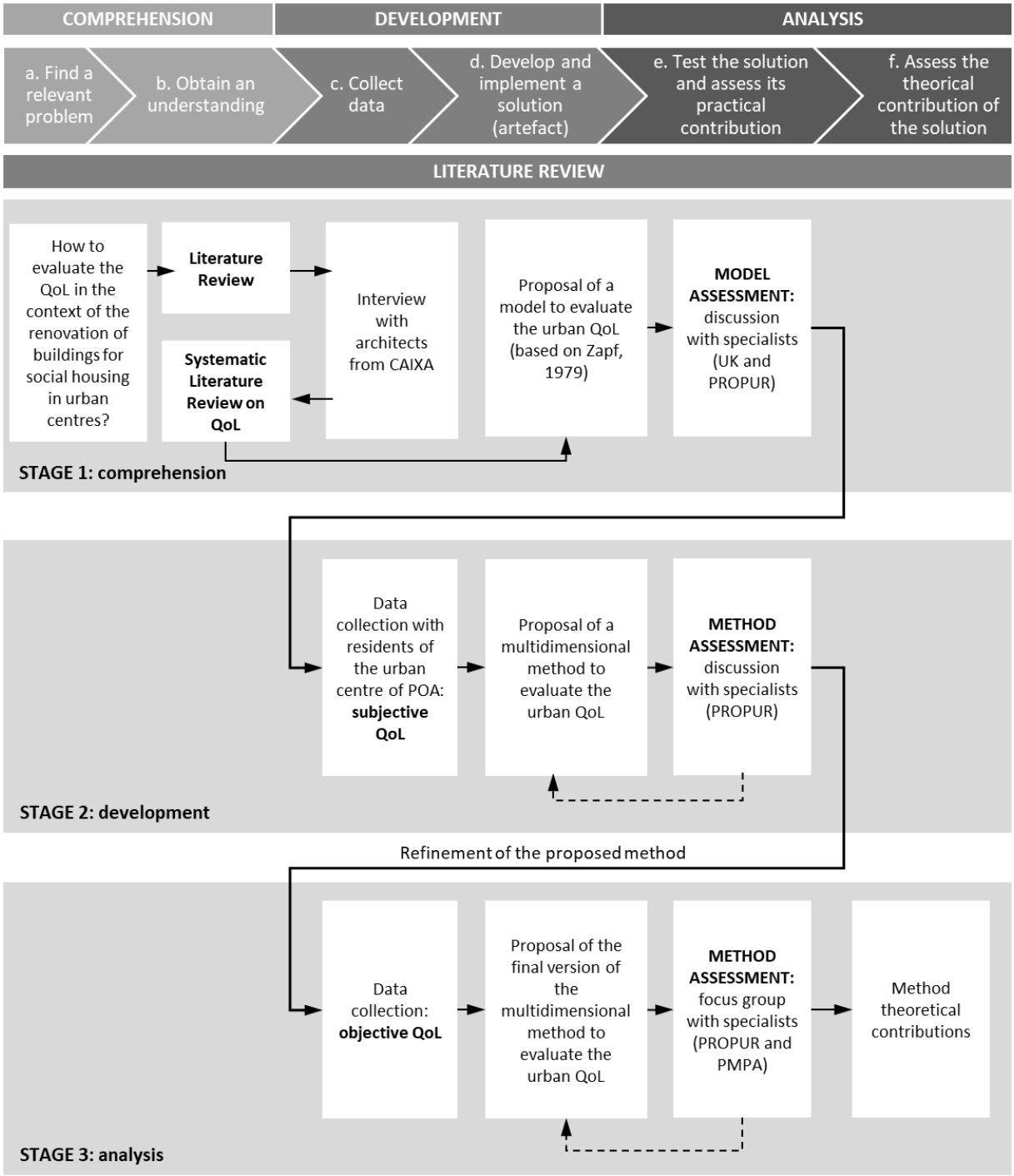

Figure 12 Overview of the research process

Table 12 presents the study stages and the sources of evidence used at each one. The three stages undertaken are described as follows.

Table 12 Study stages and sources of evidence used at each stage

Stages of the study	Sources of evidence
1	Exploratory interviews
1	Semi-structured interviews
2	Survey (to assess the subjective QoL)
2, 3	Local observation: photographic register
2, 3	Urban analysis
2, 3	Secondary data analysis (to assess the objective QoL)
2, 3	Multidimensional urban QoL method assessment (focus group)

4.2.1 Stage 1: Comprehension

Stage 1 includes the following main steps:

a) Theoretical and practical understanding of the research problem and its context through literature review, which included themes related to urban QoL and perception of value, developed from March 2017 to October 2018.

b) Exploratory interview within two architects from CAIXA, the social housing financial agency in Brazil, on 3 October, 2017 and on 3 November, 2017. On this occasion it was possible to better understand the main challenges in this context and to identify four renovated buildings for social housing in the central area of POA.

c) After that, a SLR was performed, from December 2018 to March 2019, aiming to better understand QoL definitions, QoL assessment, and QoL indicators. The results are presented in Chapter 3.

d) Two semi-structured interviews were applied within employees of the St Basils Housing Association of Birmingham[12] (on 12 March and on 9 May, 2019), aiming to better understand the process of the acquisition of social housing in the British context. At the second meeting, it was possible to validate the data collection protocol

[12] https://stbasils.org.uk/

proposed by the researcher (to assess subjective QoL in POA) with these specialists. The interview script, approved by the ethics committee of the University of Huddersfield (UK), is presented in Appendix 1.

e) By the end of this SLR, a model to evaluate the urban QoL, based on the welfare model of Zapf (1979), was proposed (Section 5.1.1).

f) The presentation and discussion on the proposed model to evaluate the urban QoL were made by the researcher when attending two seminars at the University of Huddersfield, UK (January and February 2019), during her PhD exchange scholarship (from November 2018 to May 2019), and at the SPACE International Conference 2019 on Sustainable Architecture, Planning and Urban Design in London, UK (May 2019).

g) The presentation and discussion on the proposed model to evaluate the urban QoL were made in the Qualification Exam at PROPUR/UFRGS (19 June, 2019).

Table 13 presents the main steps of Stage 1 and their execution dates.

Table 13 Main steps of Stage 1 and its execution dates

STAGE 1 main steps	Execution date
a) Theoretical and practical understanding of the research problem and its context through literature review	From March 2017 to October 2018
b) Exploratory interview within two architects from CAIXA	3 October, 2017 and 3 November, 2017
c) Systematic literature review	From December 2018 to March 2019
d) Two semi-structured interviews made with employees of the St Basils Housing Association of Birmingham (UK)	12 March, 2019 and 9 May, 2019
e) Proposal of a model to evaluate the urban QoL (based on Zapf, 1979)	May 2019
f) Model discussion with specialists in the UK	From January to May 2019
g) Qualification Exam at PROPUR/UFRGS	19 June, 2019

4.2.1.1. The Systematic Literature Review (SLR) Method

The systematic literature review (SLR) is a method of locating, assessing, and synthesising evidence (Petticrew, 2001). It aggregates the results of existing relevant studies around a specific research question. SLR follows an explicit and planned method and should be accurate, replicable, and updatable (Dresch et al., 2015, p. 142). It is also a process that requires judgements of the quality and relevance of the research evidence presented, based on specific criteria and purposes (Gough, 2007).

A SLR was therefore carried out to obtain an understanding of diverse QoL concepts and to identify dimensions and urban indicators that contribute to the evaluation of the multidimensional urban QoL, thereby helping to develop an innovative method that aims to collaborate with a real problem (Dresch et al., 2015, p. 128), that is, a multidimensional method to evaluate the urban QoL, especially in the context of renovated buildings for social housing in urban centres.

Figure 13 presents the SLR research design here adopted, based on the SLR stages proposed by Gough (2007). The steps undertaken are described below.

1. Searching for studies	a. Formulating a review question	*How can the quality of life be assessed through urban indicators?*
	b. Developing a SLR protocol	• Defining Inclusion Criteria: a) language (English, Portuguese and Spanish); and b) open access. • Defining Search terms: ("urban indicators" OR "indicadores urbanos") AND ("quality of life" OR "well-being" OR "qualidade de vida"). • Defining Databases: Scopus; Web of Science; ProQuest.
	c. Searching for studies	152 studies.
2. Screening studies	d. Screening studies by verifying whether they meet inclusion criteria	Adding a third inclusion criteria: studies should present both search terms in either the title, abstract and keywords, and at least one of the terms must appear as a keyword (26 studies).
3. Results	e. Describing and appraising quality and relevance of studies *(Section 3.1)*	Proposing a *Weight of Evidence framework* to make separate judgements and then to combine them (quality of study execution; adequacy of the study to the review question; and adequacy of the study to the focus of the review).
	f. Synthesizing findings by answering the review question *(Section 3.2)*	Identifying whether the studies considered the following aspects: QoL concept review; Secondary/Primary data; Objective/Subjective indicators; Regional/Local scale ; QoL indicators/Index.
4. Discussion and Final considerations	g. Communicating an interpretation and application of the review findings *(Section 4 and 5)*	QoL Conceptualization; QoL Evaluation; and QoL Indicators.

Figure 13 SLR research design, based on the SLR stages proposed by Gough (2007)

Searching for studies stage is described as follows. This SLR addressed the following research question: “How can the quality of life be assessed through urban indicators?”. The review started with the proposal for the SLR protocol (**Table 14**), adapted from Dresch et al. (2015, p. 155). It comprises this study framework, which addresses general research topics (subject, context, and problem), and the SLR framework, which includes the SLR question, expected findings, inclusion criteria, search terms, and databases to be used in the search. Expected findings are related to accessing a better understanding of the QoL concept and the main QoL assessment methods proposed in this literature.

Table 14 The systematic literature review protocol

SYSTEMATIC LITERATURE REVIEW PROTOCOL		
Research framework	**Research subject**	QoL in in the context of the renovation of buildings for social housing in central urban areas.
	Research context	Problems related to the location of social housing in Brazilian cities + vacant buildings in central areas.
	Research problem	Studies and public policies that focus on the financial and immediate costs of the renovation of buildings for social housing, but do not seek to evaluate whether it improves the QoL of the inhabitants or generates benefits to the urban centres.
SLR framework	**SLR question**	How can the quality of life be assessed through urban indicators?
	Expected findings	Better understanding of the QoL concept and the main evaluation methods used in order to understand the concepts and methods to assess QoL.
	Inclusion criteria	Languages: English, Portuguese, and Spanish. Studies should present both search terms in either the title, abstract and keywords, and at least one of the terms must appear as a keyword. Studies must have open access.
	Search terms	("urban indicators" OR "indicadores urbanos") AND ("quality of life" OR "well-being" OR "qualidade de vida").
	Databases	Scopus | Elsevier; Web of Science; ProQuest.

The search terms used in three databases (Scopus; Web of Science; and ProQuest) are: (“urban indicators” OR “*indicadores urbanos*”) AND (“quality of life” OR “well-being” OR “*qualidade de vida”*). The databases were chosen according to criteria of breadth of content and recognition by research on QoL. The studies were selected according to the following inclusion criteria:

a) Languages: English, Portuguese, and Spanish; and

b) Studies must have open access.

The first round of the search, conducted in January and February 2019, identified 152 papers (Scopus: 21; Web of Science: 15; ProQuest: 116).

Screening studies stage is described as follows. Many of the 152 studies identified were from the health area. Hence, a third additional inclusion criteria was used:

c) Studies should present the search terms ("urban indicators" and "quality of life") in the title, abstract and keywords, and at least one of the terms must appear as a keyword.

In this second round, 37 papers were identified (Scopus: twelve; Web of Science: eleven; ProQuest: 14). However, some were duplicates. Hence, 26 studies were considered in this SLR: 21 papers in English, one in Portuguese, and four in Spanish. Additional studies, referenced in the studies identified in the SLR, were also considered in the literature review as they presented important contributions on QoL (Allardt, 1976; Clark, 2000; Constanza et al., 2007; Cummins, 2000; Felce & Perry, 1995; Zapf, 1979;). The searches were made in March 2019.

Results stage is described as follows. Initially, the quality and relevance assessment of the papers was carried out. This is an important step as a study can meet initial inclusion criteria but not necessarily meet quality and relevance standards for the review. Therefore, a Weight of Evidence framework helps to make separate judgements and then to combine them (Gough, 2007). Following are the Weight of Evidence A, B, C and D used in this SLR, based on Gough (2007):

a) *Weight of Evidence A*: a generic judgement of the *methodological soundness*, by analyzing whether the proposed method meets the standards required by the subject of study, whether the study rigorously followed the method, and whether the results are based on facts and data;

b) *Weight of Evidence B*: *Adequacy of the study to the SLR question*, by verifying the relevance of the study (subject and an appropriate method) to the review question;

c) *Weight of Evidence C*: *Adequacy of the study to the focus of the SLR*, by verifying whether the study was performed in a similar context to that defined by the review; and

d) *Weight of Evidence D*: *Overall quality* assessment, which is based on the three previous items (A, B and C).

The Weight of Evidence framework based on criteria proposed by Pawson et al. (2003), adapted by Gough (2007) and used in this SLR, is presented in **Table 15**.

Table 15 Weight of Evidence framework (criteria)

Weight of Evidence framework		
Weight of Evidence	**Criteria**	
Methodological soundness (A)	Transparency	Clarity of purpose: aims, objectives, and all the steps of the subsequent argument.
	Accuracy	It should demonstrate that all recommendations are based upon relevant and appropriate information.
	Accessibility	Understandable: knowledge should be presented in a way that meets the needs of the knowledge seeker.
	Specificity	Method-specific quality: knowledge must pass muster within its own source domain.
Adequacy to the SLR question (B)	Purposivity	Fit for purpose method: the approaches and methods used to gain knowledge should be appropriate to the task in hand.
Focus/context of the study to the SLR question (C)	Utility	Knowledge should be appropriate to the decision setting in which it is intended to be used, and to the information need expressed by the knowledge seeker.
Overall quality (D)		Based on criteria A and B.

During the SLR performance, some emergent criteria can be identified. As Pawson (2006) points out, an emergent criteria "is similar to a priori criteria for assessing studies but based on emergent assessment of the contribution to answering the review question (just as relevance of different types of data might only emerge during the process of some qualitative process studies)".

As this SLR aims to understand the different ways of evaluating QoL from a broader approach, not limited to a specific context (C) the following *emergent criteria* is proposed: "A and/or B categories of analysis, but C, could lower the overall quality (D)". Therefore, it is helpful to have *focus/context of study* (C) criteria in isolation, but it had a lower weight in the

overall studies evaluation than *methodological soundness* (A) and *adequacy to the review question* (B) categories. A and B criteria then defined studies' *overall quality* assessment.

Then, the synthesis of the findings was organized around the SLR question (How can the quality of life be assessed through urban indicators?), aiming to identify studies considering the following aspects, which are concepts frequently addressed in the QoL literature: whether a QoL concept is proposed/reviewed; whether primary or secondary data are used in QoL assessment; whether objective and subjective indicators are used in QoL assessment; whether regional and local scale are considered; and whether QoL indicators and QoL index are proposed.

Finally, in the *discussion and final considerations* stage of the SLR, the QoL concepts and the main QoL assessment methods proposed in this literature are discussed.

4.2.2 Stage 2: Development

Stage 2 includes the following main steps:

a) After the Qualification Exam (June 19, 2019), the study project was submitted to the Research Committee of UFRGS (*Comissão de Pesquisa* - COMPESQ), on 2 September, 2019, and approved on 3 October, 2019. Then, on 22 October, 2019, it was submitted to the Research Ethics Committee of UFRGS (*Comitê de Ética em Pesquisa* – CEP) and approved on 28 November, 2019 (CAAE 24490919.3.0000.5347). The COMPESQ report is presented in Appendix 2.

b) Proposal of the conceptual framework to evaluate the multidimensional urban QoL (Section 5.2.1), based on the SLR on QoL and on urban indicators (from February to June 2020).

c) Proposal of the final data collection protocol (Appendix 3), that is, the questionnaire based on the conceptual framework (July and August 2020). It presents multiple-choice satisfaction questions (scale: *very good*; *good*; *regular*; *bad*; *very bad*; and *not applicable*), related to the living conditions of the neighbourhood, and open questions about these living conditions, aiming at a better understanding of the subjective perception of the respondents.

d) Urban analysis: preparation of the land use map and coverage map of urban equipment[13], from August 2020 to December 2020.

e) After consulting with the Statistical Advisory Nucleus (*Núcleo de Assessoria Estatística* - NAE) team of the Institute of Mathematics and Statistics at UFRGS (18 September, 2020)[14], the Sampling Plan was drawn up (**Table 16**). Simple random sample size calculation was performed with the aim of guaranteeing a minimum response percentage for each item per question in the questionnaire. For the calculation, an application made from R statistical software packages that operates with the command "sample.size.prop" was used. The target population was defined as all housing units in each building, that is, 177 housing units. Thus, considering a confidence level of 95%, a margin of error of 5% and a Y-prevalence of 50%, the planned sample consisted of 88 respondents.

Table 16 Sampling Plan

SAMPLING PLAN		
Building	**Population**	**Planned sample**
20 de Novembro Squat	17	8
Autonomous Community Utopia e Luta	42	21
Sul América Building	78	39
Bento Gonçalves Building	40	20
Total	**177**	**88**

f) Application of the online questionnaire (Google Forms) with PROPUR specialists and with two residents of the buildings under study (one resident from Utopia e Luta and the other from 20 de Novembro) in order to test and refine the instrument. The questionnaire was also reviewed by a statistician[15]. Minor changes were then made (October 2020).

g) Data collection (Survey) with residents of four buildings – *20 de Novembro Squat (Floresta district), Autonomous Community Utopia e Luta (Historic Centre), Sul*

[13] Steps "d", "h", and "i" were carried out with the collaboration of the Architecture students Giordana de Oliveira Sant'Anna and Ana Carolina Ortolan Cole, linked to Scientific Initiation (PROPUR/UFRGS research project: Quality of Life in the Context of Renovated Buildings for Social Housing in Central Urban Areas).
[14] NAE team: Professor Stela Maris de Jezus Castro, and the students Gabriel Holmer Saul, Gustavo Machado Utpott, and Rafaela Vidal Galetto.
[15] Matias Segelis Vieira.

América Building (Historic Centre), and *Bento Gonçalves Building (Historic Centre)* – to identify their QoL perception of living in a central urban area, that is, their subjective QoL (from October to December 2020). Case studies are presented in Section 4.4.

h) Tabulation of collected data (January and February 2021).

i) Graphing for interpretation of collected data (March and April 2021).

j) Subjective data analysis (from May to July 2021): content analysis presented in Section 4.2.2.1 and 5.2.4 (results).

k) Proposal of a preliminary version on the multidimensional method to evaluate the urban QoL (Section 5.2.2) and discussion with specialists from PROPUR/UFRGS, in July 2021.

l) The multidimensional subjective QoL analysis (Section 5.2.3 and 5.2.5) and the subjective QoL Index proposal (Section 5.2.6) (July 2021)[16].

[16] This stage received the assistance of statistician Paulo Ricardo Ricco Uranga.

Table 17 presents the main steps of Stage 2 and their execution dates.

Table 17 Main steps of Stage 2 and their execution dates

STAGE 2 main steps	Execution date
a) Study project submission to the Research Ethics Committee (CEP/UFRGS)	From July to November 2019
b) Proposal of the conceptual framework to evaluate the multidimensional urban QoL	From February to June 2020
c) Proposal of the data collection protocol (questionnaire).	July and August 2020
d) Urban analysis	From August 2020 to December 2020
e) Sampling plan elaboration (NAE/UFRGS)	September 2020
f) Questionnaire test and refinement	October 2020
g) Data collection with residents (Survey)	From October to December 2020
h) Tabulation of collected data	January and February 2021
i) Graphing for interpretation of collected data	March and April 2021
j) Subjective data analysis (content analysis)	From May to July 2021
k) Proposal of a preliminary version on the multidimensional method to evaluate the urban QoL and discussion with specialists from PROPUR/UFRGS	July 2021
l) Multidimensional subjective QoL analysis and QoL Index proposal	July 2021

4.2.2.1. Content analysis

Content analysis is a set of techniques for investigating the communication and meanings of a text, which enable its interpretation through an objective, systematic and quantitative description of its content (Bardin, 2011, p. 37). Based on the method of content analysis proposed by Laurence Bardin (1977, 2011), the data collected from the residents of four buildings were analyzed in three main steps described below.

In Step 1, named *organizing the analysis* (Bardin, 2011, p. 124), the preparation and exploration of the material collected in the interviews (data tabulation) were carried out, as well as the processing and interpretation of the data. Percentage graphs were generated from simple statistical operations.

In Step 2, named *codification* (Bardin, 2011, p. 133), the registration unit to be analyzed was defined, that is, “words associated with the vertical dimensions (constructs) proposed to assess the multidimensional urban QoL” (aggregation by categories): urban services; the economy; urban mobility; culture and recreation; conviviality; security; and environmental comfort. The importance of a registration unit increases with the frequency of its appearance (Bardin, 2011, p. 138). Coding can be understood as the systematic transformation (by selection, aggregation by categories and enumeration) of the raw data of the text, to enable a better description of the text's characteristics (Bardin, 2011, p. 133).

In Step 3, named *categorization* (Bardin, 2011, p. 133), the semantic grouping (theme analysis) is performed, that is, the identified words are categorized based on their meaning and relationship (analogies) with the constructs used in the research (category system).

Initially, a Google search was carried out to identify free sites and applications available for the creation of the word cloud and the word list, on February 24, 2021. After some simulations, the *WordCloud Generator (by MonkeyLearn)* application was chosen, especially for its aesthetic clarity, ease of use, and the possibility of identifying the most relevant and most frequently cited expressions – other applications only consider the words in isolation. *Word Cloud by Atlas TI* was used for the word list generation. The content analysis results are presented in Chapter 5.

4.2.3 Stage 3: Analysis

Stage 3 includes the following main steps:

a) Secondary data analysis (to assess the objective QoL): analysis of NBR 37120 (2017) and identification of its indicators in the Brazilian context (July 2021 and August 2021), from census (IBGE), local administrative data, and urban analysis.

b) Comparison and analysis between the objective and the subjective QoL, ant the identification of types of QoL: well-being, which may be considered an ideal situation; deprivation, which may show where more investment is necessary; resignation; and dissonance (August 2021).

c) Analysis of the inconsistent QoL types (resignation and dissonance) (September 2021).

d) Assessment of the method (described in Section 4.2.3.1), and of its practical contributions: focus group with specialists from PROPUR/UFRGS (29 October, 2021), including the participation of five Masters and Ph. D. postgraduate students.

e) Refinement and proposal of the final version of the multidimensional method to evaluate the urban QoL, based on the findings of Stages 2 and 3 (October 2021).

f) Assessment of the method (Section 4.2.3.1), and of its practical contributions: focus group with public managers from PMPA, on 11 November, 2021, including the participation of three public managers of the Municipal Planning Department (*Secretaria Municipal de Planejamento e Assuntos Estratégicos* – SMPAE) of the PMPA. These public managers are also part of the Porto Alegre City Observatory (*Observatório da Cidade de Porto Alegre* - ObservaPOA)[17], which provides a base of georeferenced information about the municipality of POA since 2006.

g) Local observation: photographic register (13 November, 2021). This was needed to complement the observation analysis of the site.

h) Identification of the practical and theoretical contributions of the proposed method, related to the assessment of the multidimensional urban QoL (November 2021).

[17] http://www.observapoa.com.br/

Table 18 presents the main steps of Stage 3 and their execution dates.

Table 18 Main steps of Stage 3 and their execution dates

STAGE 3 main steps	Execution date
a) Secondary data analysis: NBR 37120 (2017)	July 2021 and August 2021
b) Analysis between objective and subjective QoL, and QoL type identification (well-being; deprivation; resignation; and dissonance)	August 2021
c) Analysis of the inconsistent QoL types (resignation and dissonance)	September 2021
d) Assessment of the method with specialists from PROPUR/UFRGS	29 October, 2021.
e) Refinement and proposal of the final version of the multidimensional method to evaluate the urban QoL	October 2021
f) Assessment of the method with specialists from PMPA	11 November, 2021
g) Local observation (photographic register)	13 November, 2021
h) Identification of the theoretical contributions of the study	November 2021

4.2.3.1. Assessment of the Multidimensional Urban Qol Method

The assessment of the proposed multidimensional urban QoL method aims to assess its practical and theoretical contribution. For this purpose, two constructs are proposed to assess its performance:

a) *utility* of the method: verify whether the results obtained can help in decision making related to planning and urban policies, as well as the location of social housing and improvement of the urban QoL (perception of the usefulness of the method and perception of the usefulness of the results for decision making); and

b) *applicability* of the method: verify whether the method can be easily applied (perception of the method's ease of use, and perception of ease of understanding the results).

These two constructs are widely used to evaluate models and methods developed for the built environment area (Bonato, 2010; Monteiro, 2015, 2020; Wesz, 2013). The method evaluation

was thus carried out through two focus groups by videoconference, due to the COVID-19 pandemic:

a) The first focus group was held on 29 October, 2021, with specialists from PROPUR/UFRGS, including the participation of five postgraduate students (Masters and Ph. D. students).

b) The second focus group was held on 11 November, 2021 and included the participation of three managers of the Municipal Planning Department (*Secretaria Municipal de Planejamento e Assuntos Estratégicos* – SMPAE) of the PMPA. These public managers are also part of the Porto Alegre City Observatory (*Observatório da Cidade de Porto Alegre* - ObservaPOA)[18], which provides a base of georeferenced information about the municipality of POA since 2006.

The focus group is a qualitative data collection technique, with the purpose of obtaining opinions, information and attitudes of a certain group about a subject (Galego & Gomes, 2005, p. 175). In order to do this, the multidimensional method to evaluate the urban QoL was presented, as well as the results of the study in the central area of POA. Finally, an open question script was made available (see Appendix 4), generating the discussion.

4.3 THE CENTRAL AREA OF PORTO ALEGRE (POA)

Porto Alegre (POA) is a Brazilian municipality and the capital of the southernmost state in Brazil, Rio Grande do Sul (RS). Founded on 26 March, 1772, the effective occupation of the municipality of POA, from the 18th century, began in the central area next to Lake Guaíba, due to port activity, and expanded radially. The municipality has a total area of 495,390 km² (IBGE, 2013). The city currently has 81 official districts, whose limits are defined by 28 specific laws (PMPA[19], 2021). The estimated population of POA in 2021 is 1,492,530 inhabitants (IBGE, 2021).

Figure 14 shows the state of RS highlighted on the map of Brazil, and, on the enlarged map, Porto Alegre placed on the map of RS.

[18] http://www.observapoa.com.br/
[19] https://prefeitura.poa.br/

Figure 14 Location of RS on the map of Brazil, and POA on the map of RS

Sarandi, Lomba do Pinheiro, and Restinga districts, located on the outskirts of the municipality, have the highest population concentrations. The districts with the lowest population concentration are Pedra Redonda, São Caetano and Farroupilha (PMU/POA, 2018, p.14)[20]. The Central Zone has 276,799 inhabitants (representing 19.64% of the city's population), with an area of 26.0 km² (representing 5.46% of the city's area), and its demographic density is 10,646.12 inhabitants per km². The illiteracy rate is 0.51%, and the average monthly income of heads of household is 8.81 minimum wages[21] (ObservaPOA, 2021).

Figure 15 shows the map of POA and its Central Zone (No. 1, in orange).

[20] Porto Alegre Urban Mobility Plan (PMU - *Plano de Mobilidade Urbana de Porto Alegre*) – Accessed in November 2021 - https://prefeitura.poa.br/sites/default/files/usu_doc/projetos/smim/Plano%20de%20Mobilidade%20Urbana/4_Diagnostico_da_Mobilidade_versao_atualizada.pdf

[21] In 2021, the minimum monthly wage in Brazil is BRL 1,100.00 (USD 198.91 on 18 November, 2021).

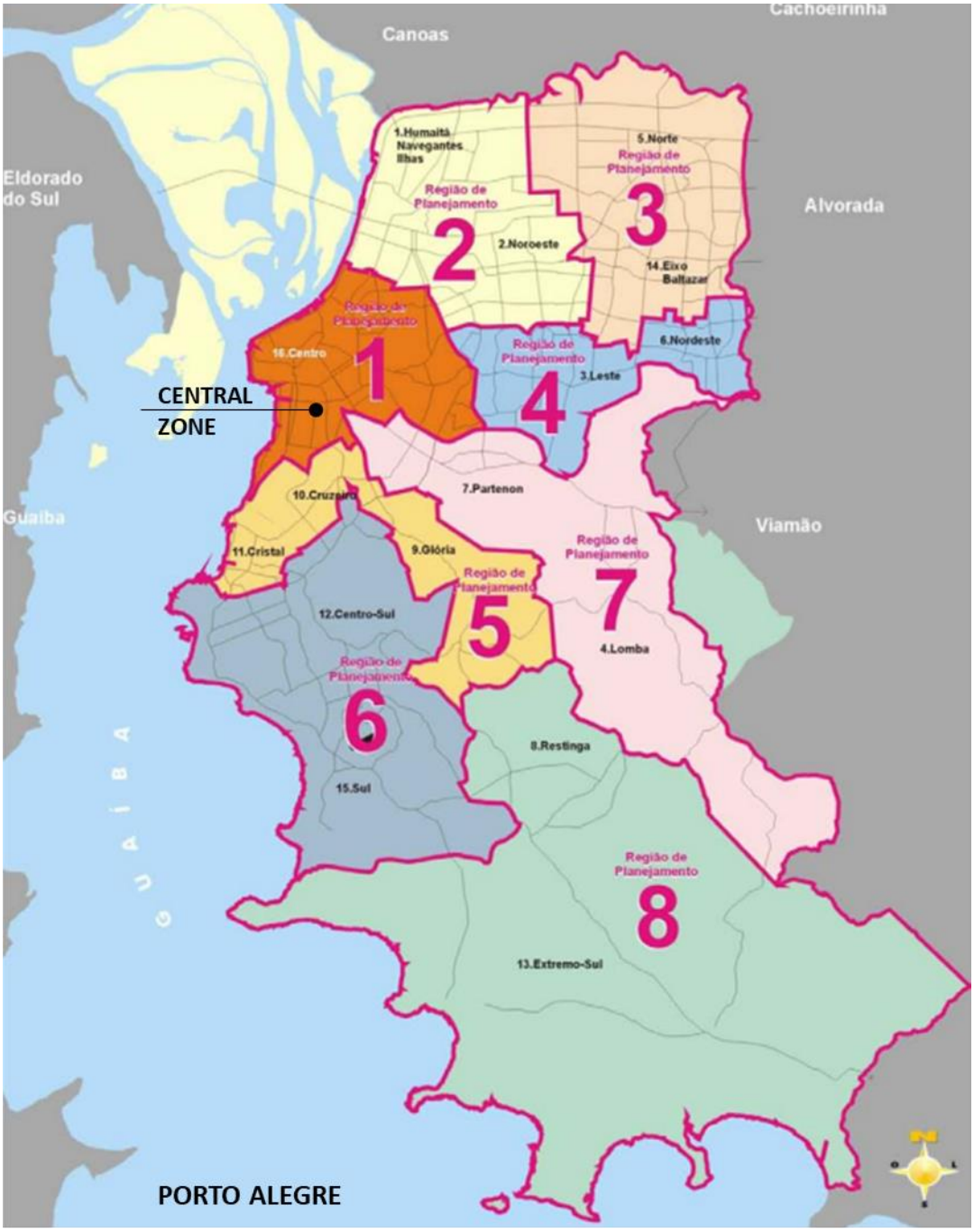

Figure 15 Map of POA and its Central Zone in orange (PDDUA), adapted by the researcher

The Historic Centre has 39,154 inhabitants, which represents 2.78% of the municipality's population. With an area of 2.43 km², representing 0.51% of the municipality's area, it has a demographic density of 16,079.67 inhabitants per km². The illiteracy rate is 0.35%, and the average monthly income of heads of household is 5.85 minimum wages (ObservaPOA, 2010). The Floresta district has 11,596 inhabitants, representing 0.82% of the municipality's population. With an area of 1.86 km², it represents 0.39% of the municipality's area, and its

demographic density is 6,211.03 inhabitants per km². The illiteracy rate is 1.31%, and the average mensal income of heads of household is 4.82 minimum wages (ObservaPOA, 2010).

Figure 16 shows the map of POA, and the Historic Centre and the Floresta district highlighted.

Figure 16 Map of POA, the Historic Centre and the Floresta district

4.4 CASE STUDIES IN THE CENTRAL AREA OF PORTO ALEGRE (POA)

The main challenges regarding the renovation of buildings for social housing in the central area of POA, pointed out by the architects from CAIXA, on 3 October, 2017 and 3 November, 2017, were: (a) insufficient budget made available by PAR-Retrofit per housing

unit (BRL 88,000.00[22]) for the renovation of existing buildings; and (b) difficulty of negotiation between the various stakeholders involved in the process such as the municipal government, owners of empty buildings in central areas, construction companies, and residents.

As for post-occupancy monitoring, an inspection visit to the renovated housing units was carried out after one year by CAIXA technicians. Visits were only then carried out when official complaints were made by the residents during the five-year housing guarantee period provided by CAIXA. They did not mention the existence of systematic analyses carried out regarding the urban impact of the renovation of buildings for social housing in the centre of POA.

Possible contributions of this study, as pointed out by the architects from CAIXA, may be the identification of long-term benefits for the city through the renovation of underutilized buildings in the urban centre of POA, where the urban and economic infrastructure will have a positive impact on dwellers' lives.

They also pointed out seven social housing buildings in the central area of POA, of which four are the case studies of this research (**Figure 17**, **Figure 18**, and **Figure 19**):

a) 20 de Novembro Squat – Rua Doutor Barros Cassal, 161, Floresta district, which is currently in the process of renovation (the architectural design project has been completed, but the execution of the renovation work has not yet started).

b) Autonomous Community Utopia e Luta – Avenida Borges de Medeiros, Historic Centre;

c) Sul América Building – Avenida Borges de Medeiros, 417, Historic Centre (renovated by PAR-Retrofit); and

d) Bento Gonçalves Building – Avenida Senador Salgado Filho, 140, Historic Centre (renovated by PAR-Retrofit);

After contacting representatives of the other three buildings (Charrua, Arachã, and Umbu), access to the researcher was denied due to the COVID-19 pandemic. The four case studies are presented as follows.

[22] USD 16,123.71 (November 16, 2021).

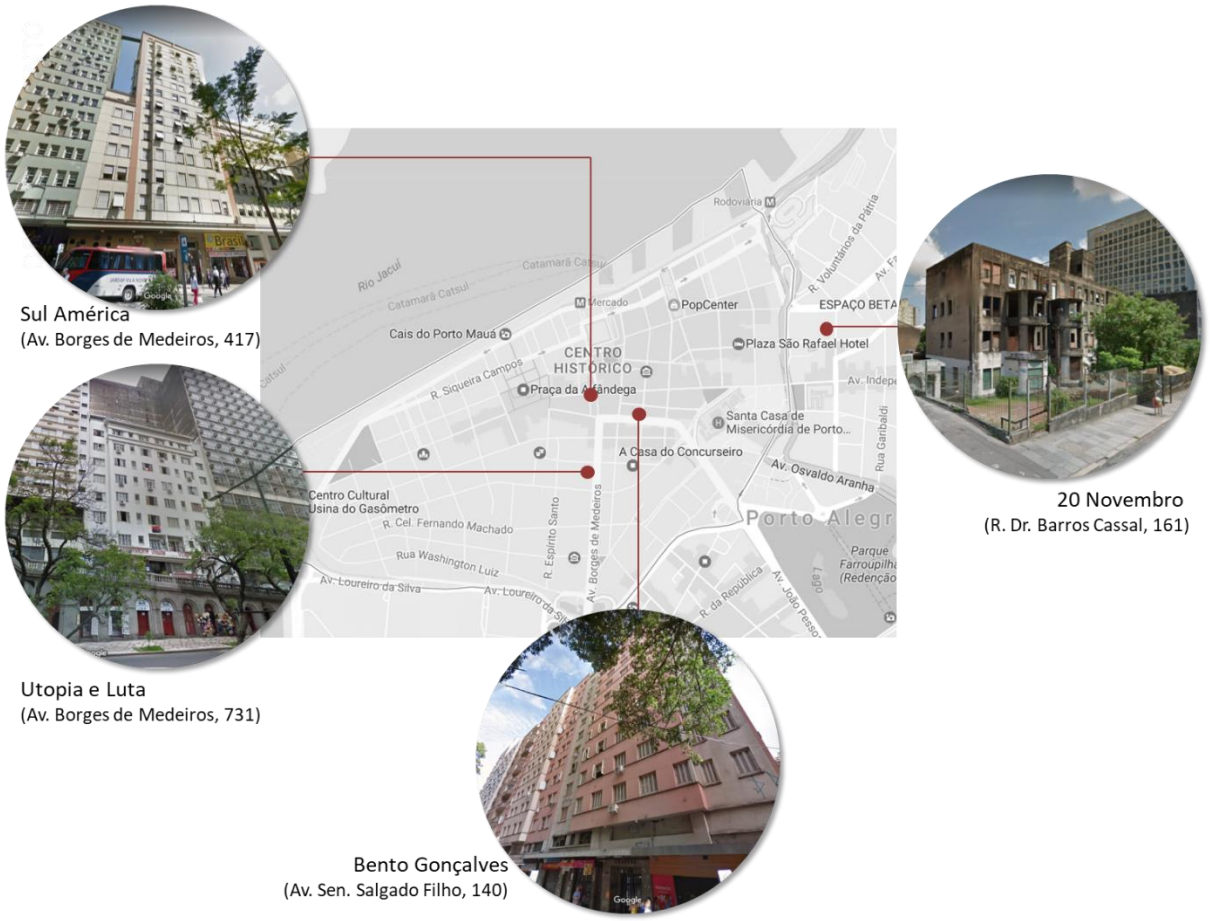

Figure 17 Four case studies in central area of POA

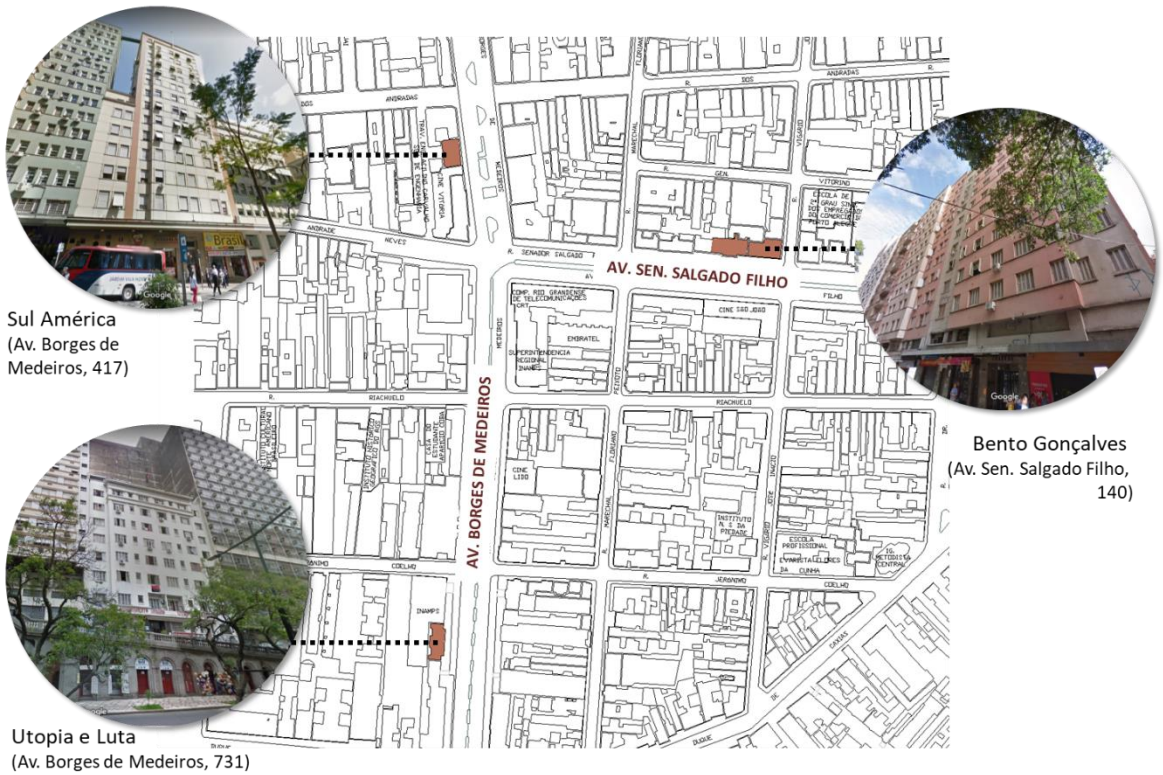

Figure 18 Three case studies in the Historic Centre, POA

Figure 19 One case study in Floresta district, POA

4.4.1 20 de Novembro Squat

The 20 de Novembro Squat (**Figure 20**), located at Rua Doutor Barros Cassal, 161, Floresta district, has four floors and a terrace. Originally belonging to the Federal Government, it was initially built with the intention of being a Federal Railway Network Hospital, in 1955, but it was not completed and remained unoccupied. In 2013, it was occupied by the National Movement for Housing (*Movimento Nacional de Luta pela Moradia*) and the National Confederation of Neighbourhood Residents Associations. On 21 March, 2016, the 17 families were granted the right of residential use.

Figure 20 20 de Novembro Squat (November 2021)

The projects for the renovation (**Figure 21**), presented by the end of 2019[23], were supported by the Sustainable Living Programme project (*Programa Morar Sustentável*) – an initiative of the Union of Architects in the State of RS (SAERGS) and the sponsorship of the Technical Assistance Program for Social Housing (*Assistência Técnica para Habitação de Interesse Social* – ATHIS) of the Council of Architecture and Urbanism (CAU/RS) of 2017. However, this is the only one of the four buildings in the study that has not yet been renovated.

[23] CAU/RS, 11/01/2019. Accessed on 23/09/2021. https://www.caurs.gov.br/projetos-do-morar-sustentavel-serao-apresentados-aos-moradores-da-ocupacao-20-de-novembro/

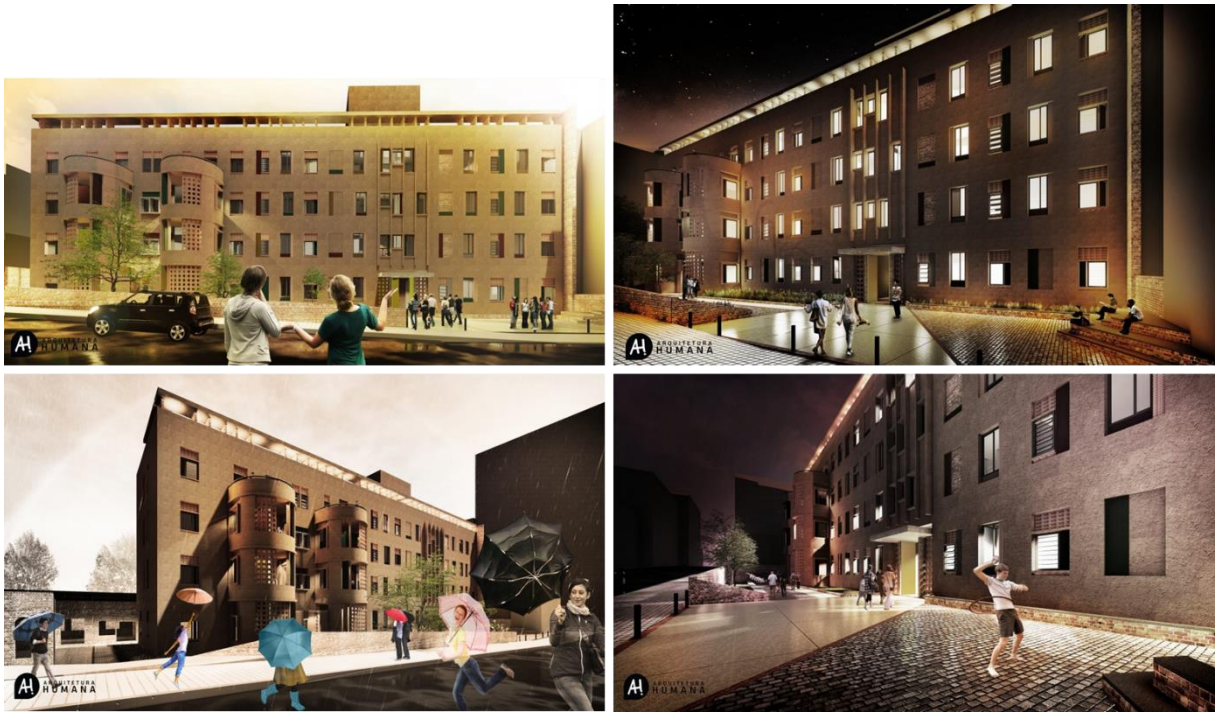

Figure 21 Photorealistic images of the design project developed for the renovation of the 20 de Novembro (AH! Arquitetura Humana[24])

The 20 de Novembro has 17 housing units. The initial contact with the residents' leadership took place on 19 October, 2020, by phone (WhatsApp messages). Then, the questionnaire was sent for validation and approval by the representative of the residents. Initially, due to the Covid-19 pandemic (which imposed social restrictions from 18 March, 2020 in Brazil), the proposal was for residents to be able to answer the questionnaire online; however, no feedback was obtained. Thus, using necessary protective measures (use of a mask and social distance of two meters), the site visit took place on 17 November, 2020, when four people were interviewed in person, and two manually answered the questionnaire. Questionnaires were also delivered to be answered by the other residents; however, after several subsequent contacts, there was no return. Thus, six responses were obtained from a total of 17 housing units, representing a sample of 35%.

[24] https://ah.arq.br/projetos/assentamento20denovembro/

4.4.2 Autonomous Community Utopia e Luta

The Autonomous Community Utopia e Luta (**Figure 22**), located at Avenida Borges de Medeiros, 727, Historic Centre, has 8 floors, including common spaces (doorway, office, collective kitchen, cafeteria, bakery, screen printing room, theatre, laundry, terrace, and vegetable garden). Originally, it was the headquarters of the National Institute of Social Security (*Instituto Nacional do Seguro Social*), but it had been empty since 1995. In 2005, during the 5th World Social Forum, its use was required and it was occupied by the National Movement for Housing. Two years later, Law 11481/2007, which provides for measures for land regularization of social interest in Federal Government properties, allowed the transfer of this public buildings for the use of social housing. The delivery of housing units to residents took place on 22 May, 2009.

Utopia e Luta has 42 housing units. The initial contact with the residents' leadership took place on October 31, 2020, by phone (WhatsApp messages). Then, the questionnaire was sent for validation and approval by the representative of the residents. The questionnaire was answered online by 12 respondents. On 17 November, 2020, printed questionnaires were delivered to the site in an attempt to increase the number of respondents. Subsequently, two questionnaires were manually answered, which were collected on 1 December, 2020. Thus, 14 responses were obtained from a total of 40 housing units, representing a sample of 33%.

Figure 22 Autonomous Community Utopia e Luta (November 2021)

4.4.3 Sul América Building

The Sul América building (**Figure 23**), located at Avenida Borges de Medeiros, 417, Historic Centre, has 14 floors and 78 housing units. It was built in 1938 and occupied by the National Movement for Housing militants in 2002, during the 2nd World Social Forum, held in Porto Alegre from 31 January to 5 February, 2002. It was PAR's first experience in the renovation

of a building in POA, completed in 2003. However, the housing units were not designated to the families that had originally occupied it.

Figure 23 Sul América building (November 2021)

The initial contact took place on 17 November, 2020, upon presentation of the survey to the janitor of the building. On that date, 40 copies of printed questionnaires were left at the entrance for distribution to the residents. Also, a resident interested in the study contacted the researcher and thus it was possible to send the link to access the online questionnaire, which was completed by one respondent. The 14 manually filled out questionnaires were collected on 21 December, 2020. Thus, 15 responses were obtained from a total of 78 housing units, representing a sample of 19%.

4.4.4 Bento Gonçalves Building

The Bento Gonçalves building (**Figure 24**), located at Avenida Senador Salgado Filho 140, Historic Centre, has 12 floors and 40 housing units, was renovated by PAR and inaugurated in 2004. The initial contact took place on 23 November, 2020, upon presentation of the research

to the janitor of the building. On this date, the researcher went to all the apartments, making the invitation to carry out the interview or leaving a copy of the questionnaire to be collected later. On this date, four interviews were conducted. On 14 December, 2020, three more answered questionnaires were collected. Thus, seven responses were obtained from a total of 40 housing units, representing a sample of 17%.

Figure 24 Bento Gonçalves building

Finally, as presented before (Section 4.2.2), the population of the four buildings analyzed in this study is 177 housing units. Thus, a sample of 24% was obtained, that is, 42 respondent housing units in total. The initially calculated sample was 50% (88 housing units), however, due to the context of the COVID-19 pandemic, access to residents was very restricted, and the sample was for convenience.

Table 19 presents the sample obtained from data collection.

Table 19 Sample obtained from data collection

SAMPLE OBTAINED FROM DATA COLLECTION			
Building	**Population**	**Planned sample**	**Sample**
20 de Novembro Squat	17	8 (50%)	6 (35%)
Utopia e Luta	42	21 (50%)	14 (33%)
Sul América Building	78	39 (50%)	15 (19%)
Bento Gonçalves Building	40	20 (50%)	7 (17%)
Total	**177**	**88 (50%)**	**42 (24%)**

Although the sample collected is not representative, due to limitations related to the COVID-19 pandemic, it was decided in this study to use the collected data, even if in a more simplified way, to allow the elaboration and proposal of the multidimensional method to evaluate the urban QoL.

5 RESULTS

This chapter presents the results of this study, considering the research process throughout Stages 1 (comprehension), 2 (development), and 3 (analysis). By the end of Stage 3, the final version of the multidimensional method to evaluate the urban QoL was proposed. It was then assessed, based on its *utility* and *applicability*. Finally, a cross-analysis of the results at the different stages of the study was carried out, and their practical and theoretical contributions were analyzed.

5.1 RESULTS OF STAGE 1 (COMPREHENSION)

This Section presents the results of *Stage 1 (comprehension)* of the study, which focuses on the theoretical and practical understanding of the urban QoL concept and evaluation. By the end of the systematic literature review (SLR), presented in Chapter 3, a model to evaluate the urban QoL, based on Zapf's (1979) welfare model (which includes both objective and subjective QoL), was proposed, and it is now discussed.

5.1.1 A model to evaluate the urban Quality of Life (QoL)

The model to evaluate the urban QoL, presented in **Figure 25** and based on the welfare model proposed by Zapf (1979) (presented in Section 3.3), includes four main propositions:

a) The *objective QoL* is related to universal metrics understood by the individuals of a society regarding the exogenous living conditions. The proposed model suggests the indicators of the NBR 37120 (presented in Section 3.4.1) as a starting point to evaluate the objective dimension of the urban QoL. Thus, it is necessary to verify whether these indicators are available for the city of Porto Alegre (POA) and, more specifically, for the Historic Centre and the Floresta district. This search should consider secondary data available in statistical databases such as that of the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* - IBGE), and local government data;

b) The *subjective QoL* is related to the endogenous perceptions of people, that is, their level of satisfaction regarding their living conditions. The proposed model suggests a survey with residents or users to evaluate the subjective dimension of the urban QoL.

It should show whether people are satisfied or not with their living conditions. It should be based on the same living conditions considered in the objective dimension but evaluated by individual perceptions;

c) Identification of *types of QoL: well-being* (referring to the person in good objective and subjective conditions), which can be considered a desirable situation; *deprivation* (referring to the person in bad conditions in both areas), which may show where more investment is necessary; *dissonance* (referring to the person who's perceived QoL does not correspond to their rather good objective living conditions); and *resignation* (referring to the person whose unfavourable objective living conditions are not subjectively rated equally unfavourably); and

d) Analysis of *inconsistent QoL types* in order to understand *dissonances* and *resignations*.

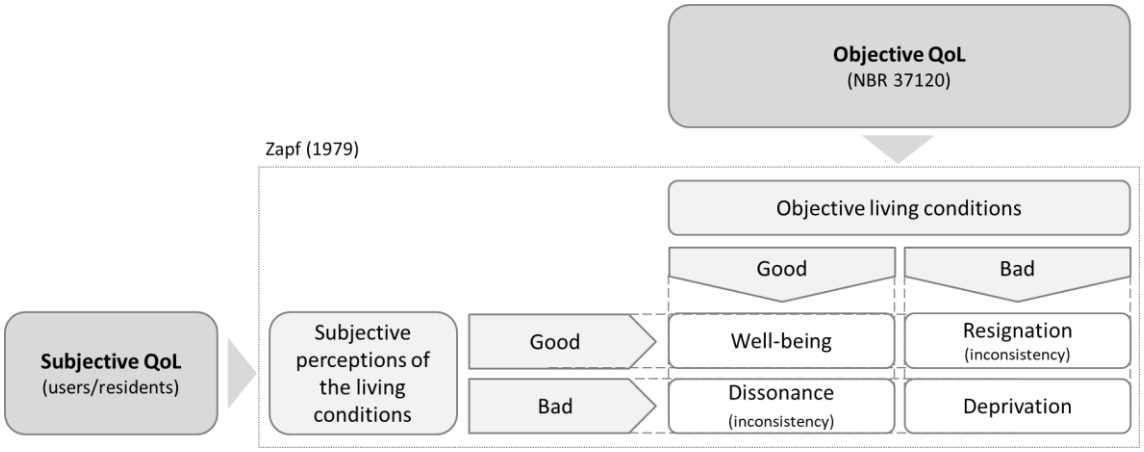

Figure 25 A model to evaluate the urban QoL**,** based on Zapf's (1979) welfare model

In Stage 1 of the study, through the presentations and discussions held with specialists on the proposed model (University of Huddersfield, SPACE International Conference 2019, and the Qualification Exam at PROPUR/UFRGS 2019), some issues were raised such as the possible difficulty in identifying the indicators proposed by NBR 37120 (2017) in the Brazilian context (secondary data), the need to define which living conditions should be analyzed in the context proposed for this study (which were later defined as vertical dimensions of the evaluation of the urban QoL), and which steps should be taken to adequately assess the urban QoL. These matters guided Stage 2 of this study, and are presented in the next section.

5.2 RESULTS OF STAGE 2 (DEVELOPMENT)

Based on the literature review carried out, this study considers the urban QoL to be a multidimensional concept as it includes a variety of factors that people value in life (Rogge & Van Nijverseel, 2019, p. 766) and, several interrelated dimensions that constitute a holistic representation of a complex phenomenon (Sánchez-Fernández & Iniesta-Bonillo, 2007, p. 430). This section presents the results of the *Stage 2 (development)* of the study, which focuses on the proposal of a conceptual framework to evaluate the multidimensional urban QoL and data collection with social housing residents (of four buildings in the central area of POA) to identify the subjective QoL. As a refinement of the model presented in Stage 1, a preliminary version of the multidimensional method to evaluate the urban QoL is then presented.

5.2.1 Conceptual Framework: Multidimensional Quality of Life (Qol)

A *conceptual framework* to evaluate the multidimensional urban QoL is proposed in **Figure 26**, which includes the *horizontal dimensions of the urban QoL* (objective and subjective QoL dimensions) and *vertical dimensions of the urban QoL.* The latter includes seven dimensions regarding the urban living conditions, previous discussed in Section 3.4: (a) urban services; (b) the economy; (c) culture and recreation; (d) urban mobility; (e) conviviality; (f) security; and (g) environmental comfort. The vertical dimensions should be evaluated by the horizontal dimensions, that is, they should be objectively and subjectively evaluated.

For each vertical dimension (construct), six indicators of the urban QoL are proposed, that is, 42 in total. They are proposed based on the literature review and are the basis of the data collection protocol (Appendix 3) to evaluate the subjective urban QoL of the residents and are presented as follows.

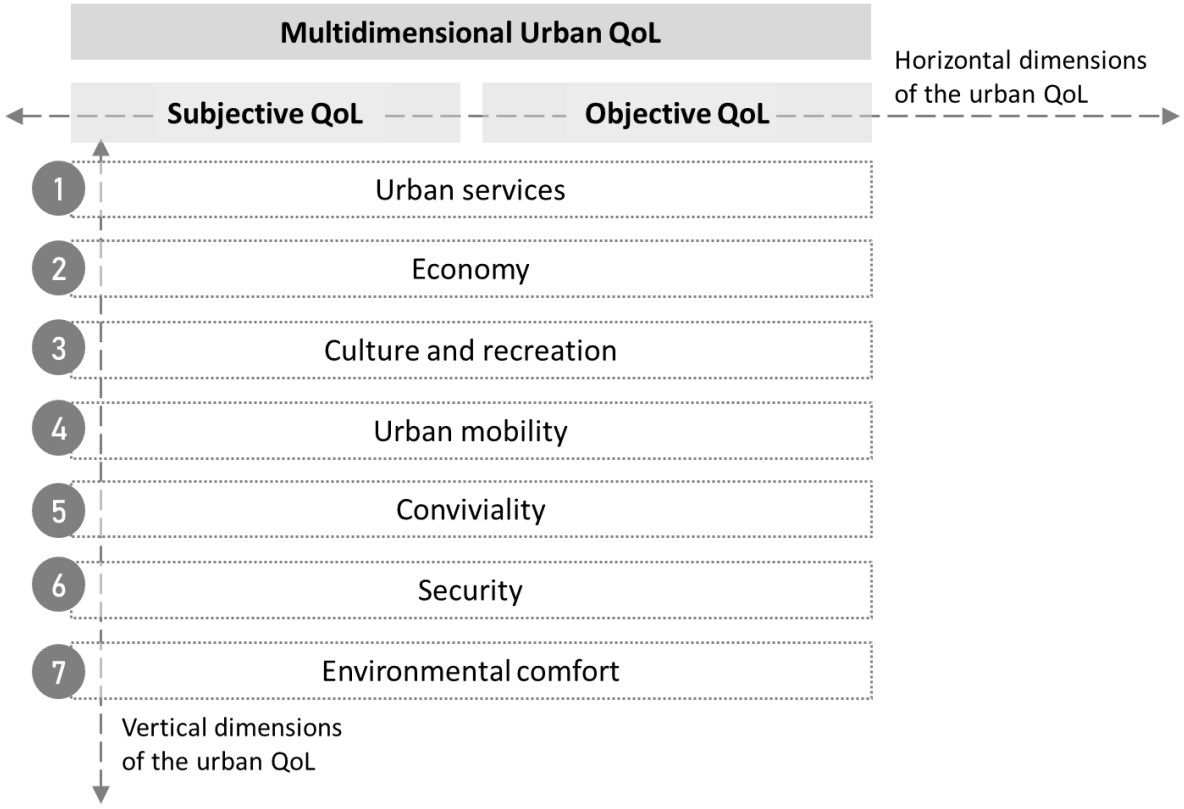

Figure 26 A conceptual framework to evaluate the multidimensional urban QoL

5.2.1.1. Urban services

This study considers the following indicators (subconstructs) in the assessment of the respondents' perception of *urban services*, as presented **Table 20**: (a) solid waste collection; (b) water supply; (c) electricity supply; (d) internet services; (e) health-related services (hospitals, health centres, etc.); and (f) educational establishments (schools, nurseries, universities, etc.).

Table 20 *Urban services* and their indicators

QoL dimension (construct)	Urban QoL indicators (subconstructs)
URBAN SERVICES	a) Solid waste collection
	b) Water supply
	c) Electricity supply
	d) Internet services
	e) Health-related services (hospitals, health centres, etc.)
	f) Education services (schools, nurseries, universities, etc.)

5.2.1.2. The economy

This study considers the following indicators (subconstructs) in the assessment of the respondents' perception of the *economy*, as presented in **Table 21**: (a) employment opportunities; (b) cost of living (expenses on housing, food, etc.); (c) existence of professional courses (computers, crafts, hairdressing, etc.); (d) access to credit (facilitated payment terms in shops and commerce); (e) variety of commercial and service establishments (markets, shops, restaurants, banks, post office, etc.); and (f) existence of tourist activities.

Table 21 The *economy* and its indicators.

QoL dimension (construct)	Urban QoL indicators (subconstructs)
ECONOMY	a) Employment opportunities
	b) Cost of living (expenses on housing, food, etc.)
	c) Existence of professional courses (computers, crafts, hairdressing, etc.)
	d) Access to credit (facilitated payment terms in shops and commerce)
	e) Variety of commercial and service establishments (markets, shops, restaurants, banks, post office, etc.)
	f) Existence of tourist activities

5.2.1.3. Culture and recreation

This study considers the following indicators (subconstructs) in the assessment of the respondents' perception of *culture and recreation*, as presented in **Table 22**: (a) number of green areas and parks; (b) quality and maintenance of green areas and parks; (c) existence of places to take part in outdoor sports; (d) existence of places for cultural activities (artistic events, museums, theatres, cinemas); (e) opportunities to take part in free cultural and artistic events; and (f) conservation of historical, artistic, and cultural heritage (buildings, houses and public spaces).

Table 22 *Culture and recreation* and its indicators.

QoL dimension (construct)	Urban QoL indicators (subconstructs)
CULTURE and RECREATION	a) Number of green areas and parks
	b) Quality and maintenance of green areas and parks
	c) Existence of places to take part in outdoor sports
	d) Existence of places for cultural activities (artistic events, museums, theatres, cinemas)
	e) Opportunities to take part in free cultural and artistic events
	f) Conservation of historical, artistic, and cultural heritage (buildings, houses, and public spaces)

5.2.1.4. Urban mobility

This study considers the following indicators (subconstructs) in the assessment of the respondents' perception of *urban mobility*, as presented in **Table 23**: (a) quality of public transport (comfort); (b) availability of public transport (number of lines and itineraries); (c) ease of going from your home to other parts of the city (workplace, study, friends' houses, etc.); (d) ease of displacement on foot (to carry out daily activities); (e) quality and location of cycle paths; and (f) quality and maintenance of pavements and streets.

Table 23 *Urban mobility* and its indicators.

QoL dimension (construct)	Urban QoL indicators (subconstructs)
URBAN MOBILITY	a) Quality of public transport (comfort)
	b) Availability of public transport (number of lines and itineraries)
	c) Ease of going from your home to other parts of the city (workplace, study, friends' houses, etc.)
	d) Ease of displacement on foot (to carry out daily activities)
	e) Quality and location of cycle paths
	f) Quality and maintenance of pavements and streets

5.2.1.5. Conviviality

This study considers the following indicators (subconstructs) in the assessment of the respondents' perception of *conviviality*, as presented in **Table 24**: (a) conviviality and interaction with neighbours; (b) conviviality and interaction with homeless people; (c) opportunities to participate in the decision-taking of your own building; (d) opportunities to participate in community activities (associations, artistic and religious groups, etc.); (e) respect of people for cultural, sexual, religious and political differences; and (f) identification with the neighbourhood and people's pride in living in it.

Table 24 *Conviviality* and its indicators.

QoL dimension (construct)	Urban QoL indicators (subconstructs)
CONVIVIALITY	a) Conviviality and interaction with neighbours
	b) Conviviality and interaction with homeless people
	c) Opportunities to participate in the decisions of your own building
	d) Opportunities to participate in community activities (associations, artistic and religious groups, etc.)
	e) Respect of people for cultural, sexual, religious, and political differences
	f) Identification with the neighbourhood and people's pride in living in it

5.2.1.6. Security

This study considers the following indicators (subconstructs) in the assessment of the respondents' perception of *security*, as presented in **Table 25**: (a) feeling of security in public places (pavement, street, etc.); (b) feeling of security when accessing your building during the day; (c) feeling of security when accessing your building at night; (d) safety for children and teenagers to experience the neighbourhood (walking, playing, etc.); (e) quality of policing; and (f) quality of public lighting (pavements, streets, parks, etc.).

Table 25 *Security* and its indicators.

QoL dimension (construct)	Urban QoL indicators (subconstructs)
SECURITY	a) Feeling of security in public places (pavement, street, etc.)
	b) Feeling of security when accessing your building during the day
	c) Feeling of security when accessing your building at night
	d) Safety for children and teenagers to experience the neighbourhood (walking, playing, etc.)
	e) Quality of policing
	f) Quality of public lighting (sidewalks, streets, parks, etc.)

5.2.1.7. Environmental comfort

This study considers the following indicators (subconstructs) in the assessment of the respondents' perception of *environmental comfort*, as presented in **Table 26**: (a) noise pollution; (b) air quality (feeling when breathing); (c) existence of trees on the pavements and in the parks (climate comfort); (d) cleanliness of public places (pavements, streets, parks, etc.); (e) drainage and sewage system (floods/odours); and (f) view from your apartment window to the outside space (street/courtyard).

Table 26 *Environmental comfort* and its indicators.

QoL dimension (construct)	Urban QoL indicators (subconstructs)
ENVIRONMENTAL COMFORT	a) Noise pollution
	b) Air pollution (feeling when breathing)
	c) Existence of trees on the pavements and in the parks (climate comfort)
	d) Cleanliness of public places (pavements, streets, parks, etc.)
	e) Drainage and sewage system (floods/odours)
	f) View from your apartment window to the outside space (street/courtyard)

5.2.2 Multidimensional Method to Evaluate the Urban Quality of Life (Qol): a preliminary version

As a refinement of the model presented in Stage 1, a preliminary version of the multidimensional method to evaluate the urban QoL is presented in (**Figure 27**), including three main steps:

a) Devise the conceptual framework (Step 1 in Figure 27): define the dimensions and indicators of the multidimensional urban QoL to be evaluated (horizontal and vertical dimensions of urban QoL). The conceptual framework can vary according to the specific historical and cultural aspects of each location to be analyzed;

b) Collect, organize and analyze data (Step 2 in Figure 27): data collection (primary data) with residents of the location to be analyzed, in order to identify their QoL perceptions of the neighbourhood, that is, to assess the subjective QoL. It should show whether people are satisfied or not with their living conditions. In the case of this study, data collection was made with residents of the four buildings renovated for social housing in the central urban area of POA. This data should then be organized and analysed. In this regard, this study presents a subjective QoL analysis (Section 5.2.3), and a content analysis (Section 5.2.4);

c) Communicate and control data (Step 3 in Figure 27): devise the subjective QoL index (as presented in Section 5.2.6) to communicate a single metric that allows a simple aggregation across the multidimensions of the urban QoL.

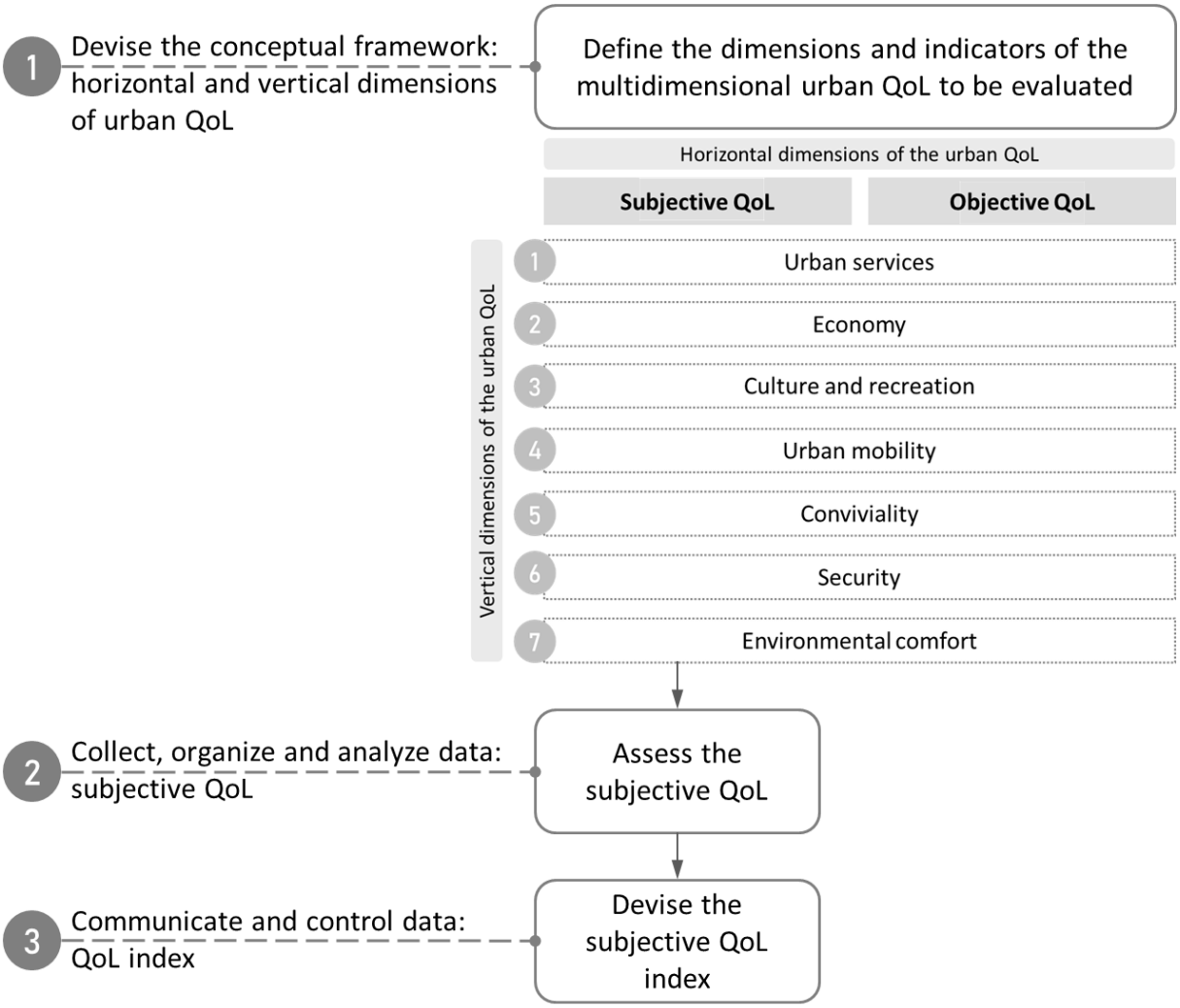

Figure 27 The preliminary version of the multidimensional method to evaluate the urban QoL

5.2.3 Multidimensional Subjective QoL Analysis

This Section presents a descriptive analysis of the respondent, a comparison between buildings, and information on the previous housing location of the respondents.

5.2.3.1. Descriptive Analysis: Respondent Profile

This Section presents the general characteristics of the sample. The building with the most residents responding was Sul América, with 35.7% of the total, followed by Utopia e Luta, with 33.3%. In the vast majority of dwellings there were between 1 to 2 people, with 76.2%

and there is a great predominance of females among the residents, also with 76.2% (**Figure 28**).

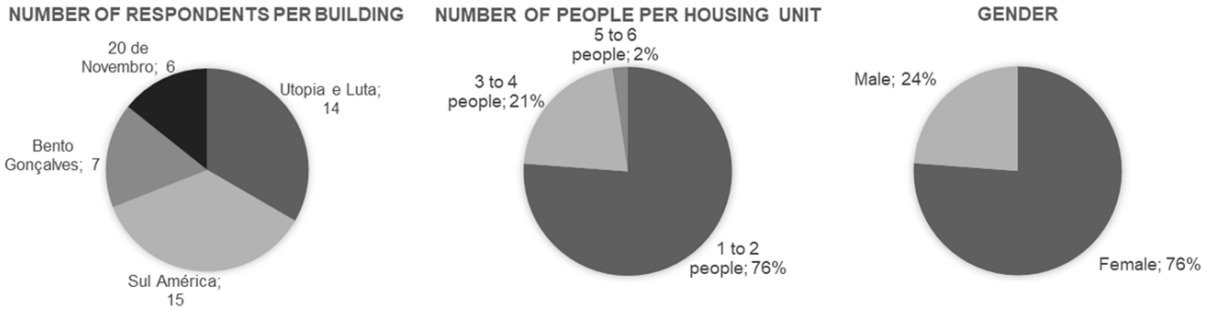

Figure 28 Number of respondents per Building; Number of people per housing unit; and Gender of respondents

Regarding age, the highest concentration is over 45 years, comprising 57.1% of the total, with only 9.5% of the sample aged up to 15 years. Most declared themselves to be white (62%), and blacks and browns represent 31% of the total. Complete higher education was the most frequent level of education, representing 26% of the total, followed by incomplete higher education and complete secondary education, both with 17% of the total (**Figure 29**).

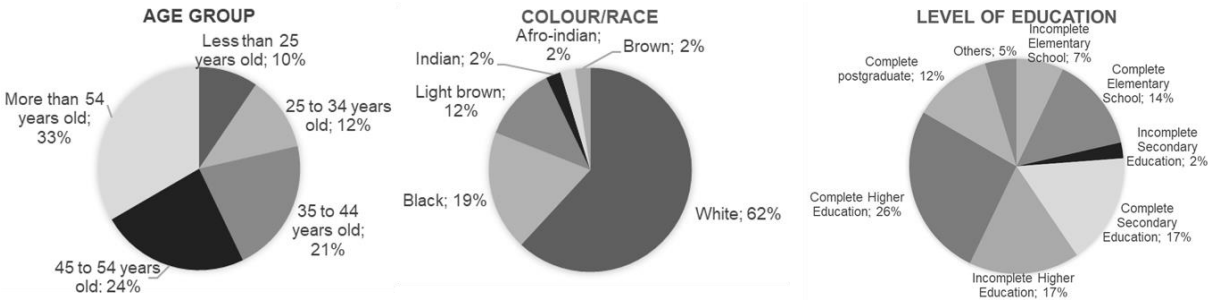

Figure 29 Age group of respondents; Colour/race of respondents (self-reported); and Respondents' level of education

Regarding income, the vast majority have a monthly income between BRL 1,045.00 and BRL 3,135.00[25], 62% of the total, and most residents are salaried with formal employment (38%), followed by self-employed, with 21% of the total. The vast majority do not own a car: 74% of residents (**Figure 30**).

[25] USD 188.97 and USD 566.91 (on 18 November, 2021).

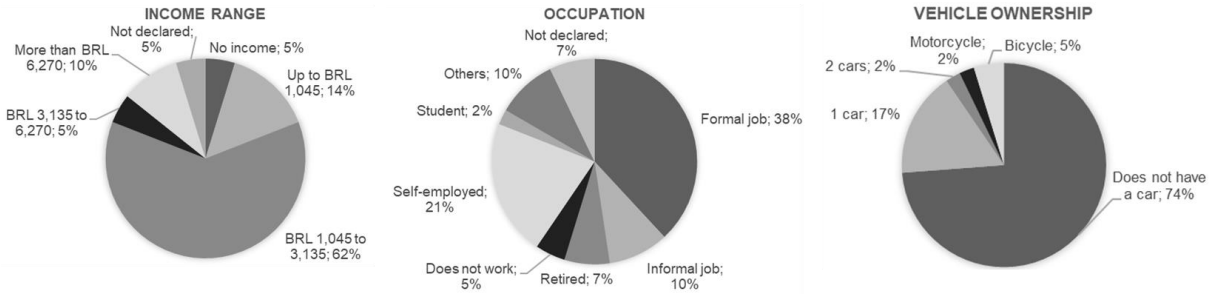

Figure 30 Respondents' income range; Respondents' occupation; and Vehicle ownership

5.2.3.2. Comparison between Buildings

In this analysis, the association between "being a resident of each building" and "the profile characteristics of the sample" is verified (**Table 27**). *Fisher's Exact Test* was used for association, and a significance level of 5% was considered. Thus, it is possible to verify a significant association between the building and three variables: *age range, family income,* and *occupation.*

Table 27 Characteristics by building (n=42)

Characteristics	Building				p-value
	20 de novembro	Bento Gonçalves	Sul América	Utopia e Luta	
Number of people per housing unit					
1 to 2 people	3 (50.0)	7 (100.0)	13 (86.7)	9 (64.3)	0.1526
3 to 4 people	3 (50.0)	0 (0.0)	2 (13.3)	4 (28.6)	
5 to 6 people	0 (0.0)	0 (0.0)	0 (0.0)	1 (7.1)	
Gender					
Female	4 (66.7)	6 (85.7)	12 (80.0)	10 (71.4)	0.8085
Male	2 (33.3)	1 (14.3)	3 (20.0)	4 (28.6)	
Age group					
Up to 25 years old	2 (33.3)	0 (0.0)	1 (6.7)	1 (7.1)	**<0.0001**
25 to 34 years old	0 (0.0)	0 (0.0)	0 (0.0)	5 (35.7)	
35 to 44 years old	0 (0.0)	0 (0.0)	3 (20.0)	6 (42.9)	
45 to 54 years old	2 (33.3)	1 (14.3)	7 (46.7)	0 (0.0)	

Over 54 years old	2 (33.3)	6 (85.7)	4 (26.6)	2 (14.3)	
Colour					
Afro-indian	1 (16.7)	0 (0.0)	0 (0.0)	0 (0.0)	0.0635
White	1 (16.7)	5 (71.4)	11 (73.3)	9 (64.3)	
Indian	0 (0.0)	0 (0.0)	1 (6.7)	0 (0.0)	
Light brown	0 (0.0)	0 (0.0)	1 (6.7)	0 (0.0)	
Brown	1 (16.7)	2 (28.6)	0 (0.0)	2 (14.3)	
Black	3 (50.0)	0 (0.0)	2 (13.3)	3 (21.4)	
Level of education					
Elementary School	2 (33.3)	3 (42.9)	2 (13.3)	2 (14.3)	0.0915
High school	3 (50.0)	1 (14.3)	3 (20.0)	1 (7.1)	
Higher Education	1 (16.7)	2 (28.6)	9 (60.0)	11 (78.6)	
Others	0 (0.0)	1 (14.3)	1 (6.7)	0 (0.0)	
Monthly family income *					
Up to BRL 1,045.00	3 (50.0)	0 (0.0)	2 (15.4)	1 (7.1)	**0.0312**
BRL 1,045.00 to 3,135.00	2 (33.3)	6 (85.7)	6 (46.1)	12 (85.8)	
BRL 3,135.00 to 6,270.00	0 (0.0)	0 (0.0)	2 (15.4)	0 (0.0)	
Over BRL 6,270.00	0 (0.0)	1 (14.3)	3 (23.1)	0 (0.0)	
No income	1 (16.7)	0 (0.0)	0 (0.0)	1 (7.1)	
Occupation **					
Retired	1 (16.7)	3 (50.0)	1 (7.1)	0 (0.0)	**0.0442**
Formal job	0 (0.0)	2 (33.3)	7 (50.0)	7 (53.8)	
Informal job	1 (16.7)	0 (0.0)	0 (0.0)	3 (23.1)	
Self-employed	3 (49.9)	1 (16.7)	4 (28.7)	3 (23.1)	
Student	0 (0.0)	0 (0.0)	1 (7.1)	0 (0.0)	
Does not work	1 (16.7)	0 (0.0)	1 (7.1)	0 (0.0)	
Vehicle ownership					
Bicycle	0 (0.0)	0 (0.0)	0 (0.0)	2 (14.3)	0.1257
Motorcycle	0 (0.0)	1 (14.2)	0 (0.0)	0 (0.0)	
One car	0 (0.0)	3 (42.9)	3 (20.0)	1 (7.1)	

Two cars	0 (0.0)	0 (0.0)	1 (6.7)	0 (0.0)	
Does not have a car	6 (100.0)	3 (42.9)	11 (73.3)	11 (78.6)	

***n=40; **n=39**

The Utopia e Luta building has higher percentages of residents between 25 and 44 years old when compared to the others. The Sul América building has a greater percentage of higher incomes when compared to the others, while 20 de Novembro has more residents without income or with income up to BRL 1,045.00[26]. Finally, in relation to the occupation of residents, the Bento Gonçalves building has the highest percentage of retired people in relation to the others, while the 20 de Novembro has the highest percentage of unemployed people, also corroborating the correlation previously found between building and family income.

5.2.3.3. Cluster analysis

The purpose of a *cluster analysis* is to identify patterns in data (similarities) and group them into different clusters (Rencher & Schimek, 1997, p.451). The number and types of groups are not known in advance (Rencher & Schimek, 1997, p.451). Thus, **Table 28** presents the data treatment for the cluster analysis (variables, description, and value).

[26] USD 188.97 (on 18 November, 2021).

Table 28 Data treatment for the cluster analysis (variables, description, and value).

Variable	Treatment	
	Description	**Value**
Number of people in the housing unit	1 to 2 people	0
	3 to 4 people	1
	5 to 6 people	2
Feminine gender	No	0
	Yes	1
Age range	Up to 25 years old	0
	25 to 34 years old	1
	35 to 44 years old	2
	45 to 54 years old	3
	Over 54 years old	4
White	No	0
	Yes	1
Education	Incomplete Elementary	0
	Elementary	1
	Incomplete high school	2
	High school	3
	Incomplete higher education	4
	Higher education	5
	Postgraduate studies	6
Monthly family income	No income	0
	Up to BRL 1.045,00	1
	From BRL 1.045,00 to BRL 3.135,00	2
	From BRL 3.135,01 to BRL 6.270,00	3
	More than BRL 6.270,00	4
Occupation = Self-employed	No	0
	Yes	1
Occupation = Retired	No	0
	Yes	1
Occupation = Salaried (formal)	No	0
	Yes	1
Own at least one car/motorcycle	No	0
	Yes	1

Then, four groups (clusters) were established from *Ward's Method* (Rencher & Schimek, 1997, p.466). The dendrogram presented in **Figure 31** shows the possible groupings from the chosen variables based on common characteristics. The vertical axes represent the dissimilarity measure, that is, the larger it is, the more different the groups will be. Thus, the horizontal cut line (in red) shows the four defined clusters for this analysis as they are distant from each other, allowing for an adequate analysis of the differences between them.

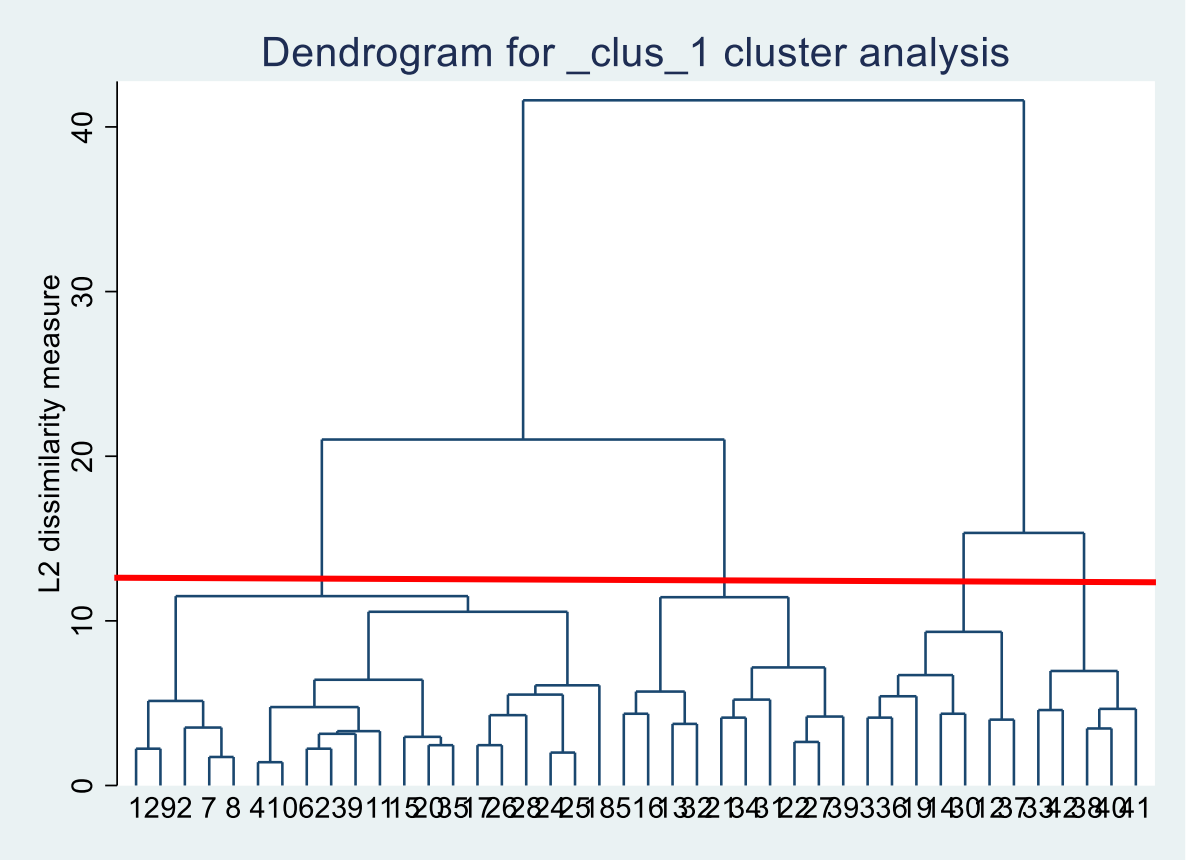

Figure 31 Dendrogram used to establish the number of groups (Ward's Method)

Table 29 shows the number of people and the percentage in each cluster.

Table 29 Number of people and the percentage in each cluster.

Cluster	N. of people	Percentage
1	20	47.62%
2	10	23.81%
3	7	16.67%
4	5	11.9%
Total	42	100%

Table 30 presents the cluster analysis results (variables, clusters, average, and standard deviation – SD). On average, all clusters have between one and two people in the household. Clusters 1 and 3 have, on average, income between BRL1,045.00 and BRL 3,135.00[27]. Clusters 2 and 4 have an income of up to up to BRL 1,045.00. Most people do not own a car, and in Cluster 4 no one does. Regarding education, in Cluster 1 there is a predominance of people with complete higher education; in Cluster 2, with complete elementary education; in

[27] BRL1,045.00 and BRL 3,135.00 = USD 188.96 and USD 566.90 (18 November, 2021).

Cluster 3, complete high school; and in Cluster 4, incomplete high school. Most formal workers are in Cluster 1. Cluster 4 includes mostly retired and self-employed workers.

Finally, Cluster 1 has the best subjective QoL, followed by Clusters 2, 3 and 4, respectively. It can be highlighted that Cluster 1 brings together most people with better financial conditions and educational qualifications (income, higher education, and formal job), which seems to impact the QoL.

Table 30 Cluster analysis results (variables, clusters, average, and standard deviation – SD)

Variable	**Cluster 1** (n = 20)		**Cluster 2** (n = 10)		**Cluster 3** (n = 7)		**Cluster 4** (n = 5)	
	Average	SD.	Average	SD	Average	SD	Average	SD
People who live in the residence	0,25	0,44	0,10	0,32	0,43	0,79	0,40	0,55
Monthly family income	2,40	0,75	1,40	0,70	2,29	0,76	1,20	0,84
Own at least one car/motorcycle	0,15	0,37	0,30	0,48	0,43	0,53	-	-
Education	4,70	1,03	1,50	1,35	3,86	1,21	2,40	1,95
Occupation = Self-employed	0,20	0,41	0,30	0,48	0,29	0,49	0,40	0,55
Occupation = Retired	0,05	0,22	0,10	0,32	0,14	0,38	0,40	0,55
Occupation = Salaried (formal)	0,55	0,51	0,40	0,52	0,14	0,38	-	-
Urban mobility	5,15	0,67	4,20	1,03	4,14	1,57	3,40	0,55
Safety	4,65	1,35	3,70	2,16	0,71	0,95	1,80	1,10
Culture and Leisure	5,25	0,64	5,00	0,94	4,14	1,35	0,40	0,89
Environmental comfort	3,30	0,80	4,60	1,07	1,00	0,82	2,80	1,10
Urban Services	5,55	0,76	5,20	0,92	4,14	1,07	4,20	0,84
Conviviality	4,40	1,57	4,30	1,49	3,57	1,72	2,40	1,52
Economy	5,35	1,04	5,00	1,05	3,71	1,80	2,00	0,71

5.2.3.4. Living in the central area of Porto Alegre

Figure 32 shows the length of residence of respondents in their current home. Most respondents have lived there for over 11 years (67%, 28 of 42 people), with 31% (13 of 42 people) between 16 and 20 years, and 29% (12 of 42 people) between 11 and 15 years.

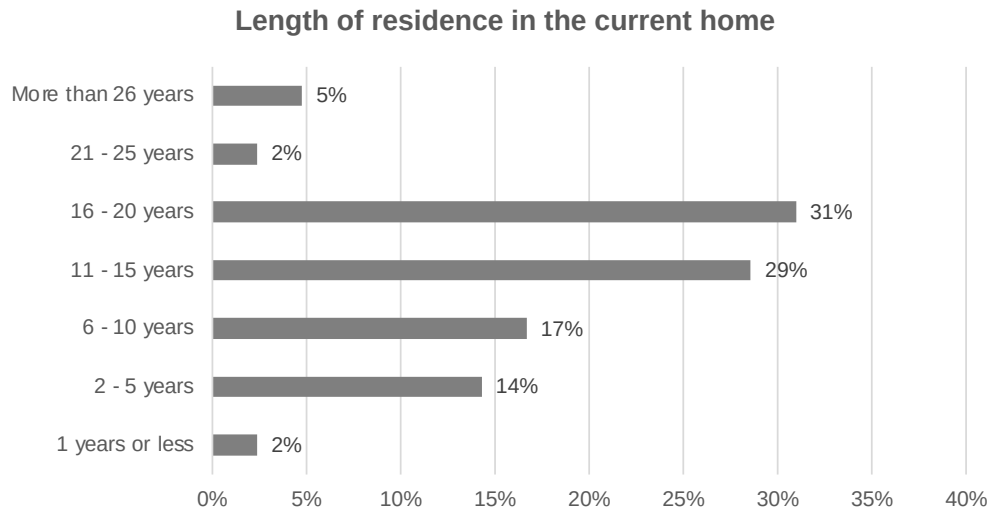

Figure 32 Length of residence of respondents in their current home

Most respondents (76%, 32 of 42 people) had already lived in Porto Alegre. The others had lived in other cities in the state of RS, as shown in **Figure 33** and **Figure 34**.

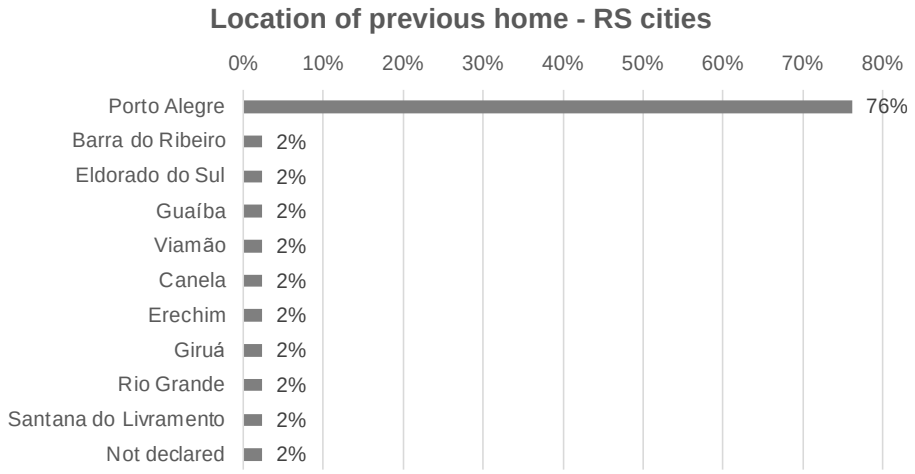

Figure 33 Location of the cities of previous respondents' homes in the state of RS

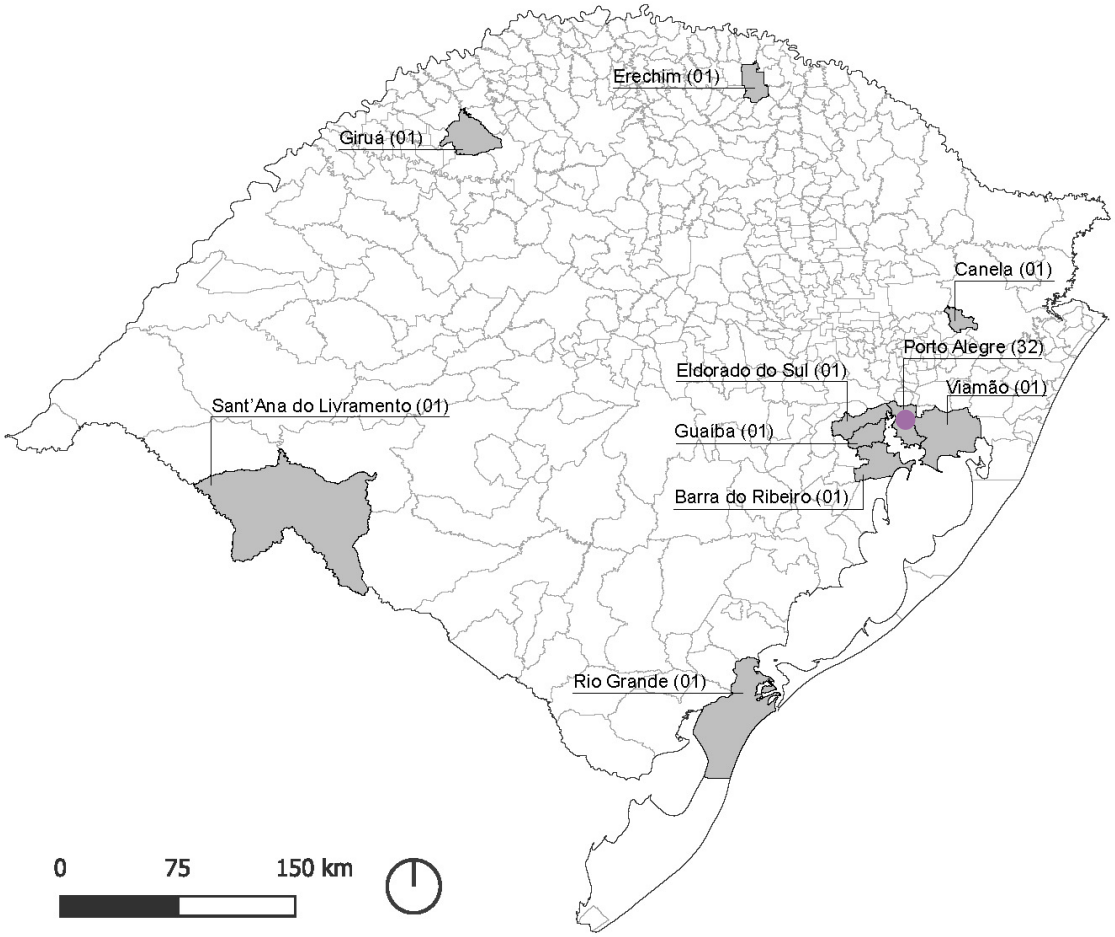

Figure 34 Map of the location of the cities of previous respondents' homes in the state of RS

31% of respondents (13 of 42 people) had also already lived in the central area of the POA, as shown in **Figure 35** and **Figure 36**.

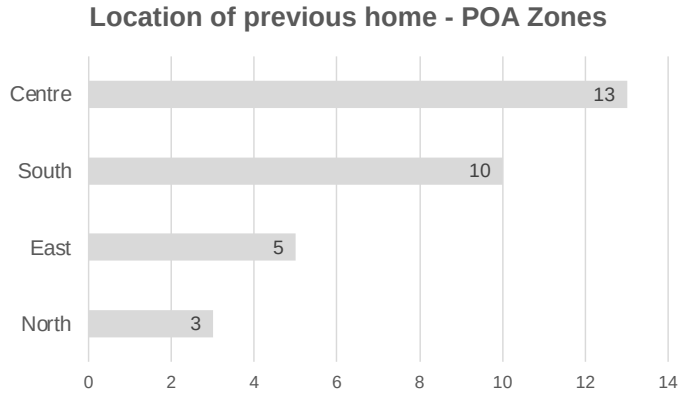

Figure 35 Location of the neighbourhoods of previous respondents' homes in POA

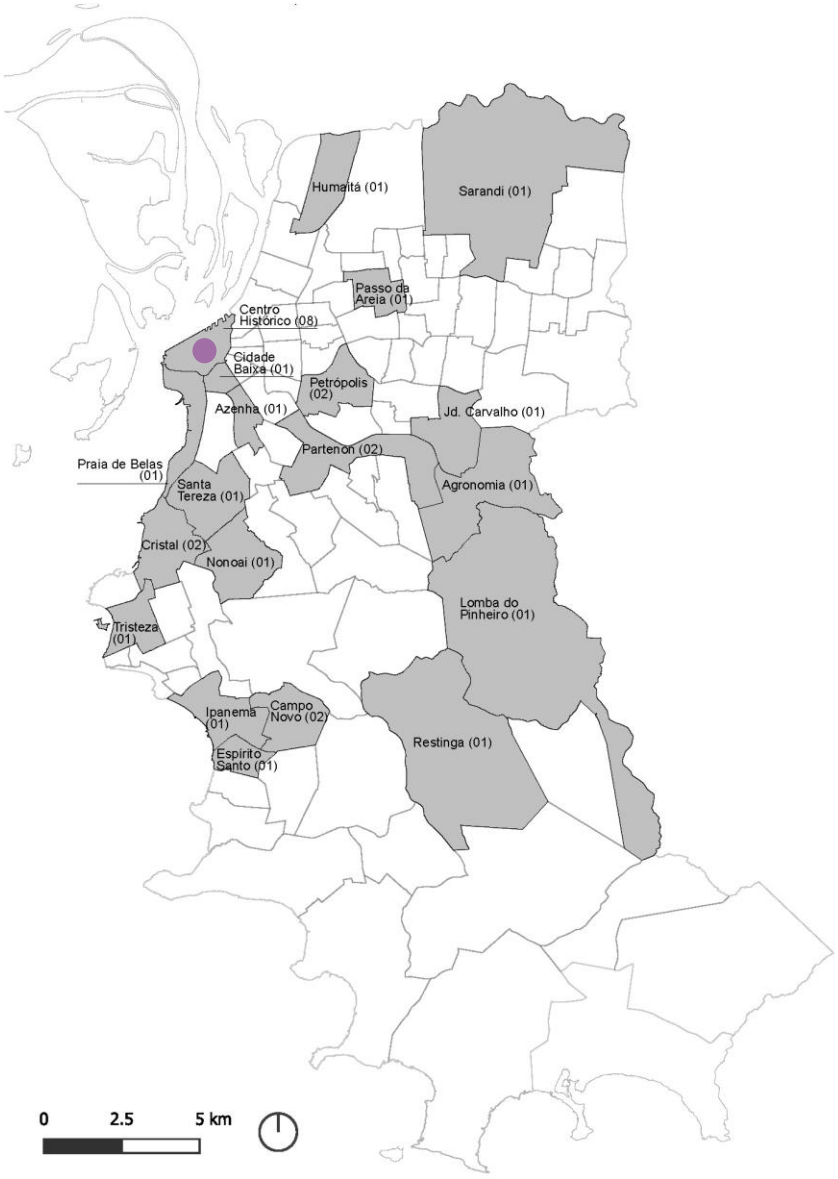

Figure 36 Map of location of the neighbourhoods of previous respondents' homes in POA

Regarding the willingness to move elsewhere, 60% of respondents said "no", 36% "yes", and 5% "maybe" (**Figure 37**).

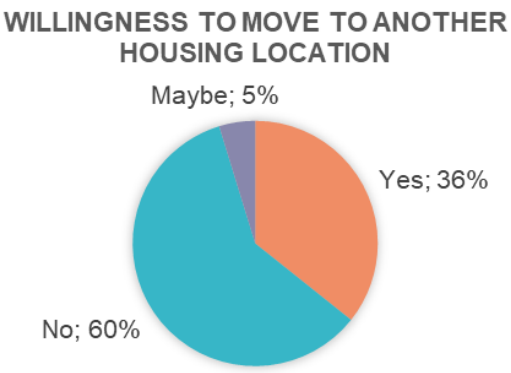

Figure 37 Willingness to move to another housing location

Among the aspects mentioned as reasons to move to another neighbourhood, the following can be highlighted:

a) noise pollution (6 people);
b) insecurity (4);
c) air pollution (1); and
d) high cost of living (1).

Desirable characteristics were also mentioned in a possible future housing location, such as a quieter neighbourhood (5 people), closer to nature (2), a more comfortable apartment, and a larger apartment with a garage (1).

5.2.4 Content Analysis Results

This section presents the content analysis results, including residents' positive and negative perceptions of their neighbourhood. The analysis was performed based on four open questions from the questionnaire, which considered aspects of the residents' neighbourhood preferences. The representation of this analysis is mainly performed through the word cloud, word list, categorization of words, and from the proposal of a categorization map. Moreover, the comments left by respondents about each dimension of the urban QoL were included in the analysis presented below.

5.2.4.1. Content analysis: positive perceptions

This section presents content analysis focusing on residents' positive perceptions of their neighbourhood. The *word cloud* presented in **Figure 38** (original word cloud, in Portuguese), which considers the 50 words most cited by respondents, was created from the answers to the following questions, which are the initial questions of the applied questionnaire:

a) What do you like most about your neighbourhood?
b) Why do you like the item mentioned in the previous question?

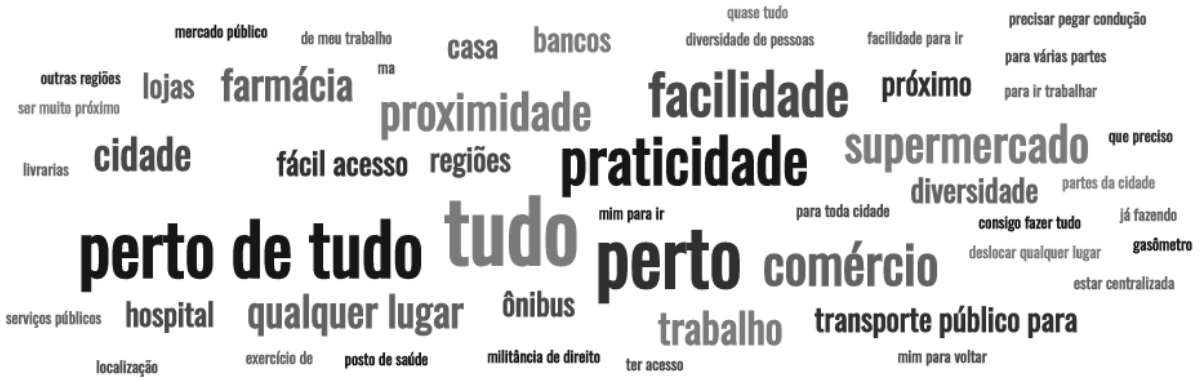

Figure 38 Word cloud generated from the residents' positive perceptions (50 words – Portuguese version) (WordCloud Generator by MonkeyLearn)

Figure 39 shows the word cloud (original word cloud, in Portuguese), considering the ten most cited expressions: close to everything, practicality, ease, commerce, and supermarket, anywhere, ease of access, and public transport (to the entire city).

Figure 39 Word cloud generated from the residents' positive perceptions (ten words words – Portuguese version) (WordCloud Generator by MonkeyLearn)

Recently (November 2021), in an attempt to generate the word cloud in the English language, it was found that only the style shown in **Figure 40** is still available for free (50 words).

Figure 40 Word cloud generated from the residents' positive perceptions (50 words – English version) (WordCloud Generator by MonkeyLearn)

In the first column of **Table 31** , the list of words (and their frequency of citation) is presented (Word Cloud by Atlas TI), with emphasis on *everything, close, practicality, access, foot,* and *commerce*. In the second column, the most cited expressions are presented (WordCloud Generator by MonkeyLearn).

Table 31 List of words and expressions related to residents' positive perceptions of the neighbourhood

Residents' positive perceptions (word list)	Residents' positive perceptions (expression list)
Everything (21) Close (16) Practicality (13) Access, Commerce, Foot (8) Facility, Pharmacy (6) Go, Proximity, Supermarket, Work, Hospital (4) City, Driving, Easy, Place, Bus, Station, Near, Public, Any, Health (3) Accessibility, Neighbourhoods, Banks, Good, Home, Moving, Diversity, Locomotion, Stores, Regions, Services, Transport (2)	Close to everything Practicality Ease of access Commerce, supermarket Anywhere Public transport (to the whole city) Work, pharmacies, hospital City Banks, stores Diversity

After the elaboration of the cloud and the list of words, content analysis was performed based on the categorization presented in the map in **Figure 41**. This map was inspired by the means-ends theory, which proposes a hierarchical representation of how people perceive products and services in three interconnected levels, gradually increasing the level of abstraction and relevance at each level (Woodruff & Gardial, 1996, p. 64-71). Due to the limitations of interviews during the Covid-19 pandemic, it was not possible to identify the *user's values* level. However, the *attributes* and *consequences* levels have been identified.

The central element of analysis is the *neighbourhood*, with 21 respondents (51%) pointing to the fact that they are *close to everything* as the feature they like most in the neighbourhood. Thus, two *functional consequences* were highlighted: *centrality* (accessibility), identified in 34 responses (83% of respondents), and *connectivity*, identified in six responses (15% of respondents), from the following expressions: *practicality, ease of access,* and *quick access to various regions of the city.* The following chain presents this relation (in grey in **Figure 41**): *Neighbourhood – Close to everything – Centrality (accessibility)/ practicality/ ease of access/connectivity – Mobility*. Thus, it is possible to highlight the positive perception of residents of the location of the neighbourhood as urban mobility is greater.

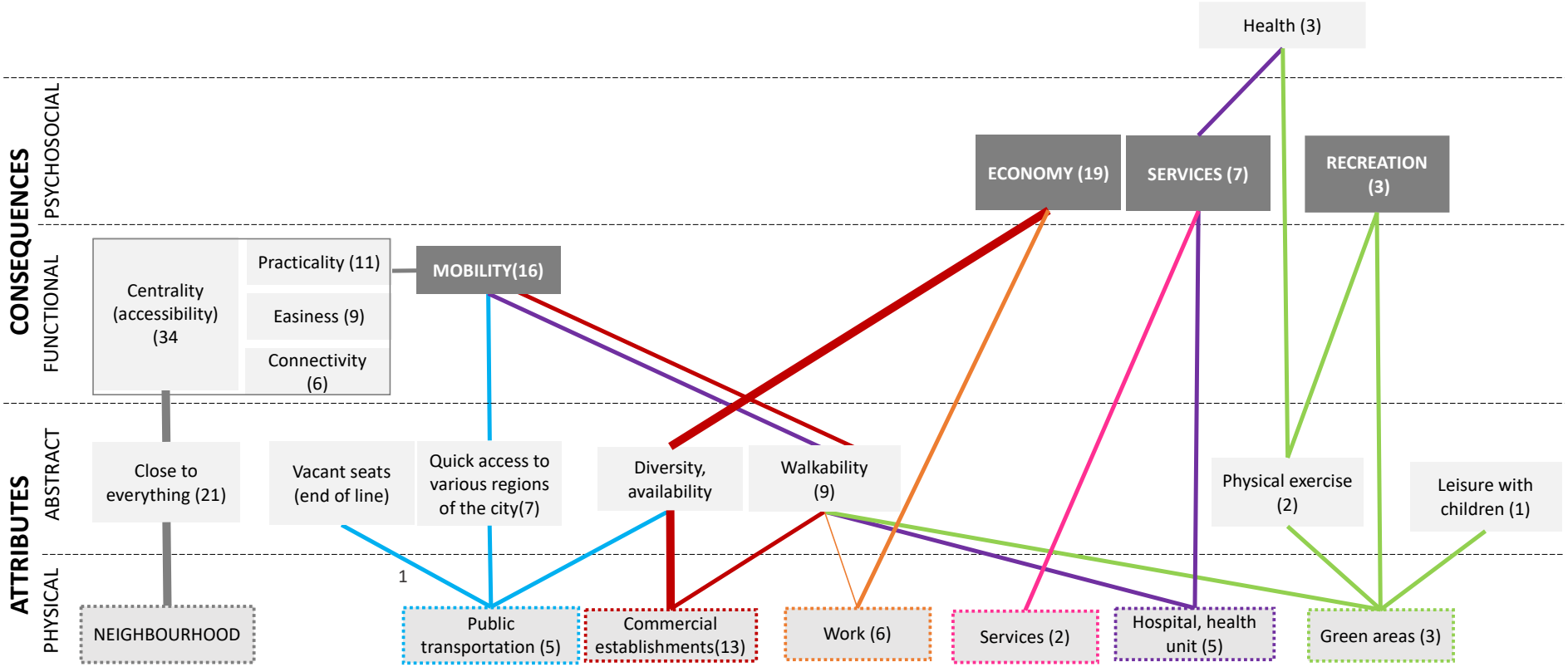

Figure 41 Categorization map of residents' positive perceptions of the neighbourhood

Furthermore, it was possible to identify specific elements motivating the positive perceptions of respondents (presented at the bottom of the map): *commercial establishments* (13 respondents), *work* (six respondents), *public transport*, and *hospitals/health centres* (five respondents each), *green areas* (three respondents) and *services* (two respondents). These elements were classified as *physical attributes* of the neighbourhood and related to the *functional* and *psychosocial consequences* generated from daily use and contact with the place of residence (more abstract features).

In the *commercial establishments* category, which appears in 13 responses, words such as diversity of *supermarkets, Public Market, pharmacies, shops, bars, banks, restaurants,* and *bookshops* were grouped. This is the biggest reason for residents' satisfaction in relation to the neighbourhood, representing 32% of respondents. Four respondents also highlighted the ease of accessing these places on foot, that is, *walkability* (abstract attribute). Thus, this category was associated with the vertical dimensions of the QoL *economy* (*psychosocial consequence*) and *urban mobility* (functional consequence). One of the residents highlighted the importance of saving time spent commuting and the cost of transport to access these places. The following chains presents this relation (in red in **Figure 41**): *Commercial establishments – Diversity/availability – Economy*; and *Commercial establishments – Walkability – Mobility*. This analysis can also be inferred from the *work* category, identified in six responses (15% of respondents), with the emphasis on *proximity* and *walkability*.

The category *public transportation* (five times - 12% of respondents) was related to *abstract characteristics* such as *diversity, availability, quick access to various regions of the city*. One of the residents also highlighted the importance of the availability of *vacant seats* on the bus at the starting point of the route. This category was associated with the QoL vertical dimension *urban mobility* (functional consequence).

The category *hospitals and health units* (five times - 7% of respondents) was associated with *walkability* (ease of accessing these places on foot) (abstract attribute) and, in this analysis, with the QoL vertical dimensions *urban mobility* (functional consequence) and *urban services* (psychosocial consequence). The category *green areas* (three times - 12% of respondents) was associated with *physical exercise* and *leisure with children* (abstract attributes) and, in this analysis, with the QoL vertical dimension *recreation* (psychosocial consequence). Thus, as more abstract consequences, the proximity to hospitals and green areas, as well as the practice of physical exercise, represent benefits for the *health* of residents. Finally, the

category *services*, cited in two responses (5% of respondents), was associated with the QoL vertical dimension *urban services* (psychosocial consequence).

In the analysis by isolated category (attribute), therefore, the *diversity and availability of commercial establishments* was identified as the main aspect positively perceived by the residents of the neighbourhood. However, in the analysis carried out from the association of attributes with the consequences of use, the QoL vertical dimensions that stand out for the greater positive perception of the neighbourhood are:

a) *Economy*: 19 associations related to the presence and diversity of commercial establishments, proximity to the workplace, as well as financial and time savings on commuting, which can often be done on foot (walkability);
b) *Urban mobility*: 16 associations related to the ease of walking, as well as the wide availability and diversity of public transport to different regions of the city;
c) *Urban services*: seven associations related to proximity to hospitals, health units and other services;
d) *Recreation*: three associations related to proximity to green areas, parks, Parque Farroupilha and Parque Orla Moacyr Scliar. These spaces were related to the practice of sports and leisure time with children.

5.2.4.2. Content analysis: negative perceptions

This section presents the content analysis focusing on residents' negative perceptions of their neighbourhoods. The word cloud presented in **Figure 42**, which considers the 50 words most cited by respondents (original word cloud, in Portuguese), was created from the answers to the following questions, which are also the initial questions of the applied questionnaire:

a) What do you least like about your neighbourhood?
b) Why do not you like the item mentioned in the previous question?

Figure 42 Word cloud generated from the residents' negative perceptions (50 words – Portuguese version) (WordCloud Generator by MonkeyLearn)

Figure 43 shows the word cloud words (original word cloud, in Portuguese), considering the ten most cited expressions: noise, pollution, dirt, homeless people.

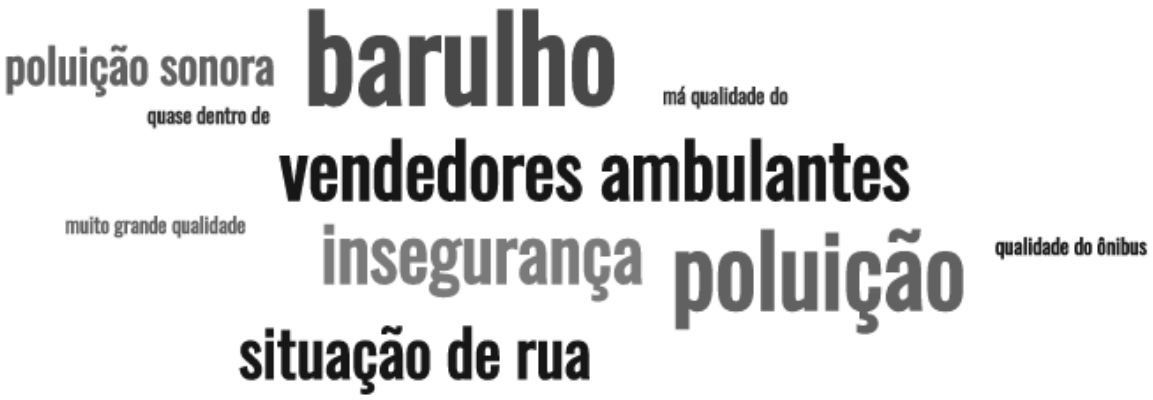

Figure 43 Word cloud generated from the residents' negative perceptions (ten words – Portuguese version) (WordCloud Generator by MonkeyLearn)

Recently (November 2021), in an attempt to generate the word cloud in the English language, it was found that only the style shown in **Figure 44** is still available for free (50 words).

Figure 44 Word cloud generated from the residents' negative perceptions (50 words–English version) (WordCloud Generator by MonkeyLearn)

In the first column of **Table 32**, the list of words (and their frequency of citation) is presented (Word Cloud by Atlas TI), with emphasis on *noise, pollution, dirt, people, insecurity, bus, building, street, violence*. In the second column, the most cited expressions are presented (WordCloud Generator by MonkeyLearn).

Table 32 List of words and expressions related to residents' negative perceptions of the neighbourhood

Residents' negative perception (word list)	Residents' negative perception (expression list)
Noise (12) Pollution, Dirt (7) People (6) Insecurity, Bus, Building, Street, Violence (5) Vendors, Absence, Stops, Sellers (4) Night, Situation (3) Muggings, Inconveniences, Rest, Front, Lighting, Residents, Streets, Bad, Going Out, Health, Social, Sleep, Sound (2)	Noise Pollution Dirt Homeless people Insecurity Poor quality of the bus Violence Street vendors Bus stops Night Theft Lighting Fear

After the creation of the word cloud and the word list, the content analysis was performed based on the categorization presented in the map in **Figure 45**. The central element of analysis, therefore, is the *neighbourhood*, but it was possible to identify more specific elements that motivate the negative responses of respondents (presented at the bottom of the map): *noise pollution* (14 respondents), *crime* (11 respondents), *air pollution* and *dirt* (five respondents), *presence of street vendors* (four respondents), *presence of homeless people* (three respondents), and *pavements*, *lighting*, and a *bus stop* (two respondents). These elements were classified as *physical attributes* of the neighbourhood and related to the *functional* and *psychosocial consequences* generated from daily use and contact with the place of residence (more abstract features).

In the *noise pollution* category, which appears in 15 responses, words such as *noise* (twelve times) *from car and bus*, and *nocturnal noise* (abstract characteristics) were grouped. This is the biggest reason for dissatisfaction of residents in relation to the neighbourhood, representing 37% of respondents. *Noise pollution* negatively impacts *environmental comfort* (functional consequence), one of the QoL vertical dimensions proposed in this research. As a *psychosocial consequence*, the *discomfort* and the *negative impact on the residents' rest and sleep* are highlighted. In a more abstract category, aspects of the interviewees' narrative can be related to the QoL vertical dimension *conviviality*; such as the excessive noise caused by users of the central region, especially at night, in addition to the noise of vehicles, establishing an environment that contains constant excessive noise. The following chain presents this relation (in red in **Figure 45**): *Noise pollution – Vehicles/nocturnal noise – Environmental comfort – Disturbance of rest – Annoyance – Conviviality.*

In the *crime* category, which appears in eleven responses, words such as theft (three times), violence (three), insecurity at night (two), insufficient policing (one), dangerous (one), marginality (one), drug trafficking (one) were grouped. Thus, the second biggest reason for dissatisfaction of residents in relation to the neighbourhood, representing 27% of respondents, can be related to the feeling of insecurity (psychosocial consequence) and to the QoL vertical dimension [lack of] security. Two residents also highlighted insecurity at night, one of the respondents related theft to the bus stop, and another one reported that drug trafficking degrades experience in the city. The following chain shows this relation: *Crime – Muggings/violence – Feeling of insecurity – Security* (in yellow in **Figure 45**).

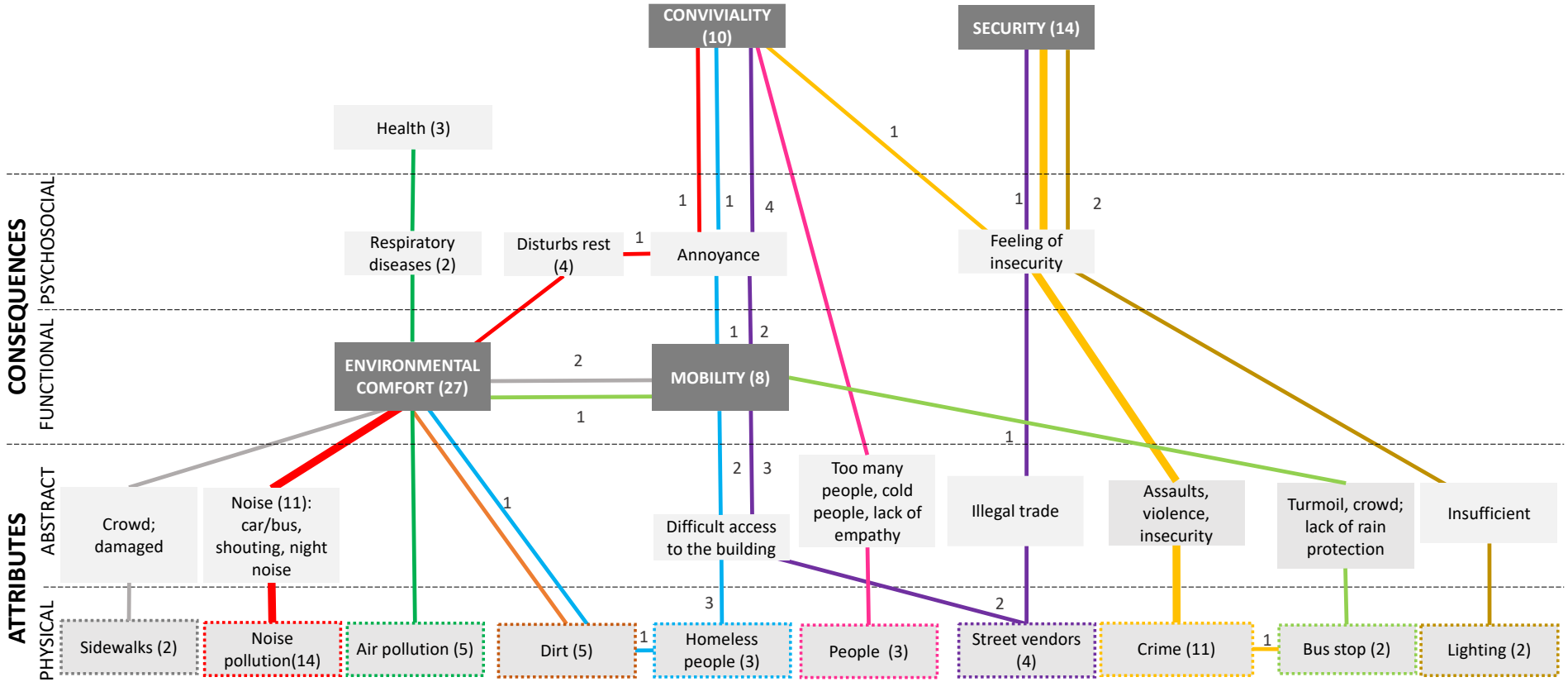

Figure 45 Categorization map of residents' negative perceptions of the neighbourhood

The *air pollution* category, which appears in five responses, represents 12% of respondents. Air pollution also negatively impacts environmental comfort (functional consequence). As a more abstract consequence, the negative impact on residents' health stands out, aggravating respiratory diseases such as rhinitis, bronchitis, and asthma (psychosocial consequence). Likewise, the *dirt* category (five times – 12% of respondents) negatively impacts environmental comfort (functional consequence). The dirt on the streets and pavements was present in the respondents' narratives, sometimes also seen as a consequence of the presence of homeless people occupying the pavements.

The *street vendors* category, cited in four responses (10% of respondents), was directly related to the *difficulty of accessing the building* (abstract characteristics), making it difficult for residents of the neighbourhood to move around. Thus, the presence of street vendors (physical characteristic) was associated with the QoL vertical dimension *urban mobility* (functional consequence). Furthermore, from the identification of the word *inconvenience* (psychosocial consequence) in this situation, it can be related to the QoL vertical dimension *conviviality*. One of the residents also reported a *feeling of insecurity* (psychosocial consequence) generated by the illegal trade in goods, which can be related to the QoL vertical dimension *security*.

The category of *homeless people*, mentioned in three responses (7% of respondents), was also related to the *difficulty of accessing the building* (abstract characteristic), making it difficult for residents and pedestrians to move around, and may be associated with the QoL dimension *urban mobility*. Furthermore, the presence of homeless people in the neighbourhood was identified by one of the residents as the cause of *dirt on the pavements*, which negatively impacts *environmental comfort* (functional consequence) although it can also be related to the vertical dimension of the QoL *conviviality*. In the category *people*, which appears in three responses (7% of respondents), the following expressions were grouped together: *many people, "cold" people, lack of empathy*. This category can be related to the QoL vertical dimension *conviviality*.

The *bus stop* category, cited in two responses (5% of respondents), was related to the excess of people (*turmoil*) and *lack of coverage and protection from bad weather*. Thus, this category was associated with the QoL vertical dimensions *urban mobility* and *environmental comfort*. The same association is made with the *pavement* category, mentioned in two responses (5% of respondents), related to overcrowding and the poor state of conservation (*damaged*). Finally,

the *public lighting* category, cited in two responses (5% of respondents), was associated with the QoL vertical dimension *security*.

In the analysis by isolated category (attribute), *noise pollution* (37% of respondents) and *crime* (public insecurity) (27% of respondents) were identified as the main aspects negatively perceived by neighbourhood residents. However, in the analysis carried out from the association of attributes with the consequences of use, the QoL vertical dimensions that stand out for the highest negative perception of the neighbourhood are:

a) *Environmental comfort*: 27 associations related especially to noise and air pollution, and dirt and the state of conservation of pavements;
b) *Security*: 14 associations especially related to muggings, violence, feelings of insecurity, and insufficient public lighting;
c) *Conviviality*: ten associations especially related to the presence of street vendors obstructing access to the building, the presence of homeless people, and the excess of people on pavements and at bus stops; and
d) *Urban mobility*: eight associations related to the same aspects mentioned in *conviviality*.

5.2.4.3. Content analysis: positive and negative perceptions

The positive perceptions of residents about the neighbourhood are related to the condition of being “close to everything”, the practicality and the ease of accessing commercial establishments and public transport, enabling connections with different parts of the city. This analysis was confirmed from the elaboration of the mapping of positive perceptions. In terms of the negative perceptions, the lists and word clouds presented expressions such as noise and air pollution, as well as dirt and insecurity, as aspects of greater dissatisfaction.

Table 33 shows the comparison between the most frequent expressions in the positive and negative perceptions of residents about the neighbourhood.

Table 33 Comparison between the most frequent expressions in the positive and negative perceptions of residents about the neighbourhood

Residents' positive perception (word list)	Residents' negative perception (word list)
Close to everything	Noise
Practicality	Pollution
Ease	Dirt
Commerce, supermarket	Homeless people
Everywhere	Insecurity
Ease of access	Poor quality of the bus
Public transport (to the whole city)	Violence
Work, pharmacies, hospital	Street vendors
City	Bus stops
Banks, stores	Night
Diversity	Theft
	Lighting
	Fear

Table 34 shows the comparison between the positive and negative perceptions of residents about the neighbourhood, based on the proposal of specific categories of analysis (categorization map).

Table 34 Relation between positive and negative perceptions of residents (specific categories of the neighbourhood)

SPECIFIC NEIGHBOURHOOD CATEGORIES			
Positive perceptions		**Negative perceptions**	
Commercial establishments	13 respondents	Noise pollution	14 respondents
Work	6 respondents	Crime	11 respondents
Public transportation	5 respondents	Air pollution	5 respondents
Hospitals/health posts		Dirt	
Green areas	3 respondents	Street vendors	4 respondents
Services	2 respondents	Homeless people	3 respondents
		People	
		Pavement	2 respondents
		Lighting	
		Bus stop	

Table 35 shows the comparison between the QoL vertical dimensions, grouped according to specific analysis categories. On the one hand, a more positive perception of residents in relation to the *economy, urban mobility,* and *urban services* QoL vertical dimensions was identified. On the other hand, a more negative perception is related to the QoL vertical dimensions *environmental comfort, security,* and *conviviality*.

Table 35 Relation between positive and negative perceptions of residents (QoL vertical dimensions)

QoL DIMENSIONS			
Positive perceptions		**Negative perceptions**	
Economy	19 associations (46%)	Environmental comfort	27 associations (66%)
Urban mobility	16 associations (39%)	Security	14 associations (34%)
Urban services	7 associations (17%)	Conviviality	10 associations (24%)
Recreation	3 associations (7%)	Urban mobility	8 associations (20%)

Finally, **Figure 46** shows the residents' ranking of relevance for the QoL dimensions (one of the multiple-choice questions in the questionnaire). Thus, residents ranked the vertical dimensions of the urban QoL according to the order of importance from their perspective. Urban mobility (67%), security (67%), and urban services (64%) were the dimensions identified as most important for QoL, followed by environmental comfort (38%), the economy (24%), culture and recreation (21%), and, in last place, conviviality (14%).

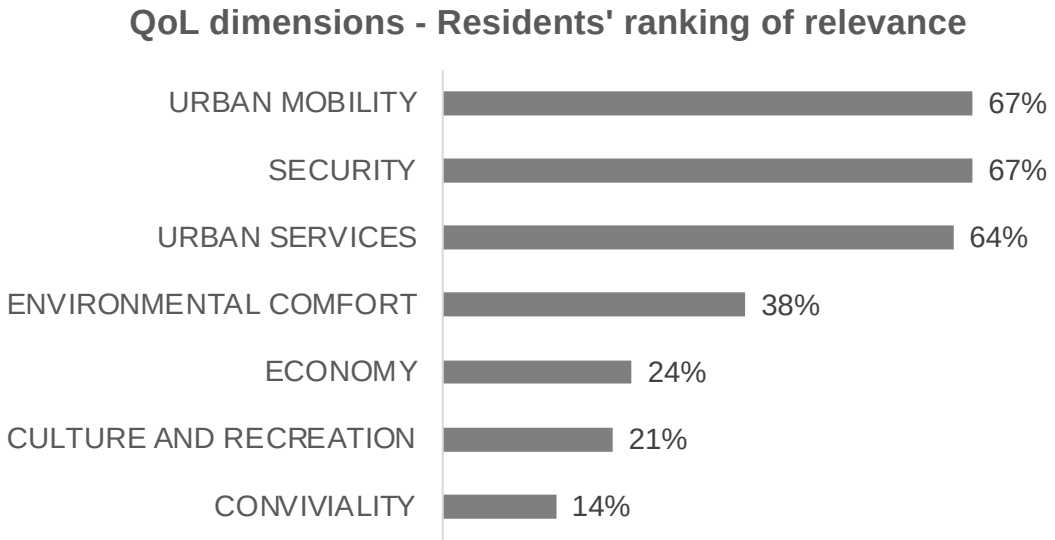

Figure 46 Residents' ranking of relevance for the QoL dimensions

5.2.5 Multidimensional Subjective Qol

An investigation to verify the percentage of respondents who have a multidimensional subjective QoL was carried out. Thus, as shown in **Figure 47**, indicators with *regular*, *good*, and *excellent* values were considered as showing that "there is a subjective QoL" (1). The other indicators, with *bad*, *very bad* and *not applicable* values, were considered as showing

that “there is no subjective QoL” (0). Thus, people who presented 29 indicators or more (four indicators per QoL vertical dimension on average), were considered to have a multidimensional subjective QoL.

		MOBILIDADE URBANA						SEGURANÇA						CULTURA E LAZER					
id		2.1 Como v	2.2 Como v	2.3 Como v	2.4 Como v	2.5 Como v	2.6 Como v	3.1 Como v	3.2 Como v	3.3 Como v	3.4 Como v	3.5 Como v	3.6 Como v	4.1 Como v	4.2 Como v	4.3 Como v	4.4 Como v	4.5 Como v	4.6 Como v
1		1	1	1	1	0	0	1	1	0	1	0	1	1	0	1	1	1	0
2		1	1	1	1	1	0	1	1	0	0	1	0	1	1	1	1	1	1
3		1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0
4		1	1	1	1	0	1	1	1	0	1	0	1	1	1	1	1	1	1
5		0	1	1	1	1	1	0	1	0	1	1	1	1	1	1	1	1	1
6		1	1	1	1	0	1	0	1	0	0	1	1	1	0	1	1	1	1
7	UTOPIA E	1	1	1	1	0	0	0	1	0	0	0	1	1	0	1	1	1	1
8	LUTA	1	1	1	1	0	1	1	1	0	0	0	0	1	0	1	1	1	1
9		1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	0
10		1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1
11		1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	1	1
12		0	0	1	1	1	0	0	0	0	0	0	0	1	0	1	1	1	1
13		1	0	1	1	1	0	0	0	0	0	0	1	0	0	1	1	1	1
14		1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1	1	0
15		1	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1
16		1	1	1	1	0	1	0	0	0	0	1	1	1	1	1	1	1	0
17		1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
18		1	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1
19		0	0	1	1	1	0	0	0	0	0	0	0	1	0	1	1	1	0
20		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
21		1	1	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1
22	SUL AMÉRICA	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
23		1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	1	1

Figure 47 A sample of the data analysis scored (good multidimensional subjective QoL = 1, and bad multidimensional subjective QoL = 0)

As shown in **Table 36**, 64.3% of respondents have a multidimensional subjective QoL, that is, 27 out of 42 people. *Urban services*, the dimension with the highest number of people with QoL, comprised 66.7% of respondents. Conversely, *environmental comfort*, the dimension with the lowest number of people with QoL, comprised only 11.9% of respondents.

Table 36 QoL index for each dimension of QoL, for each building and final

Urban QoL Dimensions	People with subjective QoL (%)	People with subjective QoL (n)
URBAN SERVICES	66.7%	28
CULTURE AND RECREATION	64.3%	27
ECONOMY	64.3%	27
URBAN MOBILITY	59.5%	25
CONVIVIALITY	45.2%	19
SECURITY	38.1%	16
ENVIRONMENTAL COMFORT	11.9%	5
Multidimensional subjective QoL	**64.3%**	**27**

5.2.6 The Subjective QoL Index

The subjective QoL index was calculated based on the methodology of the Human Development Index (HDI), including the four main steps described below. The HDI is a

composite index measuring average achievement in three basic dimensions of human development: a long and healthy life, knowledge, and a decent standard of living (Human Development Report, 2020)[28]. HDI is ranked on a scale from 0 to 1.0, in which "below 0.555" is considered a "low human development" and "0.800 and above" is considered "very high human development" (Human Development Report, 2020).

First, the score (points) presented in **Table 37** was proposed, considering the scale used in the questionnaire applied to the residents: excellent (4 points), good (3), regular (2), bad (1), very bad and not applicable (0). The *median* was used in this calculation, which is the value separating the higher half from the lower half of a data sample, providing a better representation of a "typical" value[29]. For this purpose, the median of each indicator in each building was considered.

Table 37 Proposed score, considering the scale used in the neighbourhood perception questionnaire

Scale	Points
Excellent	4
Good	3
Regular	2
Bad	1
Very bad/Not applicable	0

Figure 48 shows a sample of the data analysis responses, and **Figure 49** shows a sample of the data analysis scored.

id		2.1 Como \	2.2 Como \	2.3 Como \	2.4 Como \	2.5 Como \	2.6 Como \	3.1 Como \	3.2 Como \	3.3 Como \	3.4 Como \	3.5 Como \	3.6 Como \	4.1 Como \	4.2 Como \	4.3 Como \	4.4 Como \	4.5 Como \	4.6 Como \
1		Ótimo	Bom	Ótimo	Regular	Péssimo	Péssimo	Regular	Ótimo	Péssimo	Bom	Ruim	Bom	Bom	Péssimo	Regular	Ótimo	Ótimo	Péssimo
2		Regular	Bom	Ótimo	Ótimo	Regular	Péssimo	Regular	Bom	Ruim	Ruim	Bom	Ruim	Regular	Bom	Regular	Bom	Bom	Bom
3		Bom	Bom	Bom	Ótimo	Bom	Péssimo	Péssimo	Péssimo	Péssimo	Péssimo	Péssimo	Ruim	Ruim	Péssimo	Ruim	Regular	Regular	Péssimo
4		Ótimo	Ótimo	Ótimo	Ótimo	Ruim	Bom	Regular	Regular	Péssimo	Regular	Ruim	Regular	Bom	Bom	Bom	Bom	Bom	Bom
5		Ruim	Bom	Bom	Ótimo	Bom	Regular	Ruim	Regular	Ruim	Regular	Regular	Regular	Bom	Regular	Bom	Bom	Regular	Regular
6		Ótimo	Ótimo	Ótimo	Bom	Péssimo	Regular	Péssimo	Regular	Péssimo	Péssimo	Bom	Regular	Bom	Péssimo	Ótimo	Bom	Regular	Bom
7	UTOPIA E	Regular	Bom	Ótimo	Ótimo	Péssimo	Péssimo	Ruim	Regular	Péssimo	Ruim	Ruim	Regular	Bom	Ruim	Bom	Bom	Regular	Regular
8	LUTA	Ótimo	Ótimo	Ótimo	Ótimo	Ruim	Regular	Bom	Ótimo	Ruim	Ruim	Ruim	Ruim	Regular	Ruim	Bom	Bom	Ótimo	Bom
9		Bom	Regular	Ótimo	Ótimo	Regular	Regular	Regular	Bom	Regular	Regular	Ruim	Regular	Bom	Regular	Bom	Bom	Regular	Ruim
10		Regular	Regular	Ótimo	Ótimo	Regular	Ruim	Regular	Bom	Ruim	Bom	Regular	Regular	Ótimo	Regular	Bom	Ótimo	Regular	Regular
11		Bom	Ótimo	Ótimo	Ótimo	Regular	Regular	Regular	Bom	Ruim	Ruim	Bom	Bom	Bom	Ruim	Bom	Ótimo	Bom	Bom
12		Péssimo	Péssimo	Regular	Bom	Regular	Ruim	Péssimo	Péssimo	Péssimo	Ruim	Ruim	Ruim	Ótimo	Ruim	Ótimo	Bom	Bom	Bom
13		Regular	Ruim	Bom	Bom	Bom	Péssimo	Péssimo	Ruim	Péssimo	Péssimo	Péssimo	Regular	Ruim	Ruim	Bom	Bom	Regular	Regular
14		Bom	Bom	Ótimo	Ótimo	Não aplicá	Ruim	Péssimo	Ruim	Péssimo	Péssimo	Regular	Regular	Regular	Regular	Regular	Bom	Regular	Ruim
15		Bom	Bom	Bom	Bom	Regular	Ruim	Ótimo	Bom	Bom	Regular	Bom	Bom	Bom	Regular	Não aplicá	Bom	Bom	Bom
16		Regular	Regular	Bom	Ótimo	Ruim	Regular	Ruim	Ruim	Péssimo	Ruim	Regular	Regular	Regular	Regular	Bom	Bom	Bom	Ruim
17		Regular	Ruim	Bom	Bom	Bom	Regular	Regular	Bom	Bom	Regular	Bom	Bom	Regular	Regular	Bom	Bom	Regular	Ruim
18		Ótimo	Ótimo	Ótimo	Ótimo	Não aplicá	Péssimo	Ótimo	Ótimo	Ótimo	Regular	Ótimo	Ótimo	Ótimo	Ótimo	Ótimo	Ótimo	Não aplicá	Ótimo
19		Ruim	Péssimo	Bom	Bom	Regular	Péssimo	Ruim	Ruim	Péssimo	Ruim	Ruim	Ruim	Regular	Ruim	Regular	Bom	Bom	Ruim
20		Bom	Regular	Ótimo	Bom	Bom	Regular	Regular	Bom	Bom	Regular	Regular	Bom	Bom	Regular	Regular	Bom	Regular	Regular
21		Regular	Regular	Ótimo	Ótimo	Regular	Ruim	Regular	Ótimo	Ruim	Bom	Regular	Regular	Ótimo	Bom	Ótimo	Ótimo	Regular	Regular
22	SUL AMÉRICA	Não aplicá	Bom	Ótimo	Ótimo	Não aplicá	Bom	Bom	Ótimo	Bom	Regular	Ótimo	Ótimo	Bom	Regular	Bom	Ótimo	Bom	Regular
23		Regular	Regular	Regular	Ótimo	Bom	Regular	Regular	Bom	Ruim	Não aplicá	Regular	Regular	Bom	Ruim	Ótimo	Ótimo	Ótimo	Regular

Figure 48 A sample of the data analysis responses

[28] Human Development Report (2020) - http://hdr.undp.org/sites/default/files/hdr2020_technical_notes.pdf (Accessed in November 2021)
[29] Wolfram Math World - Statistical Median - https://mathworld.wolfram.com/StatisticalMedian.html (Accessed in November 2021)

		MOBILIDADE URBANA						SEGURANÇA						CULTURA E LAZER					
id		2.1 Como v	2.2 Como v	2.3 Como v	2.4 Como v	2.5 Como v	2.6 Como v	3.1 Como v	3.2 Como v	3.3 Como v	3.4 Como v	3.5 Como v	3.6 Como v	4.1 Como v	4.2 Como v	4.3 Como v	4.4 Como v	4.5 Como v	4.6 Como v
1	UTOPIA E LUTA	4	3	4	2	0	0	2	4	0	3	1	3	3	0	2	4	4	0
2		2	3	4	4	2	0	2	3	1	1	3	1	2	3	2	3	3	3
3		3	3	3	4	3	0	0	0	0	0	0	1	1	0	1	2	2	0
4		4	4	4	4	1	3	2	2	0	2	1	2	3	3	3	3	3	3
5		1	3	3	4	3	2	1	2	1	2	2	2	3	2	3	3	2	2
6		4	4	4	3	0	2	0	2	0	0	3	2	3	0	4	3	2	3
7		2	3	4	4	0	0	1	2	0	1	1	2	3	1	3	3	2	2
8		4	4	4	4	1	2	3	4	1	1	1	1	2	1	3	3	4	3
9		3	2	4	4	2	2	2	3	2	2	1	2	3	2	3	3	2	1
10		2	2	4	4	2	1	2	3	1	3	2	2	4	2	3	4	2	2
11		3	4	4	4	2	2	2	3	1	1	3	3	3	1	3	4	3	3
12		0	0	2	3	2	1	0	0	0	1	1	1	4	1	4	3	3	3
13		2	1	3	3	3	0	0	1	0	0	0	2	1	1	3	3	2	2
14		3	3	4	4	0	1	0	1	0	0	2	2	2	2	2	3	2	1
15	SUL AMÉRICA	3	3	3	3	2	1	4	3	3	2	3	3	3	2	0	3	3	3
16		2	2	3	4	1	2	1	1	0	1	2	2	2	2	3	3	3	1
17		2	1	3	3	3	2	2	3	3	2	3	3	2	2	3	3	2	1
18		4	4	4	4	0	0	4	4	4	2	4	4	4	4	4	4	0	4
19		1	0	3	3	2	0	1	1	0	1	1	1	2	1	2	3	3	1
20		3	2	4	3	3	2	2	3	3	2	2	3	3	2	2	3	2	2
21		2	2	4	4	2	1	2	4	1	3	2	2	4	3	4	4	2	2
22		0	3	4	4	0	3	3	4	3	2	4	4	3	2	3	4	3	2
23		2	2	2	4	3	2	2	3	1	0	2	2	3	1	4	4	4	2

Figure 49 A sample of the data analysis scored

Second, the arithmetic average of each indicator for each building was calculated. The following formula was also applied, so each indicator obtained a value between 0 and 1.

As all indicators range from 0 (lowest value) to 4 (highest value), the value of each indicator was divided by 4.

$$Indicator = \frac{Indicator\ value - Lower\ value}{Highest\ value - Lower\ value}$$

As all indicators range from 0 (lowest value) to 4 (highest value), the value of each indicator was divided by 4.

$$Indicator = \frac{Indicator\ value - 0}{4 - 0} = \frac{Indicator\ value}{4}$$

Third, the geometric mean of the indicators for each of the QoL dimensions (of each building) was calculated, according to the example below of urban mobility.

$$QoLI_{Urban\ Mobility} = \sqrt[6]{(q2.1) \times (q2.2) \times (q2.3) \times (q2.4) \times (q2.5) \times (q2.6)}$$

Finally, the QoL index (QoLI) is obtained from the geometric mean of the QoL dimensions.

$$QoLI = \sqrt[7]{\begin{matrix}(Urban\ mobility) \times (Security) \times (Culture\ and\ recreation) \times \\ (Environmental\ comfort) \times (Urban\ services) \times \\ (Conviviality) \times (Economy)\end{matrix}}$$

The following scale is proposed for the QoL index (from 0 to 1.000, with 1.000 being the highest QoL): 0 to 0.199 *very low QoL*; 0.200 to 0.399 *low QoL*; 0.400 to 0.599 *medium QoL*; 0.600 to 0.799 *high QoL*; and 0.800 to 1.000 *very high QoL* (**Table 38**).

Table 38 QoL index scale

QoL	Scale
very high QoL	0.800 - 1.000
high QoL	0.600 - 0.799
medium QoL	0.400 - 0.599
low QoL	0.200 - 0.399
very low QoL	0 - 0.199

Thus, **Table 39** shows QoL index, between 0 and 1 (the closer to 1, the better the QoL) for each vertical dimension of the subjective QoL. Based on the residents' perceptions of the neighbourhood, the QoL final index is 0.568, that is, a "medium subjective QoL". The most positive perception is related to the *urban services* (0.708) *economy* (0.667), and *culture and recreation* (0.625). A medium QoL can be linked with *urban mobility* (0.583), *conviviality* (0.542), and *security* (0.458). The most negative perception (low QoL) is related to the *environmental comfort* (0.396).

Regarding the analysis by building, Sul América presents the best QoL index (0.595 – medium QoL), with emphasis on the high QoL for *urban services* (0.750), *economy* (0.708), and *culture and recreation* (0.667). Next, the Utopia and Luta and Bento Gonçalves buildings obtained a medium QoL index, with 0.577 and 0.548, respectively. The 20 de Novembro Squat stands out for the lowest QoL index of 0.277 (low QoL), with *conviviality* (0.188), *security* (0.167) and *culture and recreation* (0.104) with the lowest indexes.

Table 39 QoL index for each dimension of QoL, for each building and final

QoL DIMENSIONS	SUL AMÉRICA	UTOPIA E LUTA	BENTO GONÇALVES	20 DE NOVEMBRO	**QoL INDEX**
URBAN SERVICES	0,750	0,688	0,708	0,458	0,708
ECONOMY	0,708	0,750	0,667	0,208	0,667
CULTURE AND RECREATION	0,667	0,583	0,500	0,104	0,625
URBAN MOBILITY	0,583	0,708	0,542	0,500	0,583
CONVIVIALITY	0,458	0,604	0,625	0,188	0,542
SECURITY	0,583	0,313	0,292	0,167	0,458
ENVIRONMENTAL COMFORT	0,417	0,396	0,500	0,313	0,396
FINAL INDEX	0,595	0,577	0,548	0,277	**0,568**

Table 40 shows a ranking of the QoL index for each QoL indicators (42 in total). In the first position, the economy indicator *diversity of commercial establishments* had the highest index of 0.935 (very high QoL), followed by urban mobility indicators *ease of moving around on foot* (0.821 - very high QoL) and *ease of going from your home to other parts of the city* (0.815 - very high QoL). Therefore, aspects related to diversity, connectivity and accessibility are characteristics that are positively perceived in the neighbourhood.

Table 40 QoL index for each QoL subjective indicators

QoL dimensions	QoL subjective indicators	Index
ECONOMY	Diversity of commercial establishments (8.5)	0,935
URBAN MOBILITY	Ease of moving around on foot (to carry out daily activities) (2.4)	0,821
URBAN MOBILITY	Ease of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	0,815
URBAN SERVICES	Electrical energy supply (6.3)	0,774
CULTURE AND RECREATION	Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	0,708
URBAN SERVICES	Water supply (6.2)	0,679
URBAN SERVICES	Solid waste collection (6.1)	0,649
CULTURE AND RECREATION	Number of urban green areas (parks) (4.1)	0,649
URBAN SERVICES	Health services (6.5)	0,631
ECONOMY	Access to credit (payment conditions facilitated in commercial establishments) (8.4)	0,625
CONVIVIALITY	Identification with the neighbourhood and people's pride in living in it (7.6)	0,613
ECONOMY	Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	0,601
CULTURE AND RECREATION	Existence of places for the practice of outdoor sports (4.3)	0,589
URBAN MOBILITY	Availability of public transport (number of lines and schedules) (2.2)	0,583
SECURITY	Feeling of security when accessing your building during the day (3.2)	0,577
URBAN SERVICES	Education services (6.6)	0,571
URBAN MOBILITY	Quality of public transport (comfort) (2.1)	0,571
ECONOMY	Existence of activities related to tourism (8.6)	0,536
ENVIRONMENTAL COMFORT	View from the window of your apartment (to the external space) (5.6)	0,536
URBAN SERVICES	Internet services supply (6.4)	0,524
CONVIVIALITY	People's respect for cultural, sexual, religious, and political differences (7.5)	0,518
ECONOMY	Job opportunities (8.1)	0,512

CONVIVIALITY	Opportunities to participate in decisions relating to the building (7.3)	0,512
SECURITY	Quality of public lighting (3.6)	0,512
CULTURE AND RECREATION	Opportunities to participate in free cultural and artistic events (4.5)	0,506
CONVIVIALITY	Coexistence and interaction with homeless people (7.2)	0,488
CONVIVIALITY	Coexistence and interaction with the neighbourhood residents (7.1)	0,470
ENVIRONMENTAL COMFORT	Trees on street (5.3)	0,440
ENVIRONMENTAL COMFORT	Drainage and sewerage system (flooding and bad odour) (5.5)	0,440
CULTURE AND RECREATION	Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	0,435
SECURITY	Policing quality (3.5)	0,435
ECONOMY	Cost of living (8.2)	0,429
CULTURE AND RECREATION	Quality and maintenance of green urban areas (4.2)	0,417
ENVIRONMENTAL COMFORT	Cleanliness of public places (pavements, streets, green areas, etc.) (5.4)	0,411
URBAN MOBILITY	Quality and location of cycle paths (2.5)	0,381
SECURITY	Sense of security in public places (3.1)	0,381
CONVIVIALITY	Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	0,363
SECURITY	Safety for children and teenagers to experience the public places (3.4)	0,339
ENVIRONMENTAL COMFORT	Air pollution (feeling when breathing) (5.2)	0,298
URBAN MOBILITY	Quality and maintenance of pavements (2.6)	0,292
SECURITY	Feeling of security when accessing your building at night (3.3)	0,256
ENVIRONMENTAL COMFORT	Noise pollution (5.1)	0,185

Conversely, in the final positions in the ranking (**Table 40**) are the environmental comfort indicator *noise pollution* (0,185 - very low QoL), the security indicator *feeling of security when accessing your building at night* (0,256 - low QoL), and the urban mobility indicator *quality and maintenance of pavements* (0,292 - low QoL).

5.3 RESULTS OF STAGE 3 (ANALYSIS)

This section presents the results of *Stage 3 (analysis)*, which focuses on the identification of QoL objective indicators (secondary data), and on the data confrontation between subjective

and objective QoL. The final version of the multidimensional method to evaluate the urban QoL is proposed. Then, it was assessed, based on its *utility* and *applicability*. Finally, a cross-analysis of the results of the different stages of the study was carried out, and their practical and theoretical contributions were analyzed.

5.3.1 Data confrontation: Subjective and Objective Indicators

In this section, the data confrontation between the QoL subjective indicators – based on the perceptions of residents of the central area of POA – and the QoL objective indicators are presented. Objective indicators were identified based on secondary data (such as IBGE, PMPA, etc.). Therefore, the RSL (presented in Section 3) and the indicators presented in NBR 37120 (2017) were the starting point for identifying indicators that reveal the objective QoL.

Afterwards, the identification of *types of QoL*, based on Zapf's (1979) welfare model (as presented in Section 5.1.1), is carried out (*well-being*; *deprivation*; *dissonance;* and *resignation*). This specific analysis should consider just two categories, that is, *good QoL* and *bad QoL*. Thus, high, and very high QoL (0.600 to 1.000) were defined as *good QoL*, and very low, low, and regular QoL (0.000 to 0.599) were defined as *bad QoL* (**Table 41**).

Table 41 Scale of the subjective QoL type identification

QoL	QoL index scale	**Subjective QoL type** (scale)
very high QoL	0.800 - 1.000	Good QoL
high QoL	0.600 - 0.799	
medium QoL	0.400 - 0.599	Bad QoL
low QoL	0.200 - 0.399	
very low QoL	0 - 0.199	

As this study do not propose an objective QoL index, and the NBR 37120 (2017) does not define targets and control values for the proposed indicators, the identification of the objective QoL types was carried out through measures considered adequate in the existing literature on urban indicators, which are pointed out throughout the analysis.

5.3.1.1 Urban services

The *Urban services* dimension was classified in third place in the ranking of relevance for the QoL, with 64% of respondents indicating it. In terms of the perceptions of residents of the

neighbourhood, 64% showed a positive perception, 21% regular, and 13% negative in relation to *urban services* (**Figure 50**). Thus, this dimension of QoL obtained the highest satisfaction in the residents' perception among the seven dimensions considered. Some popular expressions in the content analysis were *close to everything*, *ease of access*, *hospital*, *health centre*, *diversity*, *services*, and *health*. No negative terms were associated with *urban services*.

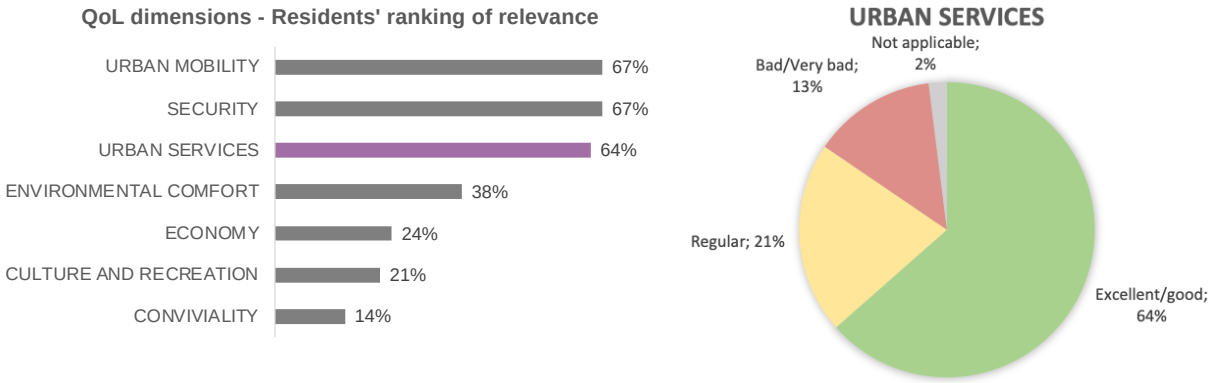

Figure 50 Residents' ranking of relevance for the QoL dimensions and the *urban services'* satisfaction graph

The great satisfaction related to the "electrical energy supply" stands out, and 83% of respondents classify it as excellent/good (**Table 42**). Its QoL index was 0.774 (high QoL), that is, good QoL. NBR 37120 (2017) suggests the use of four essential *energy* indicators, which are discussed below.

Table 42 Results of the perception of *urban services* in the neighbourhood

URBAN SERVICES			QUESTIONNAIRE SCALE						ACCUMULATED SCALE		
QoL subjective indicator			Excellent	Good	Regular	Bad	Very bad	N. A.	E./G.	Regular	B./V.B.
1	Electrical energy supply (6.3)	0,774	31%	52%	14%	0%	2%	0%	83%	14%	2%
2	Water supply (6.2)	0,679	19%	52%	17%	5%	7%	0%	71%	17%	12%
3	Solid waste collection (6.1)	0,649	12%	57%	17%	7%	7%	0%	69%	17%	14%
4	Health services (6.5)	0,631	17%	45%	19%	12%	7%	0%	62%	19%	19%
5	Education services (6.6)	0,571	14%	40%	24%	2%	12%	7%	55%	24%	14%
6	Internet services supply (6.4)	0,524	7%	33%	36%	10%	10%	5%	40%	36%	19%
URBAN SERVICES INDEX		0,708						TOTAL	63%	21%	13%

Controlling the amount of electricity consumed is necessary to manage its generation, consumption, and preservation (NBR 37120, 2017, p. 14). Residential consumption represents 31.2% of the total energy consumed in Brazil. The *total residential electricity consumption per capita* (NBR 37120, 2017, p. 14) in the South region of Brazil in 2020 was 186.3 kWh/month (EPE, 2021, p. 5). However, it was not possible to identify specific data from POA.

The *percentage of city inhabitants with regular electricity supply* (NBR 37120, 2017, p. 14) can be considered a satisfactory indicator in the state of RS and POA as this service is provided to 99.9% of the RS population (IBGE, 2019) and to 99.19% of the POA population (IBGE, 2010). In the Historical Centre and the Floresta district, in 2010, regular electricity is supplied to 99.88% and 100% of the population, respectively (PNDU, 2014[30]). The *energy consumption of public buildings per year* (NBR 37120, 2017, p. 15) in Brazil in 2020 was 12,764 GWh, representing 2.7% of the total energy consumed (EPE, 2021, p. 4). However, it was not possible to identify specific data from RS and POA.

Renewable energy sources must be a priority for sustainable development (NBR 37120, 2017, p. 15). The *percentage of total energy from renewable sources as part of the city's total energy consumption* is an essential *energy* indicator of NBR 37120 (2017, p. 15). In 2020, 48.4% of the Brazilian domestic energy supply came from renewable sources – sugarcane biomass (19.1%), hydraulic (12.6%), firewood and charcoal (8.9%) and others (7.7%) - and 51.6% from non-renewable sources - oil (33.1%), natural gas (11.8%), coal (4.9%), uranium (1.3%) and others (0.6%) (BEN, 2021, p. 16[31]). Also, as shown in **Figure 51**, Brazil stands out in the supply of renewable energy (48.4%), when compared to world data of only 13.8% (BEN, 2021, p. 12).

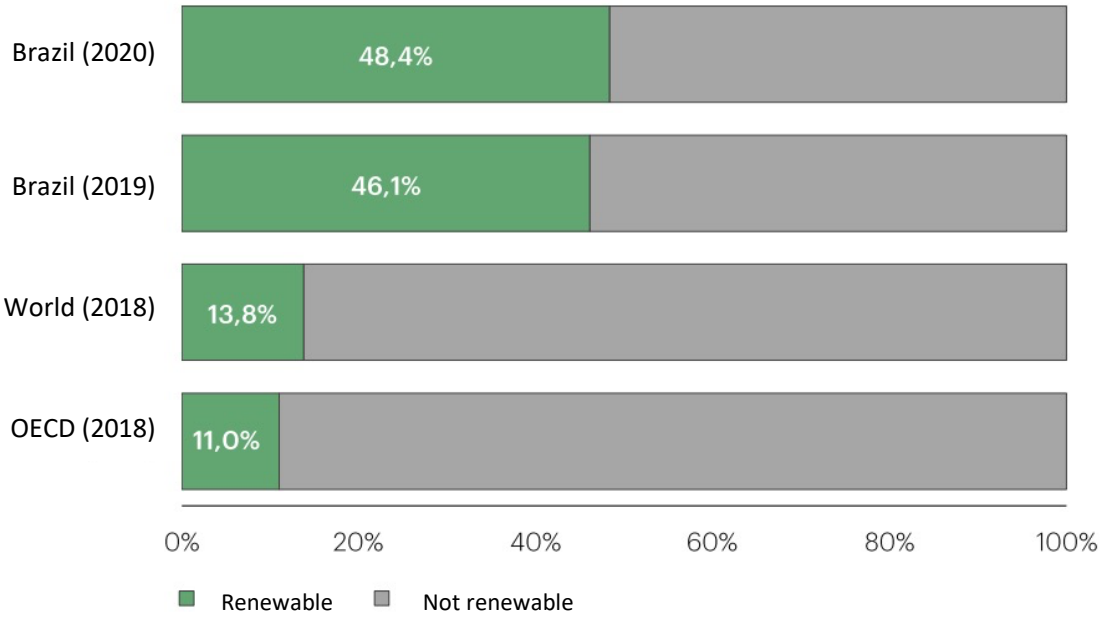

Figure 51 Participation of renewables in the energy matrix with data from Brazil and worldwide (BEN, 2021, p. 12), adapted by the researcher

[30] file:///D:/Downloads/undp-br-hdr_portugues-2014%20(1).pdf
[31] https://www.epe.gov.br/pt/publicacoes-dados-abertos/publicacoes/balanco-energetico-nacional-2021

NBR 37120 (2017) also suggests the use of three *energy* support indicators, which are discussed below. The total consumption of electricity in Brazil in 2020 was 475 TWh, around 1.4% lower than in the previous year (EPE, 2021, p.3). In 2020, in the state of RS, the *total electricity consumption per capita (kWh/year)* (NBR 37120, 2017, p. 16) was 2,588 kWh (EPE, 2021, p. 5). In 2018, the monthly average of electricity consumed per capita in POA was 166.39 kWh/month (ObservaPOA, 2021). Since 2010, when it was 199.47 kWh/month, this indicator has decreased by 16.58% (ObservaPOA, 2021).

In Brazil, the *average number of power outages per consumer per year* (NBR 37120, 2017, p. 17) continued a downward trajectory, being reduced from 6.69 outages in 2019 to an average of 6.03 outages per consumer in 2020, which means an improvement of 9.87% in the period (ANEEL, 2021[32]). Moreover, the *average duration of power outages (in hours)* (NBR 37120, 2017, p. 18) in 2020 was 11.50 hours on average, which represents a reduction of 10.51% compared to 2019, when 12.85 hours were recorded on average. Therefore, the two indicators in 2020 were below the maximum limits set by the National Electric Energy Agency (ANEEL - Agência Nacional de Energia Elétrica). The *average duration of power outages* was below the maximum limit for the first time in the last 10 years. However, it was not possible to identify specific data from RS and POA. These two indicators help to establish reliable parameters for the service and distribution of electricity (NBR 37120, 2017, p. 17).

Thus, regarding the "electrical energy supply", it can be inferred that there is *well-being* (good subjective QoL = 0.774 + good objective QoL). Regarding the difficulties in identifying objective indicators, the following can be pointed out: dispersion of indicators in different sources, unavailability of POA data (only states in Brazil), different measurement units used (year > month), and lack of updated data, especially for the city of POA.

[32] https://www.aneel.gov.br/

Table 43 presents the *energy* indicators proposed in NBR 37120 (2017), and the QoL types.

Table 43 *Energy* indicators proposed by NBR 37120 (2017), and the QoL types

URBAN SERVICES					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Electrical energy supply (6.3)	good	Total residential electricity uses per capita (kWh/year) (7.1)		good	WELL-BEING
		Percentage of city inhabitants with regular electricity supply (7.2)	good		
		Energy consumption of public buildings per year (kWh/m²) (7.3)			
		Percentage of total energy from renewable sources as part of the city's total energy consumption (7.4)	good		
		Total use of electricity per capita (kWh/year) (7.5)			
		Average number of power outages per consumer per year (7.6)	good		
		Average duration of power outages (in hours) (7.7)	good		

Despite the high QoL index regarding electrical energy supply (0.774), from the analysis of residents' comments (**Table 44**), some conditions that negatively impact the perception of *electricity supply* (3 comments) were highlighted, such as possible lack of energy, and, although good, it has a high cost.

Table 44 Residents' comments on *urban services*, organized by building

	6.7 Regarding the previous items (URBAN SERVICES), would you like to leave any comments (optional)?
UTOPIA E LUTA	In summer we are always short of water at low flow and do not go up to the water tanks.
	Lack of encouragement from public authorities for selective waste collection
	That public education establishments really work
SUL AMÉRICA	Energy: I often lack light, and I must go up and down the floors. There is the collection of sewers in the neighbourhoods, thousands were built and made - please put into use. The less we put in Guaíba, the better. Treat before eliminating in Guaíba. Use treatment centre in Riacho Ipiranga itself before Avenida Diário de Notícias.
	Agility in health care.
BENTO GONÇALVES	Very expensive electricity. Health centre has a lot of queues, you need to arrive at dawn. Great: many educational establishments.
	He mentioned Hospital Santa Casa as a good reference for health establishments in the neighbourhood.
	Health service: poor, as they serve people from the other cities of the state (Porto Alegre residents are harmed).
	Electricity supply: good but very expensive. Educational establishments: there is nothing nearby.
	Residents should have better sorting of garbage.
20 DE NOVEMBRO	There is no full-time day care centre, very few half-time places, for children under 4 years old there is no such thing.
	The nearest waste disposal site is 50 meters away.

In the second position, the "water supply", which 71% of respondents classify as excellent/good also stands out for the positive perception of the residents. The NBR 37120 (2017) suggests the use of 4 *water and sanitation* essential indicators, which are discussed below.

The *percentage of the city's population with a drinkable water supply service* (NBR 37120, 2017, p. 67), and the *percentage of the city population with access to improved sanitation* (NBR 37120, 2017, p. 68) are considered satisfactory indicators in POA as this service is provided to 100% of the population (SNIS[33], 2018). Conversely, POA has twelve working public water fountains; however, according to the most recent analysis by the PMPA, in July 2021, none of them have drinking water. Therefore, the *percentage of the city's population with sustainable access to a source of water suitable for consumption* (NBR 37120, 2017, p. 68), which considers as adequate the availability of 20 litres of water per day within a radius of 1 km from the house, is 0% (PMPA, 2021). Regarding the indicator *total domestic water consumption per capita* (litres per day) (NBR 37120, 2017, p. 69), it was not possible to identify specific data from POA.

NBR 37120 (2017) also suggests the use of three *water and sanitation* support indicators, which are discussed below. The *total water consumption per capita (litres per day)* (NBR 37120, 2017, p. 70), in POA, in 2018, was 214.9 litres per inhabitant per day (SNIS, 2018). Among the Brazilian capitals, in 2018, the highest water consumption was in Rio de Janeiro, with 328.20 litres, and the lowest in Manaus, with 78.7 litres (SNIS, 2018). It was not possible to identify specific data from POA regarding the *average annual number of hours of water supply interruption per household* (NBR 37120, 2017, p. 71). However, 1,503 *water supply interruptions* were recorded, lasting 17,304 hours in total (SINS, 2019, p. 162).

The *percentage of unbilled drinkable water losses* (NBR 37120, 2017, p. 71), in POA, in 2018, was 29.51%. In 2019 the water loss rate increased to 32.04% (DMAE[34], 2020, p. 13). Among the Brazilian capitals, in 2018, the highest water loss rate was in Porto Velho, with 77.11%, and the lowest in Campo Grande, with 19.59% (SNIS, 2018). This indicator shows the percentage of water wasted in leaks and illegal connections (NBR 37120, 2017, p. 71).

[33] http://www.snis.gov.br/
[34] https://prefeitura.poa.br/dmae

Thus, it can be inferred that, in terms of the "water supply", that there is *resignation* (good subjective QoL = 0.679 + bad objective QoL). The worst objective conditions are related to the following indicators: *percentage of the city's population with sustainable access to a source of water suitable for consumption* (NBR 37120, 2017, p. 68), *average annual number of hours of water supply interruption per household* (NBR 37120, 2017, p. 71), and *percentage of unbilled potable water losses* (NBR 37120, 2017, p. 71). Probable reasons for resignation may be related to the lack of culture of having access to clean water in public spaces, and the government accepting water loss expenditures. In addition, the occasional lack of water and the inadequate sewage treatment were pointed out in the residents' comments (two comments).

Regarding the difficulties in identifying objective indicators, the following can be pointed out: dispersion of indicators in different sources, and different measurement units used. **Table 45** presents the *water and sanitation* indicators proposed in NBR 37120 (2017), and the QoL types.

Table 45 *Water and sanitation* indicators proposed by NBR 37120 (2017), and the QoL types

URBAN SERVICES					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Water supply (6.2)	good	Percentage of the city's population with drinking water supply service (21.1)	good	bad	RESIGNATION
		Percentage of city population with sustainable access to a source of water suitable for consumption (21.2)	bad		
		Percentage of city population with access to improved sanitation (21.3)	good		
		Total domestic water consumption per capita (litres per day) (21.4)			
		Total water consumption per capita (litres per day) (21.5)			
		Average annual number of hours of interruption of water supply per household (21.6)	bad		
		Percentage of unbilled water losses (21.7)	bad		

In third place, "solid waste collection", which 69% of respondents classify as excellent/good also obtained a positive perception from the residents. NBR 37120 (2017) suggests the use of three essential *solid waste* indicators, which are discussed below. Data are from POA in 2019 (SNIS, 2019).

The *percentage of urban population with regular solid waste collection* (NBR 37120, 2017, p. 45) can be considered a satisfactory indicator in POA as this service is provided to 100% of its population (SNIS, 2019). The *total municipal solid waste collection per capita* (NBR 37120, 2017, p. 46) was 0.98 kilograms per day (357.7 kg/year) (SNIS, 2019). Although

selective collection is also carried out in 100% of households, the *percentage of urban solid waste that is recycled* (NBR 37120, 2017, p. 46) was only 2.05% (7.33 kg/year per capita).

NBR 37120 (2017) suggests the use of seven *solid waste* support indicators, which are discussed below. Data are from POA in 2019 (SNIS, 2019). The *percentage of urban solid waste disposed of in sanitary landfills* (NBR 37120, 2017, p. 48) was 0.93%. The *percentage of municipal solid waste disposed of for incineration* (NBR 37120, 2017, p. 48) was 0.005%, which are healthcare waste disposed of in microwave treatment units. The *generation of hazardous waste per capita* (NBR 37120, 2017, p. 51) was 3.32 kg/year. The *percentage of urban solid waste disposed of by other means* (NBR 37120, 2017, p. 50) was 99%, among them sorting (32%), composting units (34%), and others (33%).

No data was identified regarding the following indicators: *percentage of urban solid waste burned in the open* (NBR 37120, 2017, p. 49); *percentage of urban solid waste disposed of in open dumps* (NBR 37120, 2017, p. 50); and *percentage of hazardous urban waste that is recycled* (NBR 37120, 2017, p. 52).

Thus, regarding the "solid waste collection", it can be inferred that there is *well-being* (good subjective QoL = 0.649 + good objective QoL). Despite this, two residents' comments pointed out the need to improve the selective solid waste collection. Regarding the difficulties in identifying objective indicators, the following can be mentioned: dispersion of indicators in different sources, unavailability of some indicators, and different measurement units used. **Table 46** presents the *solid waste* indicators proposed in NBR 37120 (2017), and the QoL types.

Table 46 *Solid waste* indicators proposed by NBR 37120 (2017), and the QoL types

URBAN SERVICES					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Solid waste collection (6.1)	good	Percentage of urban population with regular solid waste collection (household) (16.1)	good	good	WELL-BEING
		Total municipal solid waste collection per capita (tonnes) (16.2)			
		Percentage of urban solid waste that is recycled (16.3)	bad		
		Percentage of urban solid waste disposed of in landfills (16.4)	good		
		Percentage of municipal solid waste disposed of for incineration (16.5)	good		
		Percentage of urban solid waste burned in the open (16.6)			
		Percentage of urban solid waste disposed of in open dumps (16.7)			
		Percentage of municipal solid waste disposed of by other means (16.8)	good		
		Generation of hazardous waste per capita (tonnes) (16.9)	good		
		Percentage of hazardous urban waste that is recycled (16.10)			

Regarding “health services”, in fourth place, 62% of respondents classify as excellent/good. NBR 37120 (2017) suggests the use of four essential *health* indicators, which are discussed below.

Life expectancy reflects the level of mortality in a population and is related to health conditions (NBR 37120, 2017, p. 34). The global life expectancy was 73.4 years in 2019 (WHO[35], 2019). The *average life expectancy* (NBR 37120, 2017, p. 34) in 2018 in POA was 76.37 (COREDES, 2018). In 2010, in the central area of POA the average life was 80.72 years (IBGE, 2010), when the average life expectancy in POA was 76.42 (IBGE, 2010). As shown in **Figure 52**, life expectancy is lower in peripheral POA neighbourhoods (ObservaPOA, 2010).

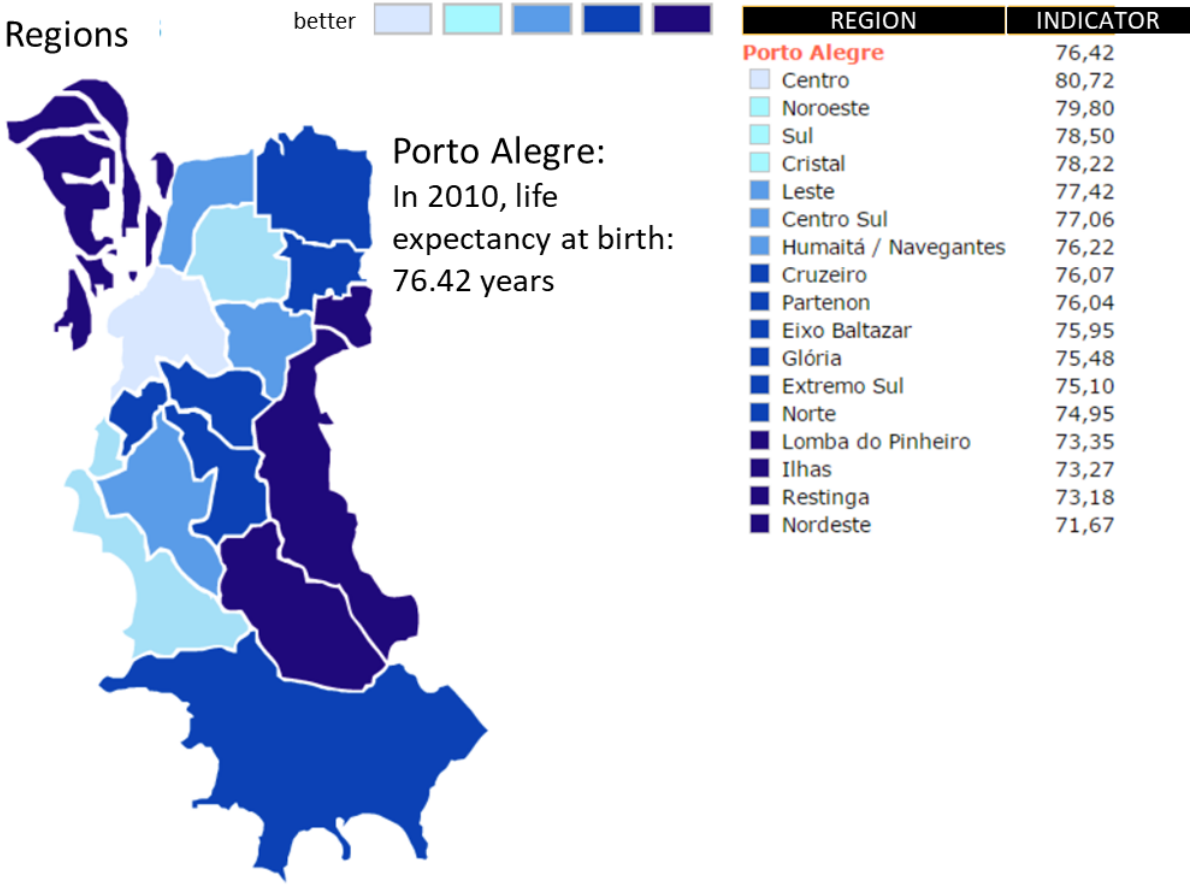

Figure 52 Life expectancy in POA (ObservaPOA, 2010), adapted by the researcher

In September 2021, POA had 8,457 hospital beds. Considering its population estimated by the IBGE (2021) of 1,492,530 inhabitants, the *average number of hospital beds per 100,000 inhabitants* (NBR 37120, 2017, p. 34) was 566.6 hospital beds per 100,000 inhabitants, that

[35] https://www.who.int/

is, 5.66 per 1,000 inhabitants. The number recommended by the Brazilian Ministry of Health is three to four beds per 1,000 inhabitants (Ministério da Saúde, 2001, p. 37). The *number of doctors per 100,000 inhabitants* (NBR 37120, 2017, p. 35) in POA in 2020 was 994 doctors, that is, 9,94 doctors per 1,000 inhabitants, well above the Brazilian average of 2.4 doctors per 1,000 inhabitants (Scheffer, 2020). The *mortality rate of children under five for every 1000 live births* (NBR 37120, 2017, p. 35) in POA went from 11 to 10.1 between 2010 and 2019 (DEE/SPGG, 2020). The Brazilian rate was 12.4 per thousand live births in 2019 (DEE/SPGG, 2020), while the global rate was 28.23 in 2019 (WHO, 2019).

NBR 37120 (2017) suggests the use of three *health* support indicators, which are discussed below. In 2019, more than 700,000 people committed suicide (one in every 100 deaths), and the global rate was 9 per 100,000 inhabitants (WHO, 2021). The lowest suicide rate is in the Eastern Mediterranean region (6.4 per 100,000) (WHO, 2021). The *suicide rate per 100,000 inhabitants* (NBR 37120, 2017, p. 37) in POA in 2017 was 8.1 and, in 2018, it was 7.4, that is, 110 cases of death caused by suicide (Franck et al., 2020), while the Brazilian rate was 6.9 (WHO, 2021). In the state of RS in 2019, there were 7.44 *mental health professionals per 100,000 inhabitants* (NBR 37120, 2017, p. 37), the state with the highest number in Brazil, which has an average of 5.20 (DATASUS[36], 2019). It was not possible to identify specific data from POA regarding the *number of people on nursing and midwifery teams per 100,000 inhabitants* (NBR 37120, 2017, p. 36).

Thus, regarding the "health services", it can be inferred that there is *well-being* (good subjective QoL = 0.631 + good objective QoL). Despite this, the residents' comments pointed to the long time to receive care as an aspect to be improved (four comments). Regarding the difficulties in identifying objective indicators, the following can be pointed out: dispersion of indicators in different sources, unavailability of one indicator, and different measurement units used.

[36] https://datasus.saude.gov.br/

Table 47 presents the *health* indicators proposed in NBR 37120 (2017), and the QoL types.

Table 47 *Health* indicators proposed by NBR 37120 (2017), and the QoL types

URBAN SERVICES					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Health services (6.5)	good	Average life expectancy (12.1)	good	good	WELL-BEING
		Average number of hospital beds per 100,000 inhabitants (12.2)	good		
		Number of doctors per 100,000 inhabitants (12.3)	good		
		Mortality rate of children under the age of five per 1000 live births (12.4)	bad		
		Number of people in the nursing and midwifery team per 100,000 inhabitants (12.5)			
		Number of mental health professionals per 100,000 inhabitants (12.6)	good		
		Suicide rate per 100,000 inhabitants (12.7)	bad		

Regarding “education services”, in fifth place, 55% of respondents classify as excellent/good, 24% regular and 14% bad/very bad (7% not applicable). Education is one of the most important indicators of human development (NBR 37120, 2017, p. 8). NBR 37120 (2017) suggests the use of four essential *education* indicators, which are discussed below.

The *percentage of school-age female population enrolled in schools* (NBR 37120, 2017, p. 8) in POA in 2019 between four and 5 years old was 85.3%, between 6 and 14 years old was 100%, and between 15 and 17 years old was 91.4% (IBGE/PNAD/SIDRA, 2019). This is an indicator of educational opportunity, which aims to promote gender equality (NBR 37120, 2017, p. 8).

The *percentage of students with complete primary education (retention rate)* (NBR 37120, 2017, p. 9) in POA in 2019 was 86.9%, while the *percentage of students with complete secondary education (retention rate)* (NBR 37120, 2017, p. 10) was only 60.3% (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira, 2019). These indicators measure the retention power and efficiency of the educational system. In POA, therefore, data show the urgent need for greater investment in education and measures to encourage the young people to stay at school. Moreover, in Brazil, the need to work (39.1%) and lack of interest (29.2%) were identified as the main reasons for dropping out of school (IBGE/PNAD, 2019). Among women, pregnancy (23.8%) and household chores (11.5%) can be underlined (IBGE/PNAD, 2019). The *student/teacher ratio in primary education* (NBR 37120, 2017, p. 11) was 20 students per teacher (Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira, 2019).

NBR 37120 (2017) suggests the use of three *education* support indicators, which are discussed below. The *percentage of school-age male population enrolled in schools* (NBR

37120, 2017, p. 12) in POA in 2019 between four and five years old was 94.5%, between six and 14 years old was 99.8%, and between 15 and 17 years old was 97% (IBGE/PNAD/SIDRA, 2019). Thus, the *percentage of school-age population enrolled in schools* (NBR 37120, 2017, p. 12) in POA in 2019 between four and five years old was 90.7%, between six and 14 years old was 99.9%, and between 15 and 17 years old was 94.3% (IBGE/PNAD/SIDRA, 2019). The *number of individuals with complete higher education per 100.000 inhabitants* (NBR 37120, 2017, p. 13) in POA in 2010 was 20,128 per 100,000 inhabitants, that is, 20,12% of the population aged 10 and over. Higher education better prepares the individual for work and is widely recognized as the main route to social mobility (NBR 37120, 2017, p. 13).

Thus, regarding the "education services", it can be inferred that there is *deprivation* (bad subjective QoL = 0.571 + bad objective QoL). Some comments from residents highlighted the insufficient number of day-care centres and the deficiency of public education (three comments). In fact, in the state of RS in 2017, there was an estimated unmet potential demand of 19.9% of the population between zero and three years (Fundação Maria Cecilia Souto Vidigal, 2020). Regarding the difficulties in identifying objective indicators, the following can be pointed out: dispersion of indicators in different sources, and different measurement units used. **Table 48** presents the *education* indicators proposed in NBR 37120 (2017), and the QoL types.

Table 48 *Education* indicators proposed by NBR 37120 (2017), and the QoL types

URBAN SERVICES					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Education services (6.6)	bad	Percentage of school-age female population enrolled in schools (6.1)	bad	bad	DEPRIVATION
		Percentage of students with complete primary education: survival rate (6.2)	bad		
		Percentage of students with complete secondary education: survival rate (6.3)	bad		
		Student/teacher relationship in primary education (6.4)	good		
		Percentage of school-age male population enrolled in schools (6.5)	good		
		Percentage of school-age population enrolled in schools (6.6)	bad		
		Number of individuals with complete higher education per 100.00 inhabitants (6.7)	bad		

Finally, with the lowest percentage of satisfaction regarding *urban services*, "internet services" has a 40% excellent/good rating, 36% regular and 19% bad/very bad (5% not applicable). This is an indicator of information access and information technology connectivity (NBR 37120, 2017, p. 53). NBR 37120 (2017) suggests the use of two essential *telecommunication and innovation* indicators (and one support indicator), with only one related to the internet service: *number of internet connections per 100 000 inhabitants* (NBR

37120, 2017, p. 53). In POA in 2019, 96.51% of households had access to internet services (IBGE/PNAD/SIDRA, 2019, Table 7316).

Thus, regarding the "internet services", it can be inferred that there is *dissonance* (bad subjective QoL = 0.524 + good objective QoL). In a study carried out in the central region of POA, in relation to the conformity of the services provided, it was highlighted that the evaluated operators reach an average signal level value within the current legislation defined by the National Telecommunications Agency (*Agência Nacional de Telecomunicações* – ANATEL), and the download rate of 80% of the service contracted by the customer, which is legally accepted, despite not being the nominal value contracted for the service (Barão et al., 2018, p. 132). This seems to be the reason for the identified *dissonance*.

Hence, it is necessary to investing in more technology and increase the mobile broadband signal distribution points, thus guaranteeing the use of 100% of the package contracted by the user and increasing the traffic capacity on the networks to meet the growing demand for multimedia services, such as photos and videos (Barão et al., 2018, p. 132). **Table 49** presents the *telecommunication and innovation* indicator proposed in NBR 37120 (2017), and the QoL types.

Table 49 *Telecommunication and innovation* indicator proposed by NBR 37120 (2017), and the QoL types

URBAN SERVICES				
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)	QOL type
Internet services supply (6.4)	bad	Número de conexões de internet por 100 000 habitantes (17.1)	good	DISSONANCE

Table 50 presents the QoL types regarding the *urban services* dimension, in which the "water supply" and the "internet services" can be highlighted, with *resignation* and *dissonance* QoL types, respectively.

Table 50 QoL types regarding *urban services* dimension

URBAN SERVICES QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
Electrical energy supply (6.3)	0,774	good	good	well-being
Water supply (6.2)	0,679	good	bad	*resignation*
Solid waste collection (6.1)	0,649	good	good	well-being
Health services (6.5)	0,631	good	good	well-being
Education services (6.6)	0,571	bad	bad	deprivation
Internet services supply (6.4)	0,524	bad	good	*dissonance*

In the analysis by building (**Table 51**), the positive perception (excellent/good) regarding *urban services* is higher in buildings renovated through Housing Programmes: Sul América

(73%) and Bento Gonçalves (74%). On the other hand, dwellings that started from occupations had slightly lower percentages: Utopia e Luta (56%) and 20 de Novembro (44%). Regarding the perception of residents in the 20 de Novembro, *education services* (67% bad/very bad) can be highlighted as major aspects of dissatisfaction, especially in relation to the insufficient number of day-care centres, and solid waste collection (67% bad/very bad), as there is no specific place for residents to deposit rubbish close to their building.

Table 51 Results in percentages of the perception of *urban services* in the neighbourhood, organized by building

Residents' Responses		TOTAL (all buildings)			
QoL subjective indicator		E./G.	Regular	B./V.B.	N.A.
URBAN SERVICES	Solid waste collection (6.1)	69%	17%	14%	0%
	Water supply (6.2)	71%	17%	12%	0%
	Electrical energy supply (6.3)	83%	14%	2%	0%
	Internet services supply (6.4)	40%	36%	19%	5%
	Health services (6.5)	62%	19%	19%	0%
	Education services (6.6)	55%	24%	14%	7%
	Total	**63%**	21%	13%	2%
SUL AMÉRICA		E./G.	Regular	B./V.B.	N.A.
URBAN SERVICES	Solid waste collection (6.1)	73%	13%	13%	0%
	Water supply (6.2)	80%	20%	0%	0%
	Electrical energy supply (6.3)	87%	13%	0%	0%
	Internet services supply (6.4)	53%	40%	7%	0%
	Health services (6.5)	73%	7%	20%	0%
	Education services (6.6)	73%	27%	0%	0%
	Total	**73%**	20%	7%	0%
UTOPIA E LUTA		E./G.	Regular	B./V.B.	N.A.
URBAN SERVICES	Solid waste collection (6.1)	71%	29%	0%	0%
	Water supply (6.2)	43%	21%	36%	0%
	Electrical energy supply (6.3)	86%	14%	0%	0%
	Internet services supply (6.4)	21%	36%	43%	0%
	Health services (6.5)	57%	36%	7%	0%
	Education services (6.6)	57%	36%	7%	0%
	Total	**56%**	29%	15%	0%
BENTO GONÇALVES		E./G.	Regular	B./V.B.	N.A.
URBAN SERVICES	Solid waste collection (6.1)	86%	14%	0%	0%
	Water supply (6.2)	100%	0%	0%	0%
	Electrical energy supply (6.3)	86%	0%	14%	0%
	Internet services supply (6.4)	71%	14%	0%	14%
	Health services (6.5)	57%	0%	43%	0%
	Education services (6.6)	43%	14%	14%	29%
	Total	**74%**	7%	12%	7%
20 DE NOVEMBRO		E./G.	Regular	B./V.B.	N.A.
URBAN SERVICES	Solid waste collection (6.1)	33%	0%	**67%**	0%
	Water supply (6.2)	83%	17%	0%	0%
	Electrical energy supply (6.3)	67%	33%	0%	0%
	Internet services supply (6.4)	17%	**50%**	17%	17%
	Health services (6.5)	50%	33%	17%	0%
	Education services (6.6)	17%	0%	67%	17%
	Total	**44%**	22%	28%	6%

The closest automated collection site (organic solid waste container) is located 60 meters away from 20 de Novembro, on Rua Dr. Barros Cassal Street. However, access is difficult because it is necessary to cross Avenida Farrapos. The other option is in Avenida Alberto Bins, 120 meters away, as shown in **Figure 53** and **Figure 54**. In relation to the other three buildings, located in the Historic Centre, this distance varies between 40 and 55 meters, without the need to cross the street.

Figure 53 Solid waste collection sites near 20 de Novembro

Figure 54 Solid waste collection sites nearby 20 de Novembro, in Avenida Alberto Bins and in Rua Dr. Barros Cassal

5.3.1.2 The Economy

The *economy* dimension was classified in fifth place in the ranking of relevance for the QoL, with 24% of respondents indicating it. Regarding the perception of residents about the neighbourhood, 58% showed a positive perception, 19% regular and 18% negative in relation to the *economy* (**Figure 55**). Thus, this dimension of QoL was placed second (out of seven) on the satisfaction scale in the residents' perception. Some common expressions in the content analysis are *close to everything*, *practicality*, *ease*, *commerce*, *supermarket*, *work*, *pharmacies*, *banks*, *shops*, and *diversity*, as well as the financial and time savings with displacements (which can often be done on foot). No negative terms were associated with the *economy*.

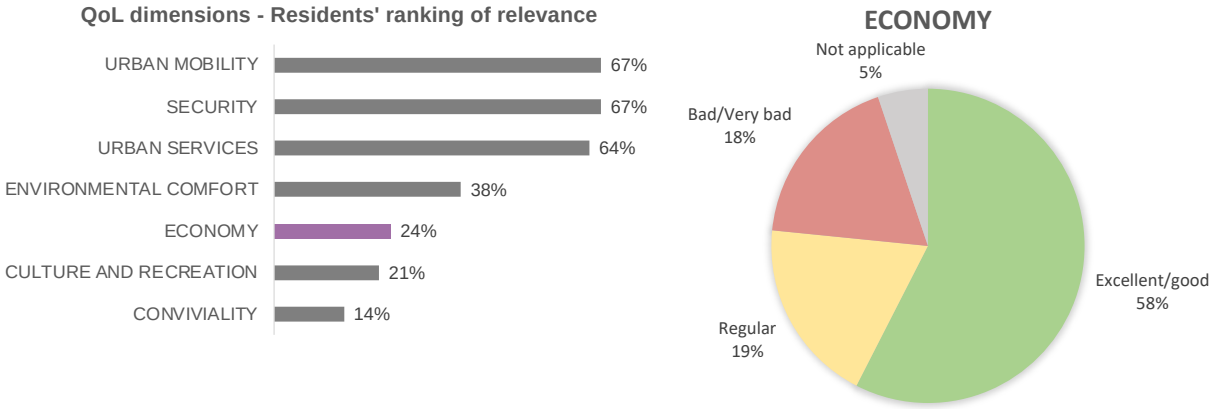

Figure 55 Residents' ranking of relevance for the QoL dimensions and the *economy* satisfaction graph

NBR 37120 (2017, p. 4-8) suggests the use of four essential *economy* indicators and three support indicators, which are discussed below and linked to the perception of the residents. Also, the *employment/housing ratio* (total number of jobs divided by the total number of housing units) (NBR 37120, 2017, p. 62), which is presented by NBR 37120 (2017) as an *urban planning* support indicator, is considered in this research as an indicator linked to the *economy* dimension.

As presented in **Table 52**, the great satisfaction related to the "diversity of commercial establishments", which 100% of respondents classify as excellent/good, is underlined. Despite this, three comments pointed to the lack of diversity of supermarket chains (**Table 53**). In second place, the "access to credit (payment conditions provided in commercial establishments)", which 69% of respondents classify as excellent/good, also stands out for the

positive perception of the residents. Regarding the "existence of professional courses (computer, craft, hairdressing, etc.)", in third place, 62% of respondents classify as excellent/good. These three subjective indicators can be linked to the following NBR 37120 (2017) indicators.

Table 52 Results of the perception of *economy* in the neighbourhood

ECONOMY			QUESTIONNAIRE SCALE						ACCUMULATED SCALE		
QoL subjective indicator			Excellent	Good	Regular	Bad	Very bad	N. A.	E./G.	Regular	B./V.B.
1	Diversity of commercial establishments (8.5)	0,935	74%	26%	0%	0%	0%	0%	100%	0%	0%
2	Access to credit (payment conditions facilitated in commercial establishments) (8.4)	0,625	19%	50%	12%	0%	12%	7%	69%	12%	12%
3	Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	0,601	17%	45%	17%	5%	10%	7%	62%	17%	14%
4	Existence of activities related to tourism (8.6)	0,536	17%	26%	26%	17%	10%	5%	43%	26%	26%
5	Job opportunities (8.1)	0,512	10%	38%	21%	10%	10%	12%	48%	21%	19%
6	Cost of living (8.2)	0,429	2%	21%	38%	21%	17%	0%	24%	38%	38%
ECONOMY INDEX		0,667						TOTAL	58%	19%	18%

Table 53 Residents' comments on *economy*, organized by building

	8.7 Regarding the previous items (ECONOMY), would you like to leave any comments (optional)?
UTOPIA E LUTA	We are obligated to buy from a single, expensive supermarket chain.
	High cost of living compared to the profile of many residents.
SUL AMÉRICA	Museum activities: it was a good incentive, but little security for those who participated. Food is expensive X the quality offered.
	Less requirement of people with experience for the work provide opportunities for learning in the work sector.
BENTO GONÇALVES	He says that the cost of housing is low (practically just the condominium), but he complains about the lack of variety in supermarkets (expensive and small).
	Courses: yes, but they are very expensive. Almost no tourism activities.
	We should have more supermarket options.
20 DE NOVEMBRO	He complained that people from other countries have more rights than they do (immigrants)
	Vocational courses are not offered for young people, job options so that young people can study as well.

The *appraisal value of commercial and industrial properties as a percentage of the total appraisal value of all properties* (NBR 37120, 2017, p. 5) provides an understanding of the

composition of assessed property values, whose downward trend may indicate an erosion of the economic base (NBR 37120, 2017, p. 5). Although it was not possible to identify specific data from POA regarding this indicator, **Figure 56** and **Figure 57** present the land use map of the surroundings of the buildings considered in this research in the Historic Centre and in the Floresta district, respectively. The existence of many commercial (in red) and mixed-use establishments, that is, commercial ground floor and the other floors for residential use (in orange), can be highlighted.

Figure 56 Land use map of the surroundings of the buildings considered in this research in the Historic Centre

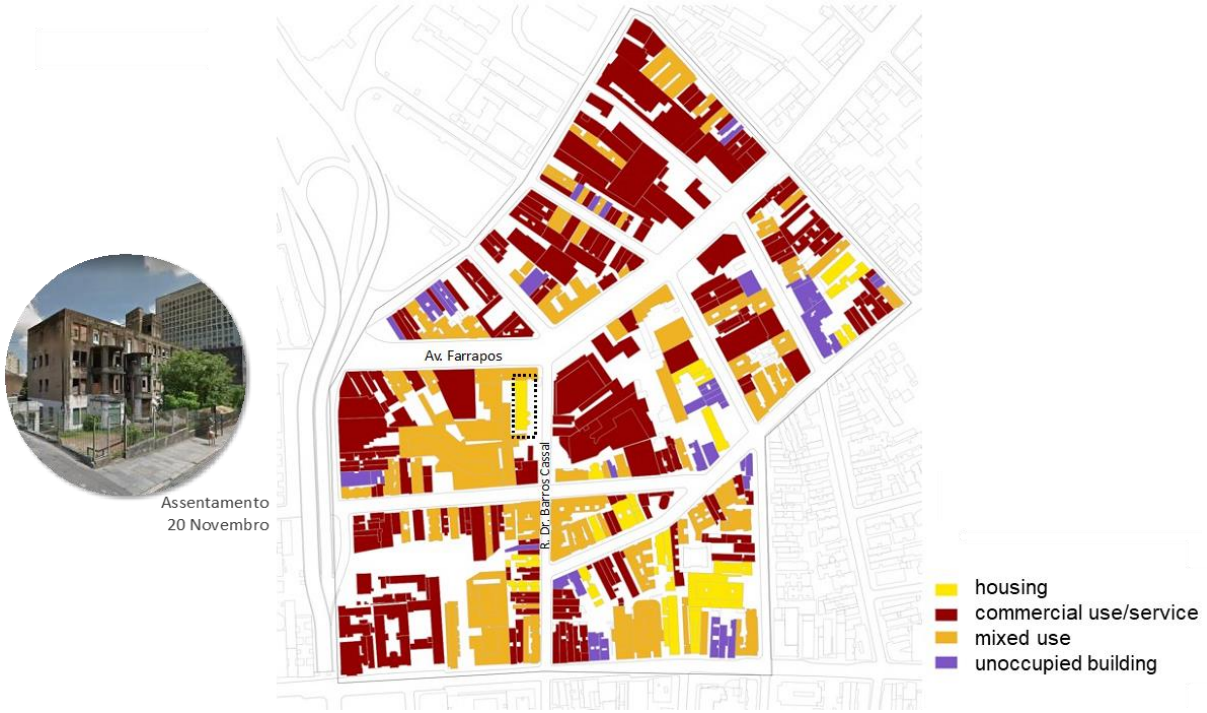

Figure 57 Land use map of the surroundings of 20 de Novembro, in the Floresta district

In POA in 2019, the *number of companies per 100,000 inhabitants* (NBR 37120, 2017, p. 7) was 5,793 companies per 100,000 inhabitants, that is, 85,956 companies in total (IBGE, 2019). Moreover, in 2019 in Brazil, the *number of new patents per 100,000 inhabitants (per year)* (NBR 37120, 2017, p. 8) was 28318 (INPI[37], 2020), that is, 13.47 new patent applications per 100,000 inhabitants. It was not possible to identify specific data from POA. These are two *economy* support indicators suggest by NBR 37120 (2017). They can indicate the level of economic activity of a city (NBR 37120, 2017, p. 7).

Thus, as shown in **Table 54**, regarding these three *economy* indicators ("diversity of commercial establishments", "access to credit", and "existence of professional courses") it can be inferred that there is *well-being* (good subjective QoL + good objective QoL).

[37] https://www.gov.br/inpi/pt-br

Table 54 *Economy* indicators proposed by NBR 37120 (2017), and the QoL types (*well-being*)

ECONOMY					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Diversity of commercial establishments (8.5)	good	Appraisal value of commercial and industrial properties as a percentage of the total appraisal value of all properties (5.2)		good	WELL-BEING
Access to credit (payment conditions facilitated in commercial establishments) (8.4)	good	Number of companies per 100,000 inhabitants (5.6)	good		
Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	good	Number of new patents per 100,000 inhabit. per year (5.7)	good		

In fourth place, the "existence of activities related to tourism" is rated 43% excellent/good, 26% regular and 26% bad/very bad (5% not applicable). NBR 37120 (2017) presents no indicator on tourism, which can be seen as a gap in the assessment of economic activities and, ultimately, of the quality of life. The number of people attended at the Tourist Information Centres has been decreasing in POA: 55,130 people were served in 2017, 31,866 in 2018 and 24,839 in 2019, representing a negative variation of 22.05% between 2018 and 2019 (BEMTUR, 2019).

In 2019, 87% of visitors were Brazilian and 13% foreign (BEMTUR, 2019). The average occupancy of hotels was 57.28% in 2019 and 51.49% in 2018 (positive variation of 5.79%) (BEMTUR, 2019). Some events stimulated daily peaks of occupancy above 95%, such as Copa América football games, Expointer and the Iron Maiden concert (BEMTUR/PMPA, 2019). The City Tour tourism bus line transported 46,027 passengers in 2019, showing a slight negative variation when compared to 2018, when it transported 46,049 passengers (BEMTUR, 2019). As shown in **Figure 58**, the Historic Centre has 47 accommodation locations (PMPA/SMURB, 2014).

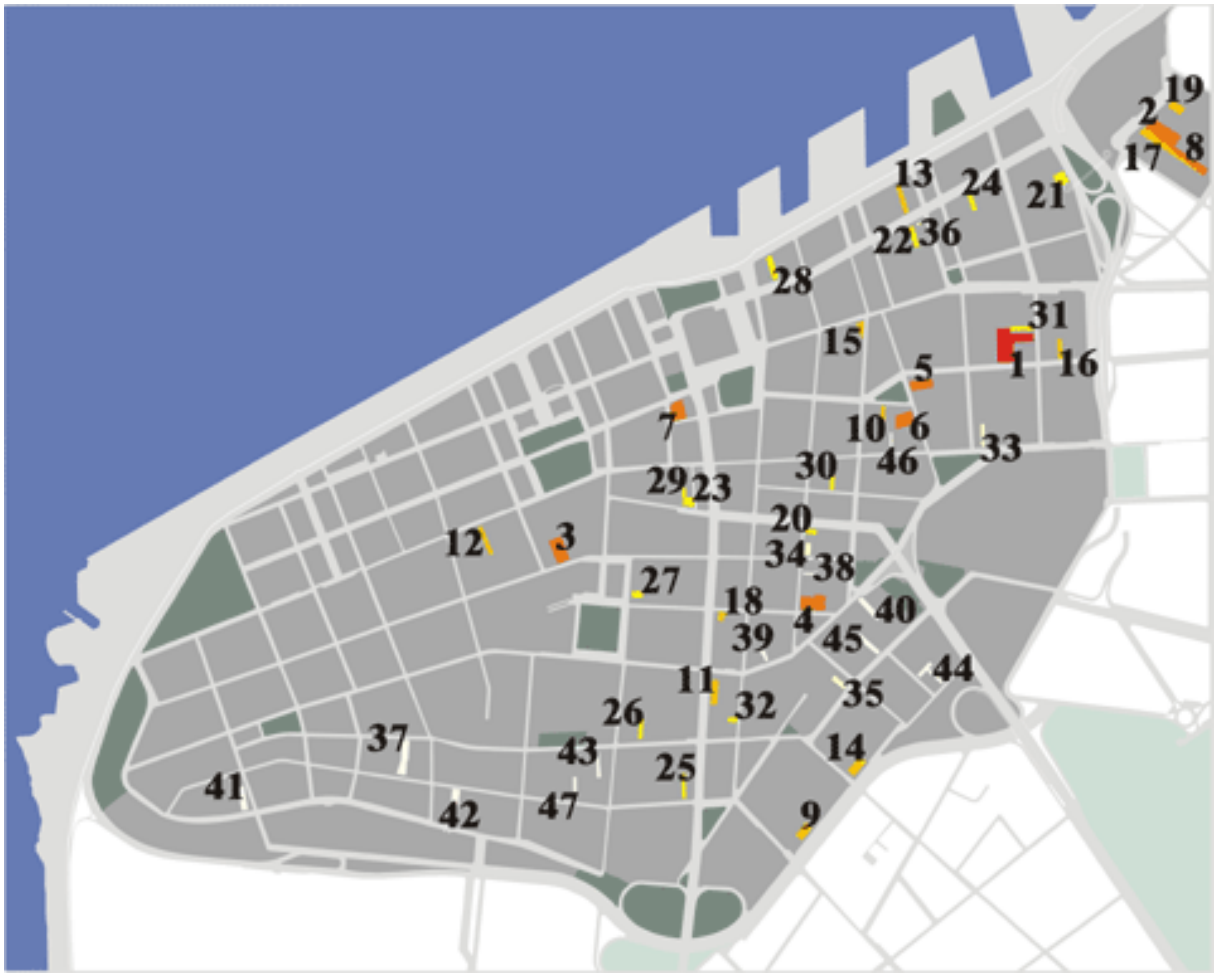

Figure 58 Historic Centre and its 47 accommodation locations (PMPA/SMURB, 2014)

In fifth place, "job opportunities" is rated 48% excellent/good, 21% regular and 19% bad/very bad (12% not applicable). In fact, some comments made by the interviewees highlighted the insufficient number of job opportunities for young people and people with less experience in the labour market (two comments). The *unemployment rate* is one of the essential *economy* indicators proposed by NBR 37120 (2017, p. 4). Low rates tend to be related to economic growth (NBR 37120, 2017, p. 4). The unemployment rate (and underutilization of the workforce) considered by the IBGE includes the unemployed population that has been looking for a job in the last 30 days. This is the same criterion proposed by NBR 37120 (2017).

In the first quarter of 2020, the unemployment rate was 10% of the POA population (most recent data), representing 8.7% of men and 11.4% of women in the municipality (IBGE, 2020). Thus, POA has one of its highest unemployment rates since 2012, being lower only than the third quarter of 2018, when it was 10.2% of the population. Despite being high, it is still lower than the Brazilian rate in the same period of 12.2% (IBGE, 2020). Due to the

current economic crisis in Brazil, which has been exacerbated by the Covid-19 pandemic, it already increased to 14.7% in the first quarter of 2021 (IBGE, 2021), the highest in the historical series of the survey, initiated in 2012. "Although there is no formula for calculating a NAIRU level, the Federal Reserve has historically used statistical models and estimates that the NAIRU level is somewhere between 5% to 6% unemployment"[38].

In the first quarter of 2020, the *percentage of population with full-time employment* (NBR 37120, 2017, p. 6) in POA was 65.9%, considering people who worked at least 40 hours a week (IBGE, 2020). In the first quarter of 2020, the *employment rate of young people* (NBR 37120, 2017, p.7) in POA was 79.8%, considering people between 14 and 24 years old (IBGE, 2020).

The number of jobs in July 2021 in POA was 547,281, with a positive variation of 1.86% compared to 537,251 registered in 2020 (CAGED[39], 2021). The most recent POA data regarding the number of permanent private households are from 2010, when the city had 508,456 (IBGE, 2010). Thus, one can estimate 1.07 jobs per household as the *employment/housing ratio* (NBR 37120, 2017, p. 62). NBR 37120 (2017) consider it as an *urban planning* support indicator (NBR 37120, 2017, p. 62), although it can measure the impact of economic growth on city planning, aiming at maximizing the use of existing infrastructure and the diversity of land use (NBR 37120, 2017, p. 62).

Finally, with the lowest percentage of satisfaction regarding *economy*, "cost of living" is rated 24% excellent/good, 38% regular and 38% bad/very bad. Cost of living of a population can be measured through calculations based on the prices of a set of products and services consumed by people (IBGE, 2021). Thus, the National Consumer Price Index (INPC - *Índice Nacional de Preços ao Consumidor*) aims to identify the monthly change in the purchasing power of wages, by measuring the changes in the prices of the items of consumption of the population with incomes between one and five minimum wages, including prices for food, housing, clothing, transport, education, etc. (IBGE, 2021). The twelve-month accumulated general INPC in Brazil in August 2021 showed an increase of 10.42%, while POA was above the national increase, at 11.34% (IBGE/SIDRA/Table 7063, 2021). The items with the greatest increase were transport (18.20%), food (16.34%), and housing (14.16%) (IBGE/SIDRA/Table 7063, 2021). According to the Expatistan cost of living ranking (2021), POA is the city in

[38] https://www.investopedia.com/terms/n/non-accelerating-rate-unemployment.asp

[39] http://pdet.mte.gov.br/caged

Brazil with the eighth highest and the state capital with the fifth highest cost of living, behind only São Paulo, Rio de Janeiro, Brasília, Florianópolis, and Curitiba.

The Gini index, which measures per capita household income, decreased from 0.545 in 2018 to 0.543 in 2019 (the closer to 1, the greater the income inequality). However, Brazil is the ninth most unequal country in the world, according to the World Bank (IBGE, 2020). The *percentage of the population below the poverty line*, an essential *economy* indicator presented in NBR 37120 (2017, p. 5), is also an indicator of social equity. It considers the number of people below the poverty line divided by the total population (multiplied by 100 and expressed as a percentage), that is, people unable to adequately provide for themselves with water, food, shelter, and other basic needs for healthy living over a twelve-month period.

In 2019 6.5% of the population of Brazil (13,689 million people) had a monthly per capita income of less than BR 151 (USD 1.90 per day), a criterion adopted by the World Bank to identify the condition of extreme poverty (IBGE/SIDRA/Table 6682, 2019). Although the percentage was stable compared to 2018, it rose from 5.8% in 2012 to 6.5% in 2018, a record in seven years (IBGE, 2019). In 2018 in POA, the percentage of the population living on less than USD 1.9 per day was 1.4% (approximately 20 thousand people), lower than in 2017, when it was 2.4% (approximately 20,500 people) (IBGE, 2018). Therefore, POA is the Brazilian capital that has the best rate, while Maceió (Alagoas State) had the worst rate, with 8% of the population below the poverty line (IBGE, 2018).

Currently, during the COVID-19 pandemic, the number of citizens living below the poverty line has reached around 27 million people, 12.8% of the Brazilian population. The survey carried out by the Getúlio Vargas Foundation (FGV, 2021) also points out that many families try to survive on an amount of BRL 246.00[40] per month.

[40] USD 44.48, considering the value of the US dollar as of 18 November, 2001 (USD 1.00 = BRL 5.53)

Thus, as shown in **Table 55**, regarding these three *economy* indicators ("existence of activities related to tourism", "job opportunities", and "cost of living") it can be inferred that there is *deprivation* (bad subjective + bad objective QoL).

Table 55 The *economy* indicators proposed by NBR 37120 (2017), and the QoL types (*deprivation*)

ECONOMY					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Existence of activities related to tourism (8.6)	bad		bad	bad	DEPRIVATION
Job opportunities (8.1)	bad	City unemployment rate (5.1)	bad	bad	DEPRIVATION
		Percentage of population with full-time employment (5.4)	bad		
		Youth employment rate (5.5)	bad		
		Employment/housing ratio (19.4)	bad		
Cost of living (8.2)	bad	Percentage of population below the poverty line (5.3)	good	bad	DEPRIVATION
			bad		

Table 56 presents the QoL types regarding the *economy* dimension, in which no dissonances or resignations were identified.

Table 56 QoL types regarding the *economy* dimension

ECONOMY QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
Diversity of commercial establishments (8.5)	0,935	good	good	well-being
Access to credit (payment conditions facilitated in commercial establishments) (8.4)	0,625	good	good	well-being
Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	0,601	good	good	well-being
Existence of activities related to tourism (8.6)	0,536	bad	bad	deprivation
Job opportunities (8.1)	0,512	bad	bad	deprivation
Cost of living (8.2)	0,429	bad	bad	deprivation

In the analysis by building (**Table 57**), the positive perception (excellent/good) regarding the *economy* is similar between Sul América (62%), Bento Gonçalves (60%), and Utopia and Luta (65%). However, the residents of 20 de Novembro presented a negative perception in 58% of the answers (bad/very bad), probably due to the lower purchasing power of its residents and inappropriate housing conditions (building undergoing renovation): the cost of living (100% bad/very bad) and the insufficient existence of tourism-related activities (83% bad/very bad) are major areas of dissatisfaction.

Table 57 Results in percentages of the perception of *economy* in the neighbourhood, organized by building

Residents' Responses		TOTAL (all buildings)			
QoL subjective indicator		E./G.	Regular	B./V.B.	N.A.
ECONOMY	Job opportunities (8.1)	48%	21%	19%	12%
	Cost of living (8.2)	24%	38%	38%	0%
	Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	62%	17%	14%	7%
	Access to credit (payment conditions facilitated in commercial establishments) (8.4)	69%	12%	12%	7%
	Diversity of commercial establishments (8.5)	100%	0%	0%	0%
	Existence of activities related to tourism (8.6)	43%	26%	26%	5%
	Total	**58%**	19%	18%	5%
SUL AMÉRICA		E./G.	Regular	B./V.B.	N.A.
ECONOMY	Job opportunities (8.1)	53%	27%	7%	13%
	Cost of living (8.2)	27%	47%	27%	0%
	Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	73%	20%	0%	7%
	Access to credit (payment conditions facilitated in commercial establishments) (8.4)	80%	13%	0%	7%
	Diversity of commercial establishments (8.5)	100%	0%	0%	0%
	Existence of activities related to tourism (8.6)	40%	33%	13%	13%
	Total	**62%**	23%	8%	7%
UTOPIA E LUTA		E./G.	Regular	B./V.B.	N.A.
ECONOMY	Job opportunities (8.1)	71%	7%	14%	7%
	Cost of living (8.2)	21%	**50%**	29%	0%
	Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	57%	29%	7%	7%
	Access to credit (payment conditions facilitated in commercial establishments) (8.4)	71%	14%	14%	0%
	Diversity of commercial establishments (8.5)	100%	0%	0%	0%
	Existence of activities related to tourism (8.6)	71%	21%	7%	0%
	Total	**65%**	20%	12%	2%
BENTO GONÇALVES		E./G.	Regular	B./V.B.	N.A.
ECONOMY	Job opportunities (8.1)	29%	29%	29%	14%
	Cost of living (8.2)	43%	29%	29%	0%
	Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	71%	0%	14%	14%
	Access to credit (payment conditions facilitated in commercial establishments) (8.4)	86%	0%	0%	14%
	Diversity of commercial establishments (8.5)	100%	0%	0%	0%
	Existence of activities related to tourism (8.6)	29%	29%	43%	0%
	Total	**60%**	14%	19%	7%
20 DE NOVEMBRO		E./G.	Regular	B./V.B.	N.A.
ECONOMY	Job opportunities (8.1)	0%	33%	**50%**	17%
	Cost of living (8.2)	0%	0%	**100%**	0%
	Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	33%	0%	**67%**	0%
	Access to credit (payment conditions facilitated in commercial establishments) (8.4)	17%	17%	**50%**	17%
	Diversity of commercial establishments (8.5)	100%	0%	0%	0%
	Existence of activities related to tourism (8.6)	0%	17%	**83%**	0%
	Total	25%	11%	**58%**	6%

5.3.1.3 Culture and recreation

The *Culture and recreation* dimension was classified in sixth place in the ranking of relevance for the QoL, with 21% of respondents indicating it. Regarding the perception of

residents about the neighbourhood, 49% showed a positive perception, 25% regular and 22% negative in relation to *culture and recreation* (**Figure 59**). Thus, this dimension of QoL was in third place out of seven on the satisfaction scale. The satisfaction with *culture and recreation* can be found in frequent expressions in the content analysis such as *close to everything*, *ease of access*, *city*, *diversity*, and *green areas* (parks, Parque Farroupilha and Parque Orla Moacyr Scliar). No negative terms were associated with *culture and recreation*.

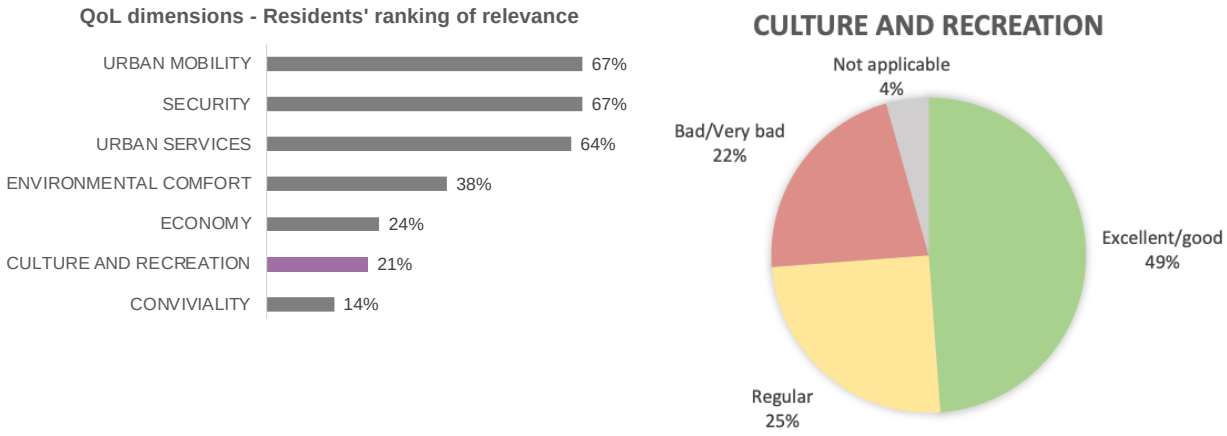

Figure 59 Residents' ranking of relevance for the QoL dimensions and the *culture and recreation* satisfaction graph

NBR 37120 (2017, p. 38-39) presents two *recreation* support indicators (the *area of public indoor* and *outdoor recreation spaces per capita*), however, it does not present *culture* indicators, which can be considered a major limitation of the standard for QoL assessment. Also, the *green areas (hectares) per 100,000 inhabitants* (NBR 37120, 2017, p. 60), which is presented by NBR 37120 (2017) as an essential *urban planning* indicator, is considered in this study as an indicator linked to the *culture and recreation* dimension.

As presented in **Table 58**, the great satisfaction related to the "existence of places for cultural activities (artistic events, museums, theatres, cinemas)", which 81% of respondents classify as excellent/good, is highlighted. In fact, of the 388 cultural spaces POA had in 2012, 297 were in its central region (ObservaPOA, 2012). The Historic Centre stands out with the presence of eleven libraries, six cinemas, five cultural centres, 16 museums and nine theatres (PMPA/SMAMUS[41], 2014). In total, the Historic Centre and the Floresta district have 76 and eight cultural spaces, respectively (ObservaPOA, 2014). However, the "opportunities to participate in free cultural and artistic events", in fourth place, had only 38% of excellent/good responses.

[41] https://prefeitura.poa.br/smamus

Table 58 Results of the perception of *culture and recreation* in the neighbourhood

CULTURE AND RECREATION			QUESTIONNAIRE SCALE						ACCUMULATED SCALE		
QoL subjective indicator			Excellent	Good	Regular	Bad	Very bad	N. A.	E./G.	Regular	B./V.B.
1	Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	0,708	21%	60%	7%	5%	5%	2%	81%	7%	10%
2	Number of urban green areas (parks) (4.1)	0,649	12%	55%	19%	10%	2%	2%	67%	19%	12%
3	Existence of places for the practice of outdoor sports (4.3)	0,589	12%	45%	24%	5%	7%	7%	57%	24%	12%
4	Opportunities to participate in free cultural and artistic events (4.5)	0,506	10%	29%	36%	7%	12%	7%	38%	36%	19%
5	Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	0,435	2%	26%	26%	33%	10%	2%	29%	26%	43%
6	Quality and maintenance of urban green areas (4.2)	0,417	2%	19%	38%	24%	12%	5%	21%	38%	36%
CULTURE AND RECREATION INDEX		0,625						TOTAL	49%	25%	22%

There seems to be a *dissonance*, as the central region of POA offers several free cultural options, such as visits to museums and cultural centres, street theatre festivals, musical shows at Parque Farroupilha and Parque Orla Moacyr Scliar, musical performances from the Porto Alegre Symphony Orchestra, guided walks (*Caminhos da Matriz* and Free Walk POA) in addition to several street market options. This perception of residents seems to indicate the need for greater publicity of these places and events to the community, which could be carried out by the city council.

Regarding the "number of urban green areas (parks)", in second place, 69% of respondents classify as excellent/good, 19% regular, and 12% bad/very bad (2% not applicable). In fact, POA has 697 green areas, with a total area of 21,537,572 m² (SMAMUS, 2021), that is, 14.47 m² per inhabitant (IBGE, 2020). The World Health Organization (WHO) recommends 12 m² of green area per inhabitant. The *green areas (hectares) per 100,000 inhabitants*, an essential *urban planning* indicator suggested by NBR 37120 (2017, p.60), was 144.7 hectares per 100,000 inhabitants in POA in 2020. The Historic Centre and the Floresta district have 24 and five urbanized green areas, respectively (SMAMUS, 2021).

The radius of influence is 2,400 m for parks, and 600 m for neighbourhood parks (Pitts, 2004). Considering these distances, **Figure 60** shows the areas of influence of green areas in the central region of POA. All buildings are within the area of influence of Parque Farroupilha, one of the largest parks in the city. The buildings located in the Historic Centre are better served, being in the influence area of the Orla Moacyr Scliar Park. Also, Utopia e Luta is within the influence of Praça dos Açorianos, Praça Marechal Deodoro, Praça da Alfândega, and Praça Conde de Porto Alegre. Sul América and Bento Gonçalves are within the influence of Praça Marechal Deodoro, Praça da Alfândega and Praça Conde de Porto

Alegre. The 20 de Novembro, however, has a greater lack of green areas, being only within the area of influence of Praça Dom Sebastião and Parque Farroupilha.

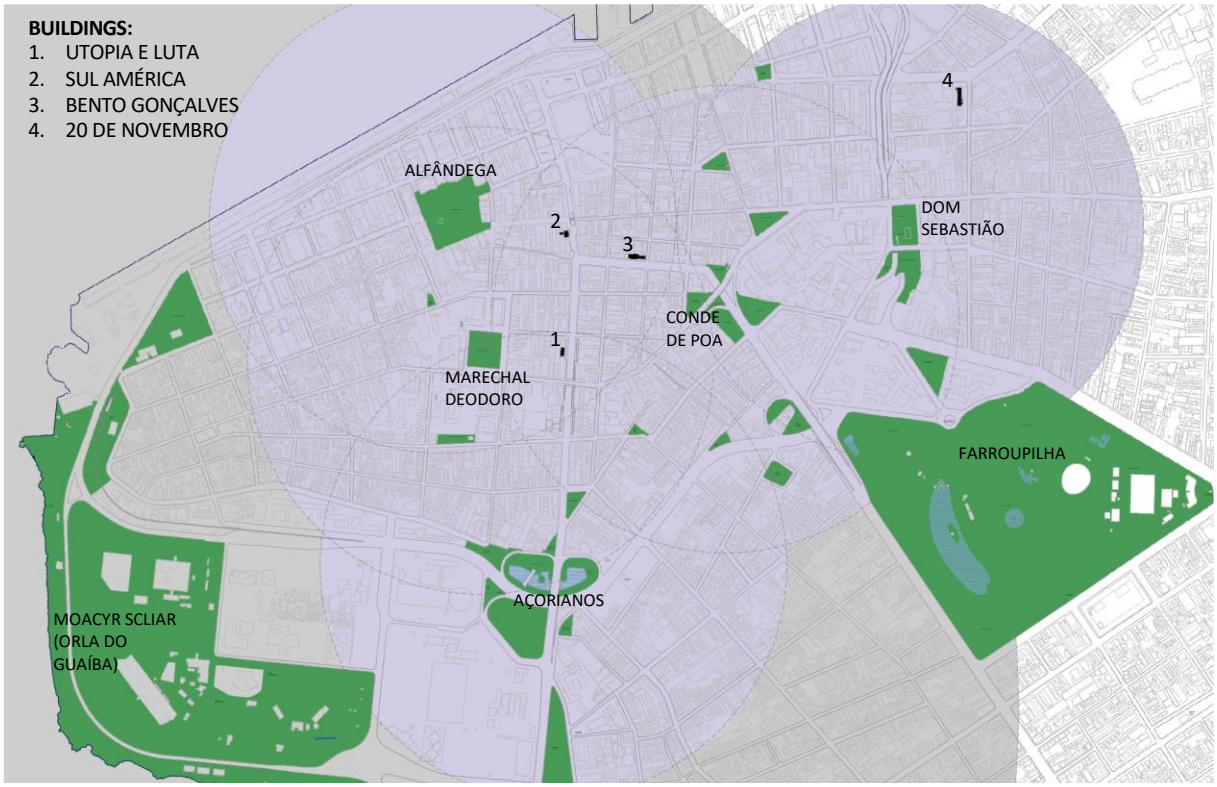

Figure 60 Area of influence of green areas in the central region of POA

However, with the lowest percentage of satisfaction regarding *culture and recreation*, the "quality and maintenance of urban green areas" is rated 21% excellent/good, 38% fair and 36% bad/very bad (5% not applicable). POA has 684 green areas and, since November 2019, the maintenance and cleaning teams have been expanded from 10 to 24, reducing the period between maintenance from 100 days to 45 days. The DMLU, currently under the coordination of the Municipal Department of Urban Services (Secretaria Municipal de Serviços Urbanos/SMSUrb[42], has been responsible for maintaining the squares since 2016.

In 2019, PMPA announced the revitalization of more than 600 green areas in the city, in an investment that would reach BRL 24 million[43]. In the first five months of 2021, 38 squares were renovated, four of them within the area of influence of the buildings analyzed (Dom Sebastião, Daltro Filho, General Braga Pinheiro, Nelson Sangoy) (PMPA, 2021). Improvements included renovation to playgrounds, outdoor gym equipment, benches, game

[42] https://prefeitura.poa.br/smsurb
[43] USD 4,339,963 (on 18 November, 2021).

tables, fences, and pavements. The renovation is carried out by the city council's own teams and by contracted companies (PMPA, 2021). Hence, there seems to be a *dissonance*. This perception of residents may be linked to the fact that the renovation of the POA green areas is still a recent project.

The "existence of places for the practice of outdoor sports", in third place, presents a positive perception by 57% of the respondents, 24% regular and 36% bad/very bad (2% not applicable). NBR 37120 (2017) suggests two *recreation* support indicators: the *area, in square meters, of public indoor recreation spaces per capita* (NBR 37120, 2017, p. 38), and the *area, in square meters, of public outdoor recreation spaces per capita* (NBR 37120, 2017, p. 39). There is no data available for the city of POA.

The radius of influence is 2,000 m for sports centres (Pitts, 2004). There are no public indoor recreation spaces in the neighbourhoods in question. However, there are three public sports courts in the Historic Centre (at Praça Brigadeiro Sampaio and Praça General Osório) and a football pitch (at Praça Júlio Mesquita Park), between 1.3 and 1.6 km away from the three buildings in the neighbourhood studied. There are only two public sports courts in the Floresta district, located at Praça Florida and at Praça Dante Santoro, 1 and 1.4 km away from the 20 de Novembro Squat, respectively. Public spaces located in neighbouring districts, such as Parque Orla Moacyr Scliar (Praia de Belas district) and Parque Farroupilha (Farroupilha district), can also be used for sports. **Figure 61** shows the location map of these areas for sports and the distances to the analysed buildings.

Figure 61 Sports areas in the Historic Centre

Finally, in fifth place, the "conservation of cultural heritage (buildings, houses, and public spaces)", is rated by 29% as excellent/good, 26% fair, and 43% bad/very bad (2% not applicable). The Historic Centre of POA has about 52 listed monuments and public spaces (PMPA/SMSUrb, 2014), listed at the municipal level (SMC - *Secretaria Municipal da Cultura* - Municipal Department for Culture), at the state level (IPHAE - *Instituto do Patrimônio Histórico e Artístico do Estado* - State Historical and Artistic Heritage Institute), and eight of them (highlighted in yellow in **Figure 62**) are listed nationally by the National Historical and Artistic Heritage Institute (IPHAN - *Instituto do Patrimônio Histórico e Artístico Nacional*): Central Portico and Warehouses A and B from the Porto Pier (10); the Faculty of Law at UFRGS (26); Nossa Senhora das Dores Church (29); the Former Post and Telegraph building (Memorial of Rio Grande do Sul) (31); the UFRGS Astronomical Observatory (36); Solar dos Câmara (50); the Historic Site of Praça da Matriz; and the Historic Site of Praça da Alfândega (IPHAN, 2021). The Floresta district does not have any nationally listed properties, only one listed at the state level (IPHAE), the Vice-Governor's Palace (Rua Cristóvão Colombo, 300) and nine listed at the municipal level (PMPA/SMAMUS, 2014).

Figure 62 Cultural heritage in the Historic Centre of POA

Currently, 88 properties are in the process of restoration in Brazil, with an investment of more than BRL 386 million[44] through IPHAN: eight in RS and only one in POA – the restoration of the roof and general air conditioning of the Museum of Art of Rio Grande do Sul (MARGS) (IPHAN, 2020). It was not possible to identify indicators on the amount of historical heritage restored in POA over the years, showing a lack of control over this process. In fact, residents' comments about *culture and recreation* in the neighbourhood emphasize the perception of the need for more actions for the conservation of historic buildings in the central area of POA (three comments) and the demand for free cultural events (three comments) (**Table 59**).

Table 59 Residents' comments on *culture and recreation*, organized by building

	4.7 Regarding the previous items (CULTURE and RECREATION), would you like to leave any comments (optional)?
UTOPIA E LUTA	That they saw the culture with the respect it deserves.
	We have more access to information on free activity than we had in more distant neighbourhoods we didn't have.
	Apart from the fact that cultural equipment is mostly scrapped by public administration.
	More free events.
SUL AMÉRICA	Idle buildings: sells, barters them, or open them for the private to use with tax incentives if they are maintained and valued. E.g.: Confeitaria Rocco building, MP building, Andrade Neves corner.
	I suggest painting and cleaning public buildings and greater zeal (supervision) on the part of managers.
BENTO GONÇALVES	Complains about the lack and insufficient number of toilets in parks and public spaces. Many historic buildings in need of renovation (e.g., Blue House near Zaffari).
	He doesn't go to parks.
	He doesn't go to parks or places for outdoor sports.
20 DE NOVEMBRO	Cultural and leisure activities carried out by the community: they hold events on November 20th, such as patio parties open to the community. But there is ambiguity. He described a certain hostility from some neighbours with greater purchasing power, such as those in Moinhos de Vento.
	We don't have a square nearby, nor a leisure facility for the young people, nothing cultural.
	There is no leisure for poor people.

[44] USD 69,801,084 (on 18 November, 2021).

Table 60 presents the QoL types regarding the *culture and recreation* dimension, in which the "opportunities to participate in free cultural and artistic events", and "quality and maintenance of urban green areas" can be highlighted, with *dissonance* QoL type.

Table 60 *Culture and recreation* indicators proposed by NBR 37120 (2017), and the QoL types

CULTURE AND RECREATION					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	good		good		WELL-BEING
Number of urban green areas (parks) (4.1)	good	Green areas (hectares) per 100,000 inhabitants (19.1)	good		WELL-BEING
Existence of places for the practice of outdoor sports (4.3)	bad	Area, in square meters, of covered public recreation spaces per capita (13.1)	bad	bad	DEPRIVATION
		Area, in square meters of public outdoor recreation spaces per capita (13.2)	bad		
Opportunities to participate in free cultural and artistic events (4.5)	bad		good		DISSONANCE
Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	bad		bad		DEPRIVATION
Quality and maintenance of urban green areas (4.2)	bad		good		DISSONANCE

Table 61 summarizes the subjective QoL index and the QoL types regarding the *culture and recreation* dimension.

Table 61 QoL types regarding the *culture and recreation* dimension

CULTURE AND RECREATION QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	0,708	good	good	well-being
Number of urban green areas (parks) (4.1)	0,649	good	good	well-being
Existence of places for the practice of outdoor sports (4.3)	0,589	bad	bad	deprivation
Opportunities to participate in free cultural and artistic events (4.5)	0,506	bad	good	*dissonance*
Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	0,435	bad	bad	deprivation
Quality and maintenance of urban green areas (4.2)	0,417	bad	good	*dissonance*

In the analysis by building (**Table 62**), the perception of *culture and recreation* is more positive (excellent/good) in the Sul América (59%) and Utopia e Luta (55%) buildings, and a little less in Bento Gonçalves (45%), where the "conservation of cultural heritage" presents 71% negative perception (bad/very bad). Residents of the 20 de Novembro presented a negative perception in 56% of the answers (bad/very bad). Also, the "conservation of cultural

heritage" (67% bad/very bad) and the "opportunities to participate in free cultural and artistic events" can be highlighted as major aspects of dissatisfaction (67% bad/very bad).

Table 62 Results in percentages of the perception of *culture and recreation* in the neighbourhood, organized by building

Residents' Responses		TOTAL (all buildings)			
QoL subjective indicator		E./G.	Regular	B./V.B.	N.A.
CULTURE AND RECREATION	Number of urban green areas (parks) (4.1)	67%	19%	12%	2%
	Quality and maintenance of urban green areas (4.2)	21%	38%	36%	5%
	Existence of places for the practice of outdoor sports (4.3)	57%	24%	12%	7%
	Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	81%	7%	10%	2%
	Opportunities to participate in free cultural and artistic events (4.5)	38%	36%	19%	7%
	Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	29%	26%	43%	2%
	Total	**49%**	25%	22%	4%
SUL AMÉRICA		E./G.	Regular	B./V.B.	N.A.
CULTURE AND RECREATION	Number of urban green areas (parks) (4.1)	80%	20%	0%	0%
	Quality and maintenance of urban green areas (4.2)	27%	**53%**	20%	0%
	Existence of places for the practice of outdoor sports (4.3)	67%	27%	0%	7%
	Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	93%	7%	0%	0%
	Opportunities to participate in free cultural and artistic events (4.5)	53%	33%	7%	7%
	Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	33%	33%	33%	0%
	Total	**59%**	29%	10%	2%
UTOPIA E LUTA		E./G.	Regular	B./V.B.	N.A.
CULTURE AND RECREATION	Number of urban green areas (parks) (4.1)	64%	21%	14%	0%
	Quality and maintenance of urban green areas (4.2)	14%	29%	57%	0%
	Existence of places for the practice of outdoor sports (4.3)	71%	21%	7%	0%
	Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	93%	7%	0%	0%
	Opportunities to participate in free cultural and artistic events (4.5)	43%	**57%**	0%	0%
	Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	43%	29%	29%	0%
	Total	**55%**	27%	18%	0%
BENTO GONÇALVES		E./G.	Regular	B./V.B.	N.A.
CULTURE AND RECREATION	Number of urban green areas (parks) (4.1)	86%	14%	0%	0%
	Quality and maintenance of urban green areas (4.2)	29%	**43%**	14%	14%
	Existence of places for the practice of outdoor sports (4.3)	43%	29%	14%	14%
	Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	86%	0%	14%	0%
	Opportunities to participate in free cultural and artistic events (4.5)	29%	14%	**43%**	14%
	Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	0%	29%	**71%**	0%
	Total	**45%**	21%	26%	7%
20 DE NOVEMBRO		E./G.	Regular	B./V.B.	N.A.
CULTURE AND RECREATION	Number of urban green areas (parks) (4.1)	17%	17%	50%	17%
	Quality and maintenance of urban green areas (4.2)	17%	17%	50%	17%
	Existence of places for the practice of outdoor sports (4.3)	17%	17%	50%	17%
	Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	17%	17%	50%	17%
	Opportunities to participate in free cultural and artistic events (4.5)	0%	17%	67%	17%
	Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	17%	0%	67%	17%
	Total	14%	14%	**56%**	17%

5.3.1.4 Urban mobility

Respondents pointed out to *urban mobility*, together with *security*, as the most important dimension of QoL, with 67% of respondents indicating it. In the perception of residents about the neighbourhood, 49% showed a positive perception, 27% regular, and 20% negative in relation to *urban mobility* (**Figure 63**). This dimension of QoL was thus the fourth (out of seven) on the satisfaction scale in the residents' perception and was validated by some common expressions in the content analysis such as *close to everything*, *practicality*, *facility*, *everywhere*, *ease of access*, and *public transport (to the whole city)*, and *walking*. Conversely, the following expressions point to possible dissatisfaction: *low quality of the buses*, *thefts*, *at night*, and *bus stops*.

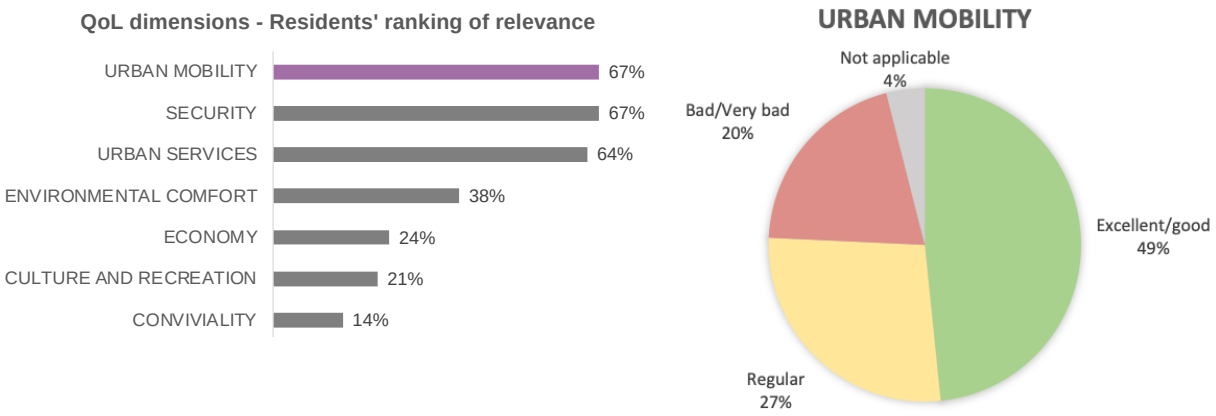

Figure 63 Residents' ranking of relevance for the QoL dimensions and the *urban mobility* satisfaction graph

NBR 37120 (2017, p. 54-60) suggests the use of four essential *transport* indicators and four support indicators, which are discussed below and linked to the perception of the residents. As presented in **Table 63**, the great satisfaction related to the "ease of moving around on foot (to carry out daily activities)" stands out, which 88% of respondents classify as excellent/good. In fact, the region contains a diversity of commerce and services.

Table 63 Results of the perception of *urban mobility* in the neighbourhood

URBAN MOBILITY			QUESTIONNAIRE SCALE						ACCUMULATED SCALE		
QoL subjective indicator			Excellent	Good	Regular	Bad	Very bad	N. A.	E./G.	Regular	B./V.B.
1	Ease of moving around on foot (to carry out daily activities) (2.4)	0,821	52%	36%	5%	2%	2%	2%	88%	5%	5%
2	Ease of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	0,815	48%	33%	17%	2%	0%	0%	81%	17%	2%
3	Availability of public transport (number of lines and schedules) (2.2)	0,583	17%	29%	36%	10%	10%	0%	45%	36%	19%
4	Quality of public transport (comfort) (2.1)	0,571	14%	31%	36%	7%	10%	2%	45%	36%	17%
5	Quality and location of cycle paths (2.5)	0,381	0%	19%	43%	10%	10%	19%	19%	43%	19%
6	Quality and maintenance of sidewalks (2.6)	0,292	0%	12%	29%	24%	36%	0%	12%	29%	60%
URBAN MOBILITY INDEX		0,583						TOTAL	48%	27%	20%

However, some conditions that negatively impact circulation and accessibility were identified in residents' comments (**Table 64**). The negative perception of the presence of street vendors, especially identified as barriers to accessing the building, was information that spontaneously emerged in their responses. In addition, they complain about the streets being too crowded with people, poor environmental conditions, lack of pedestrian-only streets, and poor accessibility conditions for people with disabilities.

In second place, "ease of going from your home to other parts of the city (work, study, friends' houses, etc.)", which 81% of respondents classify as excellent/good, also stands out for the positive perception of the residents. Public transport use is a key indicator of the ease of getting around the city in ways other than single-occupancy vehicles (NBR 37120, 2017, p. 56). In POA, considering the estimated population of 1,488,252 (IBGE, 2020), the *annual number of trips on public transport per capita*, an essential *transport* indicator suggested by NBR 37120 (2017, p. 56), has been on a downward trend since 2017: 178.71 trips per capita in 2017, 166.05 in 2018, 156.99 in 2019, and 75.75 in 2020 (first year of the Covid-19 pandemic) (EPTC[45], 2020).

The *number of private cars per capita* (NBR 37120, 2017, p. 57), also an essential *transport* indicator, was 0.41 per capita in 2020, that is, one car per 2.4 inhabitants (607,649 cars in total) (DENATRAN[46], 2020). POA is the city in the Brazil with the tenth highest number of private cars (DENATRAN, 2020). The *number of two-wheeled motor vehicles per capita* (NBR 37120, 2017, p. 58), a *transport* support indicator, was 0.07 per capita in 2020, that is, 111,297 in total (DENATRAN, 2020). The decrease in the number of public transport trips and the large number of vehicles per capita are negative indicators of urban mobility.

[45] http://www2.portoalegre.rs.gov.br/eptc/
[46] https://www.denatran.org/

However, the central region offers better conditions since most of the city's bus lines connect to it.

Table 64 Residents' comments on *urban mobility*, organized by building

	2.7 Regarding the previous items (URBAN MOBILITY), would you like to leave any comments (optional)?
UTOPIA E LUTA	I think the buses should be more ecological and less polluted and make less noise when starting up and honking horns, with schedules that do not interfere with the rest at night; some lines leave at dawn like the Restinga at 3:30 and 4:30.
	Lack of cycle paths and pedestrian-only streets.
	In relation to public transport, it is considered excellent considering that, in the centre, buses of many lines pass at different times.
	Improve environmental conditions.
	The issues of quality and quantity of public transport vary greatly depending on where you want to go!
SUL AMÉRICA	In the Historic Centre could work electric trams could be used as they do not pollute and/or something alternative. In European countries they work very well, they transport tourists and facilitates mobility.
	Suggestion: clean the streets and sidewalks of the Historic Centre daily. Move street vendors to a place suitable for this purpose.
	The pollution of street vendors on the sidewalks hindering free movement and polluting the city.
	Slippery basalt floors.
	Greater access for people with disabilities.
BENTO GONÇALVES	Scored poorly for displacements on foot, as there are many people on the streets and slopes.
	He thinks the neighbourhood should have more bike paths.
	The sidewalks are terrible. Very scarce public transport. Instead of getting better, it's getting worse.
	May the sidewalks improve.
20 DE NOVEMBRO	Need to improve public transport and non-motorized transport alternatives.
	Quality and cost of living, as in the whole city, is very bad.
	There are almost no bike paths, and paving are broken.

Since 2015 POA has been better than the United Nations (UN) target, which aims to reduce the number of fatal victims in traffic accidents in the world (EPTC, 2021). In 2020, POA had 64 fatal victims in traffic accidents (UN target was 76), a reduction of 55% compared to 2010,

when there were 143 victims (EPTC, 2021) (**Figure 64**). Thus, the *traffic mortality per 100,000 inhabitants*, a *transport* support indicator suggested by NBR 37120 (2017, p. 59), was 4.3 in POA in 2020, and 4.9 in 2019, well below the Brazilian rate of 15.2 in 2019 (DATASUS/SIM, 2019).

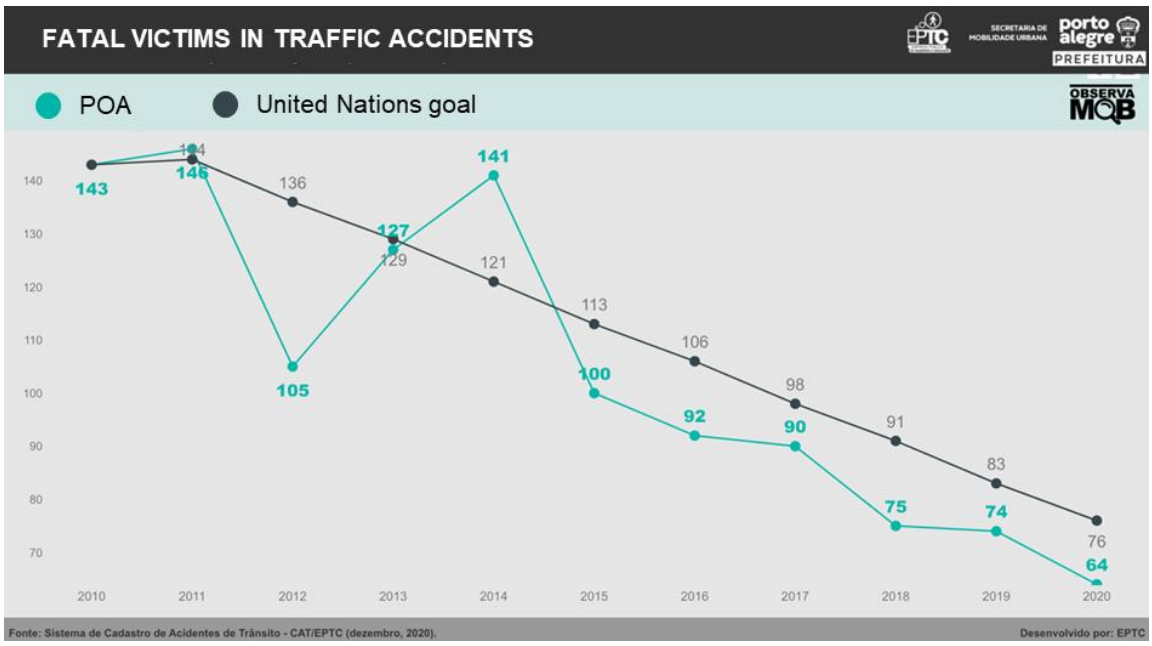

Figure 64 Number of fatal victims in traffic accidents in POA (EPTC, 2021), adapted by the researcher

Thus, as shown in **Table 65**, regarding the "ease of moving around on foot (to carry out daily activities)", it can be inferred that there is *well-being* (good subjective QoL = 0.821 + good objective QoL). However, regarding the "ease of going from your home to other parts of the city (work, study, friends' houses, etc.)", it can be inferred that there is *resignation* (good subjective QoL = 0.815 + bad objective QoL). Probable reasons for resignation may be related to the existence of many bus lines in the central region of POA. Moreover, as in most large cities in the world, the use of the individual transport ride-hailing service (app-taxi or e-taxis) has been consolidated in Porto Alegre, increasing the demand for space for the circulation and parking of these vehicles (PMU[47]/POA, 2018, p. 9).

[47] Porto Alegre Urban Mobility Plan (PMU - *Plano de Mobilidade Urbana de Porto Alegre*) – Accessed in November 2021 - https://prefeitura.poa.br/sites/default/files/usu_doc/projetos/smim/Plano%20de%20Mobilidade%20Urbana/4_Diagnostico_da_Mobilidade_versao_atualizada.pdf

Table 65 *Urban mobility* indicators proposed by NBR 37120 (2017), and the QoL types

URBAN MOBILITY					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Easiness of moving around on foot (to carry out daily activities) (2.4)	good		good	good	WELL-BEING
Easiness of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	good	Annual number of trips on public transport per capita (18.3)	bad	bad	RESIGNATION
		Number of private cars per capita (18.4)	bad		
		Number of two-wheeled motor vehicles per capita (18.6)	bad		
		Traffic mortality per 100,000 inhabitants (18.8)	good		

In third place, the “availability of public transport (number of lines and schedules)" was rated by 45% of interviewed residents (of the central region of POA) as excellent/good, by 36% as regular, and by 19% as bad/very bad. POA has 95 km of medium-capacity public transport system: 56.3 km of bus lanes, 37.9 km of exclusive lanes for public transport, and taxi transportation (PMPA, 2021), and 0.8 km of the light rail vehicle that connects the airport to the train (TRENSURB[48], 2021). Thus, in POA, considering the estimated population of 1,492,530 (IBGE, 2021), the *kilometres of medium-capacity public transport system per 100,000 inhabitants* (light rail vehicles, trams, buses, etc.), an essential *transport* indicator proposed by NBR 37120 (2017, p. 54), in POA in 2021, was 6.4 km per 100,000 inhabitants.

In 2009 the POA bus fleet consisted of 1,592 buses, reaching 1,712 in 2016, but decreasing to 1,480 buses in 2020 (EPTC, 2020). All buses are equipped with GPS, real-time location app and a facial recognition system (PMPA, 2021). The average age of the fleet in 2020 was 6.22 years. Regarding the number of passengers carried, there has been a continuous reduction since 2012, when 328,706,834 passengers were transported, to 233,645,234 passengers in 2019 and 112,738,856 in 2020 (the large reduction related to the Covid-19 pandemic).

According to the National Association of Urban Transport Companies (*Associação Nacional das Empresas de Transportes Urbanos*[49], 2008), the availability of buses can be assessed from the number of buses per 1,000 inhabitants. Therefore, in POA, considering the estimated population of 1,488,252 inhabitants (IBGE, 2020), the availability is 0.99 bus per 1,000 inhabitants, that is, one bus per 1,005 inhabitants. The higher the indicator, the greater the availability of transport.

In July 2021, there were 222 bus lines on weekdays, 158 on Saturdays and 112 on Sundays. In the pre-pandemic period, there were 371 lines on weekdays, 217 on Saturdays and 176 on Sundays, which transport an average of 880 thousand passengers per day (PMU/POA, 2018,

[48] http://www.trensurb.gov.br/home.php
[49] https://www.ntu.org.br/novo/Default.aspx

p.8). The special bus (*lotação*) system has 31 lines, with 441 vehicles, which transport an average of 50,000 passengers per day (PMU/POA, 2018, p.8). In July 2021, the tickets cost BRL 4.80 and BRL 6.60[50], respectively.

As shown in **Figure 65**, most of the bus lines connected to the central region of POA (PMPA, 2012), and there are three circular lines in the Historic Centre (**Figure 66**). However, a diagnosis carried out by the POA City Council highlighted its inefficiency and irregularity (PMU/POA, 2018, p.10). According to Moovit (2021), people spend an average of 47 minutes per day traveling in POA, with 48% of passengers spending more than two hours per day. Passengers wait an average of 22 minutes at the bus stop and travel 7.9 km per day (MOOVIT, 2021). In 2019, the bus trip compliance rate was only 90% (number of trips made/number of scheduled trips) (EPTC, 2019).

The Trensurb, a train system that connects the cities of the metropolitan region of POA (Canoas, Esteio, Sapucaia do Sul, São Leopoldo, and Novo Hamburgo), has a total of 43.8 km. However, only 7.9 km is in the city of POA (TRENSURB, 2021). Thus, the *kilometres of high-capacity public transport system per 100,000 inhabitants* (subway, underground systems, and commuter trains), an essential *transport* indicator proposed by NBR 37120 (2017, p. 54), in 2021 in POA is only 0.5 km per 100,000 inhabitants. This highlights the great need for a high-capacity public transport system in POA.

As for the “quality of public transport (comfort)”, in fourth place, 45% of respondents classify it as excellent/good, 36% regular, and 17% bad/very bad (2% not applicable). Some conditions that generate a negative perception in relation to public transport were identified in the residents' comments (four comments): polluting and noisy means of transport (suggestion of alternative and sustainable transport), quality and quantity of transport vary according to the destination in the city, and high fare cost. In fact, between 2003 and 2017, there was a 10% reduction in the number of bus system users in Porto Alegre (PMU/POA, 2018, p. 8).

[50] USD 0.87 and USD 1.19 (on 18 November, 2021).

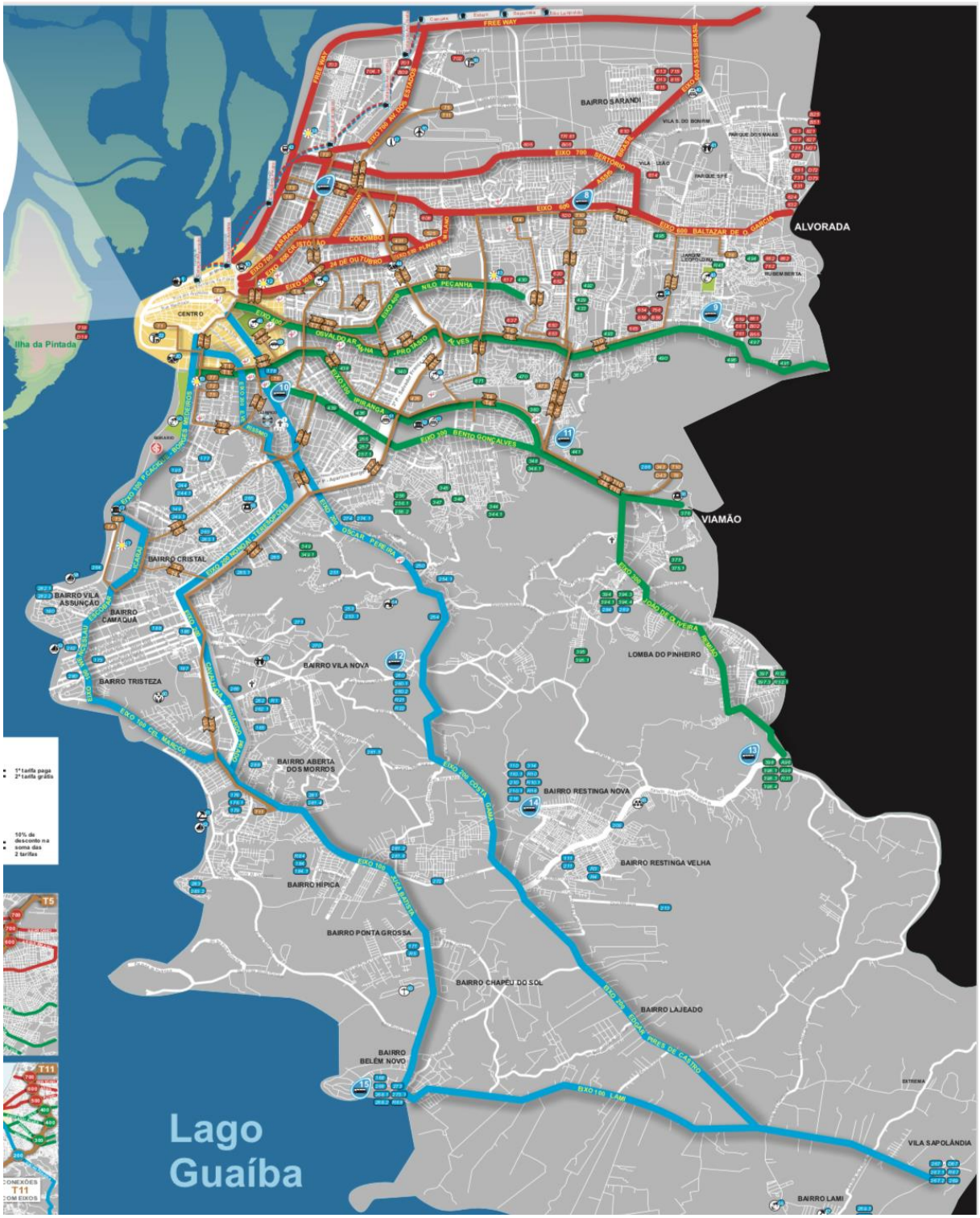

Figure 65 POA Bus Line Map (PMPA, 2012)

Figure 66 Map of the three circular bus lines in the Historic Centre of POA (PMPA, 2012)

The results of a survey of satisfaction conducted in 2019 with 1765 customers of the POA municipal bus system, including 108 lines (EPTC/WRI, 2019) showed that the overall satisfaction score was 5.1 (out of 10), with 38% having a positive perception (satisfied/very satisfied), 34% regular and 28% negative (dissatisfied/very dissatisfied). Specifically, as for the comfort of buses, 31% of users had a positive perception (satisfied/very satisfied), 26% regular, and 43% negative (dissatisfied/very dissatisfied). The score for this aspect was 4.4 (out of 10) (EPTC/WRI, 2019).

As pointed out in the comments of residents of the central region of POA, the EPTC/WRI's survey shows high percentages of dissatisfaction related to *exposure to noise and pollution*, with 56% dissatisfaction, and *bus ticket price*, with 58% dissatisfaction. In December 2010, the ticket was BRL 2.45, in December 2020, BRL 4.55 (EPTC, 2020) and, in July 2021, it was readjusted to BRL 4.80[51] (increase of 5.5%) (PMPA, 2021). Regarding *bus availability*,

[51] USD 0.87, considering the value of the US dollar as of 18 November, 2001 (USD 1.00 = BRL 5.53)

34% of users had a positive perception (satisfied/very satisfied), 23% regular and 43% negative (dissatisfied/very dissatisfied) (EPTC/WRI, 2019).

It was not possible to identify the *percentage of passengers commuting to work as an alternative to the private car*, a *transport* support indicator suggested by NBR 37120 (2017, p. 57), although in POA in 2019, 75.4% of passengers use the bus to go to work, and 20.1% to go to their place of study (EPTC/WRI, 2019). **Figure 67** presents these data compared to 2018, when 73.3% of passengers used the bus to go to work, and 25.2% to go to their place of study (EPTC/WRI, 2019).

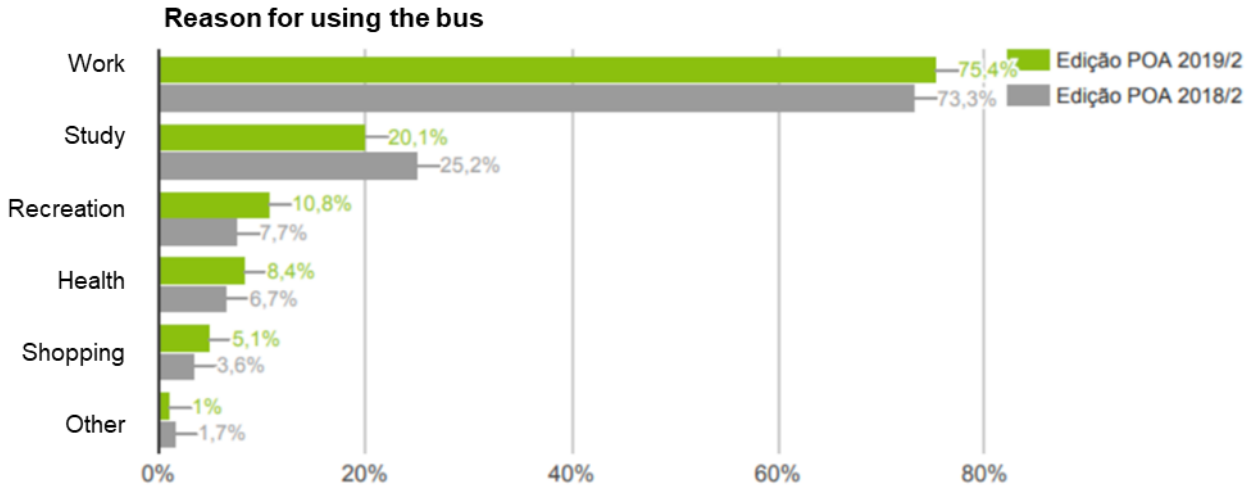

Figure 67 Main reasons for using public transport (bus) in a survey conducted with 1,765 customers of the POA municipal bus system (EPTC/WRI, 2019), adapted by the researcher

The evolution of the quality of the POA bus fleet, using the following criteria elaborated by the Public Transport and Circulation Company (*Empresa Pública de Transporte e Circulação* – EPTC[52], 2020): the use of air conditioning, adaptation for people with disabilities, type of engine, and type of gearshift. There is an improvement in the number of buses with air conditioning, from 22.5% (2009) of the fleet to 45.90% (2020), and in the adaptation for people with disabilities from 31.53% (2009) of the fleet to 91.35% (2020). The other aspects showed little improvement.

In fifth place, the "quality and location of cycle paths" was rated by 19% of interviewed residents (of the central region of POA) as excellent/good, by 43% as regular, by 19% as bad/very bad, and 19% not applicable, indicating the low use of bicycles. In the comments,

[52] http://www2.portoalegre.rs.gov.br/eptc/

the low number of cycle paths (three comments) and the poor conservation of the existing ones were pointed out.

The following criteria can be used to assess the quality of the cycling infrastructure: location, size, and paving (regular, waterproof, and non-slip) of cycle lanes, signalling and continuity of routes, integration with public transport, and safe bicycle parking (Ministério das Cidades, 2016, p. 26). One-way bicycle lanes are preferable, as they allow cyclists to circulate in the same flow as other vehicles and, consequently, make movements by other road users more predictable. This reduces the possibility of collisions and being run over at intersections. One-way bicycle paths and cycle lanes must have a minimum width of 1.20 m. Bidirectional cycle paths and cycle lanes must have a minimum width of 2.50 m (Ministério das Cidades, 2016, p. 30).

Horizontal and vertical signage at intersections is essential to reduce the risk of accidents (Ministério das Cidades, 2016, p. 34). "One of the inhibiting aspects of cycling is the lack of infrastructure, whether for circulation or parking. The urban transport network must integrate different modes of transport. For this reason, stopping points, stations and terminals must be connected with cycle lanes and have bicycle parking facilities" (Ministério das Cidades, 2016, p. 37).

POA has a shared bicycle system that has 41 stations and 400 bicycles. There is currently a visible increase in bicycle travel, driven by the increase in infrastructure, the offer of a sharing service, and an ongoing cultural change. However, the existing cycling network is small and disjointed and lacks information for the user to plan their trips (PMU/POA, 2018, p. 8). POA has only 54 km of cycle paths (EPTC, 2020), that is, 1.92% of its streets. There were 3.6 *kilometres of cycle lanes per 100,000 inhabitants*, a *transport* support indicator suggested by NBR 37120 (2017, p. 58), in 2020 in POA. In fact, as shown in **Figure 68**, there are few cycle paths in the central region of POA, with insufficient coverage and connection to the existing road network, which justifies the low adherence to the use of bicycles as a means of transport.

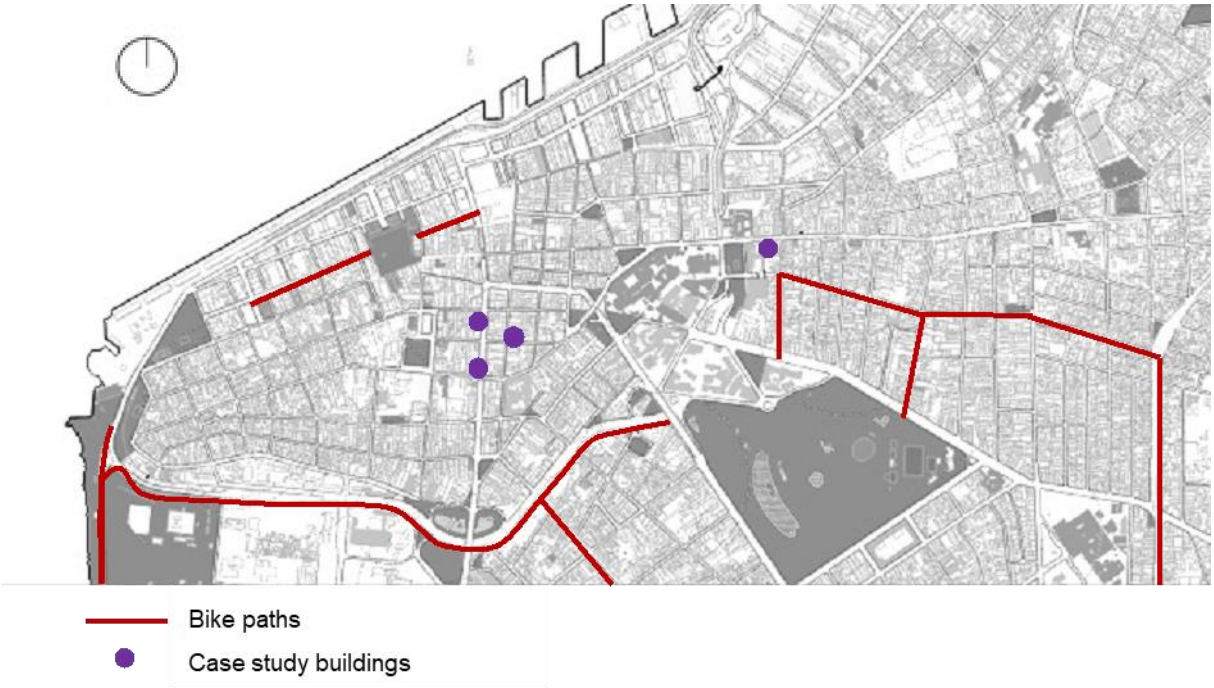

Figure 68 Central area of POA, with the identification of the analysed buildings and the existing bike paths in the surroundings

Finally, with the lowest degree of satisfaction, the "quality and maintenance of pavements" is rated 12% excellent/good, 29% fair, and 60% bad/very bad. The following criteria can be used to evaluate the quality of pavements: dimensioning, paving, cross slope for water drainage (up to 3%), presence of lighting, environmental comfort (presence of vegetation), urban furniture (located in the *service lane*), information system (to guide pedestrians in the urban environment), and continuity (no gaps or steps) (Ministério das Cidades, 2016, p. 12). Also, the narrower the pavements, the less people feel invited to use them, making the population more sedentary. This includes children who could also use them for roller skating and cycling (Jacobs, 2011, p. 87).

The *free circulation lane* should measure at 1.20 m (recommended 1.50 m) and should vary according to the estimated flow of pedestrians per hour. Pavements must also include a *service lane* (for urban furniture) with a minimum width of 0.70 m, adjacent to the curb (Ministério das Cidades, 2016, p. 13). Moreover, the *transition lane* with a minimum width of 0.45 m, next to the front of the building, allows the provision of tables, chairs, advertisements, etc. The reduction of the width of the streets should be proposed in cases where the existing pavement does not have the minimum dimensions required (Ministério das Cidades, 2016, p. 14). The paving must be regular, continuous, cohesive, and non-slip. Suitable materials

include cast-in-place concrete and interlocking blocks (Ministério das Cidades, 2016, p. 16). **Figure 69** shows a sidewalk in POA with three defined lanes.

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Figure 69 Pavement with three defined lanes (Ministério Das Cidades, 2016, p. 14)

In POA, the owner of the land is responsible for the provision and maintenance of the pavement, which results in different types of pavement and conditions. According to the diagnosis carried out by PMPA, the pavements had insufficient infrastructure and poor conservation, which hinders pedestrian circulation, making it difficult to walk and giving problems to people with disabilities (PMU/POA, 2018, p. 8). In 2020, the POA City Council registered 8,167 maintenance requests related to pavement problems, and 79% of those responsible met the municipality's demands (Jornal do Comércio, 2021). There were five comments that showed a negative perception in relation to pavements: dirty, in poor condition, and unsatisfactory paving (slippery basalt).

These characteristics can also be seen at the site, on the pavement in front of the Utopia and Luta Building and of the Sul América Building, on Avenida Borges de Medeiros, as shown in **Figure 70** (November 2021). Moreover, access to Utopia and Luta becomes more difficult, due to its location on the Viaduto Otávio Rocha.

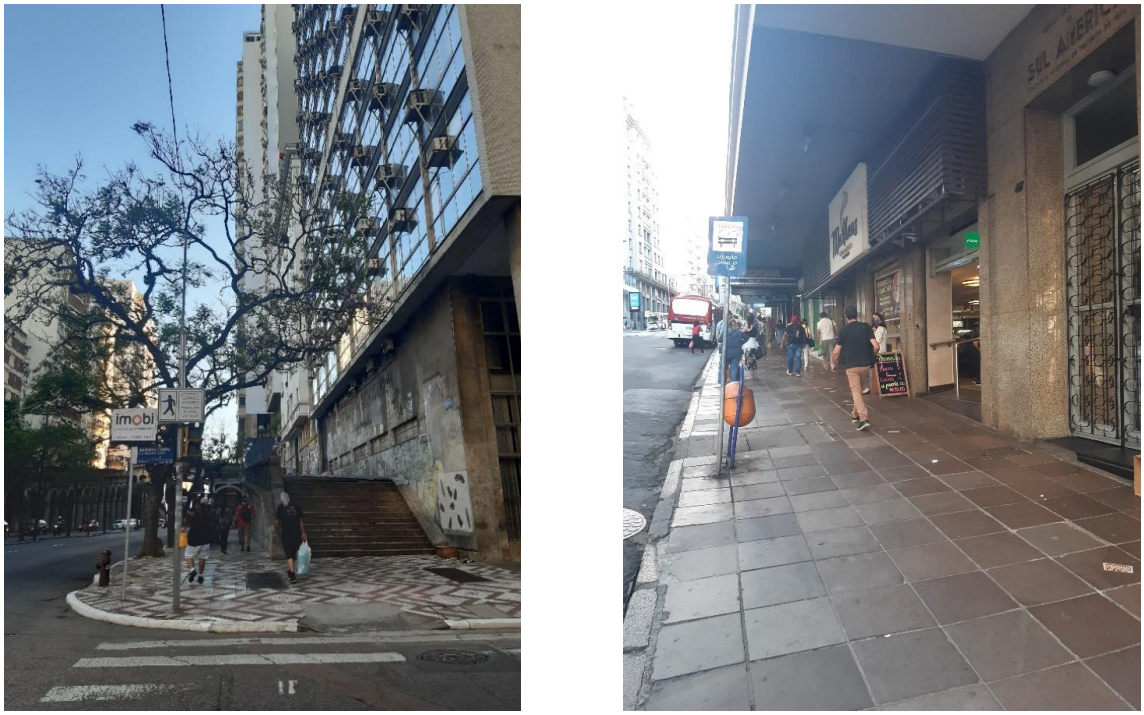

Figure 70 Pavements in front of the Utopia and Luta and of the Sul América Building (Avenida Borges de Medeiros)

Figure 71 shows the pavement conditions in front of the Bento Gonçalves Building (on Avenida Senador Salgado Filho – December 2020) and of the 20 de Novembro Building (Rua Doutor Barros Cassal - November 2021).

Figure 71 Pavements in front of the Bento Gonçalves Building (Avenida Senador Salgado Filho) and of the 20 de Novembro Building (Rua Doutor Barros Cassal).

As shown in **Table 66**, regarding these four *urban mobility* indicators ("availability of public transport", "quality of public transport", "quality and location of cycle paths", and "quality and maintenance of pavements"), it can be inferred that there is *deprivation* (bad subjective + bad objective QoL). Thus, it is necessary to improve the evaluation criteria, include cross-data analysis and seek investments in the area, especially in public transport, pavement maintenance, and bicycle paths. Regarding the difficulties in identifying objective indicators, the following can be mentioned: outdated data, and dispersion of indicators in different sources.

Table 66 *Urban mobility* indicators proposed by NBR 37120 (2017), and the QoL types (*deprivation*)

URBAN MOBILITY					
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)		QOL type
Availability of public transport (number of lines and schedules) (2.2)	bad	Percentage of passengers commuting to work as an alternative to the private car (18.5)	bad	bad	DEPRIVATION
Quality of public transport (comfort) (2.1)	bad	Kilometres of high-capacity public transport system per 100,000 inhabitants (18.1)	bad		
		Kilometres of medium-capacity public transport system per 100,000 inhabitants (18.2)	good		
Quality and location of cycle paths (2.5)	bad	Kilometres of cycle paths and cycle lanes per 100,000 inhabitants (18.7)	bad		
Quality and maintenance of sidewalks (2.6)	bad		bad		

Table 67 presents the QoL types regarding the *urban mobility* dimension, in which the "easiness of going from your home to other parts of the city (work, study, friends' houses, etc.)" can be highlighted, with *resignation* QoL type.

Table 67 QoL types regarding *urban mobility* dimension

URBAN MOBILITY QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
Easiness of moving around on foot (to carry out daily activities) (2.4)	0,821	good	good	well-being
Easiness of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	0,815	good	bad	*resignation*
Availability of public transport (number of lines and schedules) (2.2)	0,583	bad	bad	deprivation
Quality of public transport (comfort) (2.1)	0,571	bad	bad	deprivation
Quality and location of cycle paths (2.5)	0,381	bad	bad	deprivation
Quality and maintenance of sidewalks (2.6)	0,292	bad	bad	deprivation

In the analysis by building (**Table 68**), the perception of urban mobility is more positive in Utopia and Luta (57% excellent/good), followed by Sul América and 20 de Novembro (both 47% excellent/good), and Bento Gonçalves (36% great/good). The negative perception of the

"quality and maintenance of pavements" is reinforced as an aspect of dissatisfaction in all buildings. Also, residents of Bento Gonçalves showed a greater negative perception in relation to the "quality and quantity of public transport" (43% bad/very bad).

Table 68 Results in percentages of the perception of *urban mobility* in the neighbourhood, organized by building

Residents' Responses		TOTAL (all buildings)			
QoL subjective indicator		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
URBAN MOBILITY	Quality of public transport (comfort) (2.1)	45%	36%	17%	2%
	Availability of public transport (number of lines and schedules) (2.2)	45%	36%	19%	0%
	Ease of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	81%	17%	2%	0%
	Ease of moving around on foot (to carry out daily activities) (2.4)	88%	5%	5%	2%
	Quality and location of cycle paths (2.5)	19%	43%	19%	19%
	Quality and maintenance of sidewalks (2.6)	12%	29%	60%	0%
	Total	**48%**	27%	20%	4%
SUL AMÉRICA		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
URBAN MOBILITY	Quality of public transport (comfort) (2.1)	33%	53%	7%	7%
	Availability of public transport (number of lines and schedules) (2.2)	33%	53%	13%	0%
	Ease of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	87%	13%	0%	0%
	Ease of moving around on foot (to carry out daily activities) (2.4)	100%	0%	0%	0%
	Quality and location of cycle paths (2.5)	20%	60%	7%	13%
	Quality and maintenance of sidewalks (2.6)	7%	33%	**60%**	0%
	Total	**47%**	36%	14%	3%
UTOPIA E LUTA		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
URBAN MOBILITY	Quality of public transport (comfort) (2.1)	57%	29%	14%	0%
	Availability of public transport (number of lines and schedules) (2.2)	71%	14%	14%	0%
	Ease of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	93%	7%	0%	0%
	Ease of moving around on foot (to carry out daily activities) (2.4)	93%	7%	0%	0%
	Quality and location of cycle paths (2.5)	21%	**36%**	36%	7%
	Quality and maintenance of sidewalks (2.6)	7%	36%	57%	0%
	Total	**57%**	21%	20%	1%
BENTO GONÇALVES		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
URBAN MOBILITY	Quality of public transport (comfort) (2.1)	29%	29%	43%	0%
	Availability of public transport (number of lines and schedules) (2.2)	29%	29%	43%	0%
	Ease of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	57%	29%	14%	0%
	Ease of moving around on foot (to carry out daily activities) (2.4)	71%	14%	14%	0%
	Quality and location of cycle paths (2.5)	14%	43%	0%	43%
	Quality and maintenance of sidewalks (2.6)	14%	29%	57%	0%
	Total	**36%**	29%	29%	7%
20 DE NOVEMBRO		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
URBAN MOBILITY	Quality of public transport (comfort) (2.1)	67%	17%	17%	0%
	Availability of public transport (number of lines and schedules) (2.2)	33%	50%	17%	0%
	Ease of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	67%	33%	0%	0%
	Ease of moving around on foot (to carry out daily activities) (2.4)	67%	0%	17%	17%
	Quality and location of cycle paths (2.5)	17%	17%	33%	33%
	Quality and maintenance of sidewalks (2.6)	33%	0%	67%	0%
	Total	**47%**	19%	25%	8%

5.3.1.5 Conviviality

Respondents pointed to *conviviality* as the least important dimension of QoL, with only 14% of respondents indicating it. Regarding the perception of residents about the neighbourhood, 43% showed a positive perception, 23% regular, and 22% negative in relation to *conviviality* (**Figure 72**). Thus, this dimension of QoL was the fifth (out of seven) on the satisfaction scale in the residents' perception. Some common expressions in the content analysis such as *the presence of street vendors obstructing the access to the building*, *the presence of homeless people*, *the excess of people on pavements*, and *bus stops* can be related to dissatisfaction with conviviality.

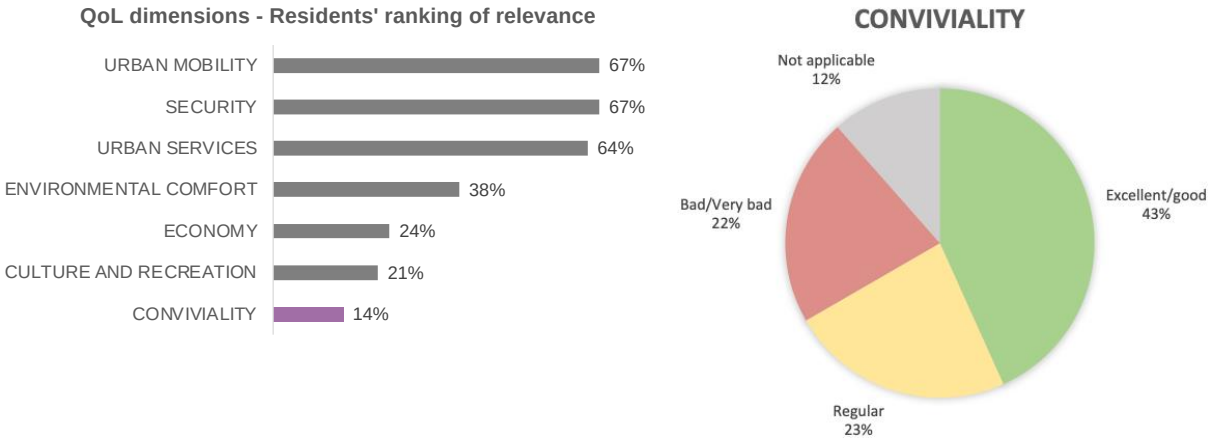

Figure 72 Residents' ranking of relevance for the QoL dimensions and the *conviviality* satisfaction graph

The "identification with the neighbourhood and people's pride in living in it", with 60% of excellent/good responses (26% regular, 5% bad/very bad, 10% not applicable), and the "people's respect for cultural, sexual, religious and political differences", with 45% of excellent/good responses (26% regular, 26% bad/very bad, 2% not applicable), are the aspects of the more positive perceptions of residents (**Table 69**).

Then, "opportunities to participate in decisions related to the building", "conviviality and interaction with homeless people", and "conviviality and interaction with neighbourhood residents" were classified as excellent/good by 45%, 40% and 40% of residents, respectively. However, in the comments, residents' concern for the difficult reality of homeless people can be seen, highlighting the need for public policies (four comments) (**Table 70**).

Table 69 Results of the perception of *conviviality* in the neighbourhood

CONVIVIALITY			QUESTIONNAIRE SCALE						ACCUMULATED SCALE		
QoL subjective indicator			Excellent	Good	Regular	Bad	Very bad	N. A.	E./G.	Regular	B./V.B.
1	Identification with the neighbourhood and people's pride in living in it (7.6)	0,613	14%	45%	26%	0%	5%	10%	60%	26%	5%
2	People's respect for cultural, sexual, religious and political differences (7.5)	0,518	12%	33%	26%	7%	19%	2%	45%	26%	26%
3	Opportunities to participate in condominium decisions (7.3)	0,512	14%	36%	12%	17%	7%	14%	50%	12%	24%
4	Conviviality and interaction with homeless people (7.2)	0,488	5%	36%	24%	21%	5%	10%	40%	24%	26%
5	Conviviality and interaction with the neighbourhood residents (7.1)	0,470	0%	40%	26%	14%	10%	10%	40%	26%	24%
6	Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	0,363	5%	19%	26%	17%	10%	24%	24%	26%	26%
CONVIVIALITY INDEX		0,542						TOTAL	43%	23%	22%

Table 70 Residents' comments on *conviviality*, organized by building

	7.7 Regarding the previous items (CONVIVIALITY), would you like to leave any comments (optional)?
UTOPIA E LUTA	A hypocritical neighbourhood that thinks it's better than other neighbourhoods.
	Personally, I don't have a problem with people who are homeless. What makes me angry is the total absence of public policies regarding for these people.
	People could relate more to each other.
SUL AMÉRICA	It's not because I live almost on the Democratic Corner that every event must be held there. Quiet hours are not respected with *pagode* and rock concerts with decibels above the permitted level. You come home tired, and the noise goes on until midnight.
	Participation in the decisions of the building is difficult due to the administrator.
	Homeless people are a social plague that urgently needs public measures.
BENTO GONÇALVES	Bad: property manager, residents are left without autonomy, and maintenance is more difficult (e.g., water tank with dirt from pigeons). However, she seems to be proud of living there, of participating in a residents committee, of having organized the garbage collection and the renovation of the reception and the access door to the building.
	She reports the difficulty of having homeless people sleeping and having sex on the sidewalk. He says he doesn't participate much in the decisions of the building, but he likes living there, mainly because of the low cost of maintaining the house.
	Homeless people: bad situation.
	Difficult interaction with the neighbouring block (Charrua).
20 DE NOVEMBRO	Respect depends a lot on the different groups they interact with. Ex.: Presence of neo-Nazis, but also transsexual population (more respectful).
	We don't feel part of the neighbourhood community (she reported that they hear people who pass by saying bad things about the occupation).
	The “bourgeoisie” sees us as "monkeys".
	People who live in the Centre end up losing respect for others, threaten neighbours and feel superior because of their violent position.

NBR 37120 (2017) does not present indicators of *conviviality*, which can be considered, together with *culture*, another limitation of the standard for QoL assessment. However, the *number of homeless per 100,000 inhabitants*, which is presented by NBR 37120 (2017, p. 44) as a *housing* support indicator, is considered in this research to be an indicator linked to the *conviviality* dimension. In POA in 2020, there were about 258 homeless per 100,000 inhabitants, that is, 3,850 people (0.26% of the population), mostly men from 25 to 45 years old (PMPA/FASC, 2020). This number grew 38.73% compared to 2019, when the Foundation for Social Assistance and Citizenship (*Fundação de Assistência Social e Cidadania* - FASC[53]) estimated the homeless population at 2,775 people.

Until 2019 the average was 350 new people coming to the streets of POA per year, but due to the Covid-19 pandemic in 2020, 1,075 people ended up in this condition, three times more than the trend of previous years (PMPA/FASC, 2020). Currently, in neighbourhoods in the central region of POA, closer to commercial areas where it is possible to collect solid waste for recycling and livelihood, improvised huts can be seen (PMPA/FASC, 2021). Therefore, it is necessary to expand social assistance for this portion of the population, as well as job and housing generation.

Finally, with the lowest degree of satisfaction, the "opportunities to participate in community activities (associations, artistic, religious groups, etc.)" is rated 24% excellent/good, 26% regular, and 24% bad/very bad (24% not applicable).

Table 71 presents the QoL types regarding the *conviviality* dimension. It was not possible to identify other objective indicators of conviviality. Therefore, this is a limitation in assessing QoL.

[53] http://www2.portoalegre.rs.gov.br/fasc/

Table 71 *Conviviality* indicators proposed by NBR 37120 (2017), and the QoL types

CONVIVIALITY				
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)	QOL type
Identification with the neighborhood and people's pride in living in it (7.6)	good		good	WELL-BEING
People's respect for cultural, sexual, religious and political differences (7.5)	bad			
Opportunities to participate in condominium decisions (7.3)	bad		bad	DEPRIVATION
Conviviality and interaction with homeless people (7.2)	bad	Number of homeless per 100,000 inhabitants (15.2)	bad	DEPRIVATION
Conviviality and interaction with the neighbourhood residents (7.1)	bad		bad	DEPRIVATION
Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	bad		bad	DEPRIVATION

Table 72 summarizes the subjective QoL index and the QoL types regarding the *conviviality* dimension.

Table 72 QoL types regarding the *conviviality* dimension

CONVIVIALITY QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
Identification with the neighbourhood and people's pride in living in it (7.6)	0,613	good	good	well-being
People's respect for cultural, sexual, religious and political differences (7.5)	0,518	bad		
Opportunities to participate in condominium decisions (7.3)	0,512	bad	bad	deprivation
Conviviality and interaction with homeless people (7.2)	0,488	bad	bad	deprivation
Conviviality and interaction with the neighbourhood residents (7.1)	0,470	bad	bad	deprivation
Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	0,363	bad	bad	deprivation

In the analysis by building (**Table 73**), the perception of *conviviality* is more positive in Bento Gonçalves (60% excellent /good), followed by Utopia and Luta (42% excellent /good), and Sul América (41% excellent /good). The greatest dissatisfaction of Sul América's residents (53% bad/very bad) in relation to "opportunities to participate in participate in decisions related to the building" is highlighted since the administration is carried out via a real estate company, thereby reducing the chances of the residents to participate (two comments).

Table 73 Results in percentages of the perception of *conviviality* in the neighbourhood, organized by building

Residents' Responses		TOTAL (all buildings)			
QoL subjective indicator		E./G.	Regular	B./V.B.	N.A.
CONVIVIALITY	Conviviality and interaction with the neighbourhood residents (7.1)	40%	26%	24%	10%
	Conviviality and interaction with homeless people (7.2)	40%	24%	26%	10%
	Opportunities to participate in condominium decisions (7.3)	50%	12%	24%	14%
	Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	24%	26%	26%	24%
	People's respect for cultural, sexual, religious and political differences (7.5)	45%	26%	26%	2%
	Identification with the neighbourhood and people's pride in living in it (7.6)	60%	26%	5%	10%
	Total	**43%**	23%	22%	12%
SUL AMÉRICA		E./G.	Regular	B./V.B.	N.A.
CONVIVIALITY	Conviviality and interaction with the neighbourhood residents (7.1)	47%	27%	7%	20%
	Conviviality and interaction with homeless people (7.2)	20%	20%	33%	27%
	Opportunities to participate in condominium decisions (7.3)	40%	0%	53%	7%
	Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	33%	27%	7%	33%
	People's respect for cultural, sexual, religious and political differences (7.5)	40%	27%	33%	0%
	Identification with the neighbourhood and people's pride in living in it (7.6)	67%	20%	0%	13%
	Total	**41%**	20%	22%	17%
UTOPIA E LUTA		E./G.	Regular	B./V.B.	N.A.
CONVIVIALITY	Conviviality and interaction with the neighbourhood residents (7.1)	29%	36%	36%	0%
	Conviviality and interaction with homeless people (7.2)	36%	36%	29%	0%
	Opportunities to participate in condominium decisions (7.3)	57%	36%	7%	0%
	Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	14%	36%	43%	7%
	People's respect for cultural, sexual, religious and political differences (7.5)	57%	36%	7%	0%
	Identification with the neighbourhood and people's pride in living in it (7.6)	57%	43%	0%	0%
	Total	**42%**	37%	20%	1%
BENTO GONÇALVES		E./G.	Regular	B./V.B.	N.A.
CONVIVIALITY	Conviviality and interaction with the neighbourhood residents (7.1)	71%	29%	0%	0%
	Conviviality and interaction with homeless people (7.2)	57%	29%	14%	0%
	Opportunities to participate in condominium decisions (7.3)	57%	0%	0%	43%
	Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	29%	14%	0%	**57%**
	People's respect for cultural, sexual, religious and political differences (7.5)	57%	14%	14%	14%
	Identification with the neighbourhood and people's pride in living in it (7.6)	86%	14%	0%	0%
	Total	**60%**	17%	5%	19%
20 DE NOVEMBRO		E./G.	Regular	B./V.B.	N.A.
CONVIVIALITY	Conviviality and interaction with the neighbourhood residents (7.1)	17%	0%	67%	17%
	Conviviality and interaction with homeless people (7.2)	83%	0%	17%	0%
	Opportunities to participate in condominium decisions (7.3)	50%	0%	17%	33%
	Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	17%	17%	67%	0%
	People's respect for cultural, sexual, religious and political differences (7.5)	17%	17%	67%	0%
	Identification with the neighbourhood and people's pride in living in it (7.6)	17%	17%	33%	33%
	Total	33%	8%	**44%**	14%

Residents of the 20 de Novembro had a more negative perception, with 44% of responses classified as bad/very bad. Thus, among the greatest dissatisfactions are with "living and interacting with the neighbourhood residents", "opportunities to participate in community activities (associations, artistic, religious groups, etc.)", and "respect for people because of cultural, sexual, religious, and political differences", with 67% of the answers classified as bad/very bad. These perceptions are also highlighted in the comments, and best expressed by the comment "*We do not feel part of the neighbourhood community*", highlighting that the lack of conviviality can negatively influence people's sense of belonging and appropriation of public spaces.

5.3.1.6 Security

Respondents pointed to *security*, together with *urban mobility*, as the most important dimension of QoL, with 67% of respondents indicating it. In relation to *security*, only 27% showed a positive perception, 30% regular, and 41% negative (**Figure 73**). This dimension of QoL was the sixth (out of seven) on the satisfaction scale in the residents' perception. Their worries are seen in some common expressions in the content analysis such as *insecurity*, *violence*, *thefts*, *night*, *insufficient public lighting*, *bus stop*, and *fear*.

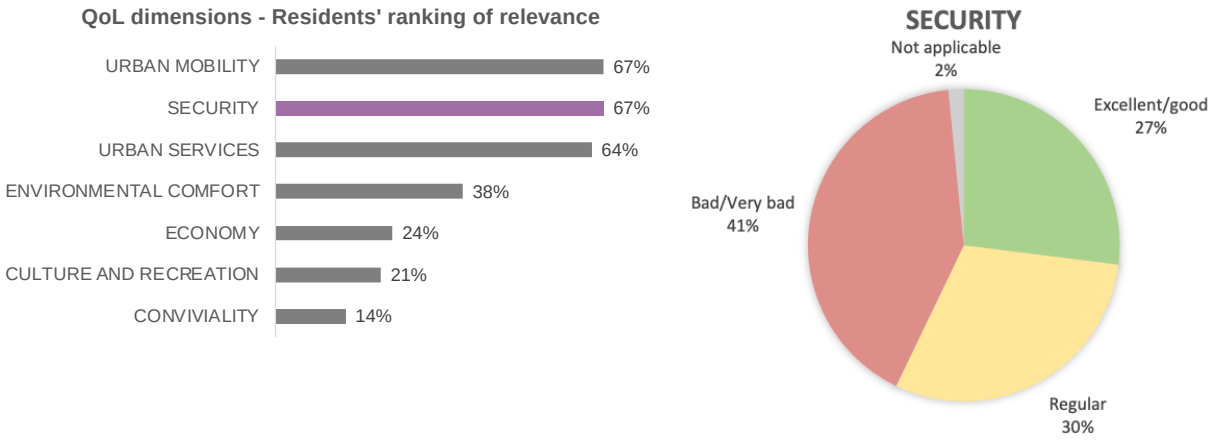

Figure 73 Residents' ranking of relevance for the QoL dimensions and the *security* satisfaction graph

NBR 37120 (2017, p. 40-42) suggests the use of two essential *security* indicators and three support indicators, which are discussed below and linked to the perception of the residents. As presented in **Table 74**, in first place, the "feeling of security when accessing your building

during the day" was rated as 55% excellent/good, 21% regular, and 24% bad/very bad. Conversely, the "feeling of security when accessing your building at night" is the most negatively perceived aspect, with 14% of responses excellent/good, 17% regular, and 67% bad/very bad.

Table 74 Results in percentages of the perception of *security* in the neighbourhood

SECURITY			QUESTIONNAIRE SCALE						ACCUMULATED SCALE		
QoL subjective indicator			Excellent	Good	Regular	Bad	Very bad	N. A.	E./G.	Regular	B./V.B.
1	Feeling of security when accessing your building during the day (3.2)	0,577	14%	40%	21%	10%	14%	0%	55%	21%	24%
2	Quality of public lighting (3.6)	0,512	5%	33%	33%	19%	10%	0%	38%	33%	29%
3	Policing quality (3.5)	0,435	5%	19%	38%	21%	17%	0%	24%	38%	38%
4	Sense of security in public places (3.1)	0,381	5%	12%	40%	17%	26%	0%	17%	40%	43%
5	Safety for children and teenagers to experience the public places (3.4)	0,339	0%	14%	31%	31%	17%	7%	14%	31%	48%
6	Feeling of security when accessing your building at night (3.3)	0,256	2%	12%	17%	24%	43%	2%	14%	17%	67%
SECURITY INDEX		0,458						TOTAL	27%	30%	41%

In POA in 2020, there were 18.6 homicides per 100,000 inhabitants (NBR 37120, 2017, p. 41), an essential *security* indicator, that is, 277 in total (SSP/RS[54], 2020). There was a decrease in homicides compared to previous years: 323 in 2019 (21.7 homicides /100,000 inhabitants) and 536 in 2018 (36 homicides /100,000 inhabitants) (SSP/RS, 2020). However, it is still considered a high rate, especially when compared to the global homicide rate of 6.1 per 100,000 inhabitants (WHO, 2017).

Moreover, even though the *number of crimes against property per 100,000 inhabitants* in POA has decreased since 2018, it remains very high. It is a *security* support indicator suggested by NBR 37120 (2017, p. 41). There were 74,727 crimes in 2018 (5,021/100,000 inhabitants) and 68,840 in 2019 (4,625/100,000 inhabitants) (SSP/RS, 2020). In 2020, there were 58,116 crimes against property (SSP/RS, 2020), that is, 3,905 per 100,000 inhabitants (SSP/RS, 2020). Crimes against property include robbery, theft, minor offence, and motor vehicle theft (NBR 37120, 2017, p. 42).

The *number of violent crimes per 100,000 inhabitants*, another *security* support indicator suggested by NBR 37120 (2017, p. 42), has also decreased since 2018, although it remains high. There were 816 in 2018 (54.8 /100,000 inhabitants) and 516 violent crimes in 2019 (39.2 /100,000 inhabitants) (SSP/RS, 2020). In 2020, there were 516 violent crimes (SSP/RS, 2020), that is, 34.7 violent crimes per 100,000 inhabitants (NBR 37120, 2017, p. 42), a

[54] https://ssp.rs.gov.br/inicial

security support indicator (SSP/RS, 2020). Violent crimes include homicides, violent robberies, and rapes (224 cases in 2020) (SSP/RS, 2020).

In second place, the "quality of public lighting" was rated by 38% of interviewed residents (of the central region of POA) as excellent/good, by 33% as regular, and by 29% as bad/very bad. The quality of public lighting is related to the feeling of security in the perception of public road users, especially in relation to crime. Therefore, good lighting is an important demand from society, especially in places most affected by crime (PMPA/Relatório de Diagnóstico Técnico da Rede de Iluminação Pública de POA, 2017[55]).

The expansion of the public lighting network in POA was 27% between 2008 and 2017, going from 79,300 street lights in 2008 to 101,487 in 2017, covering 2,200 km of public roads in the city (PMPA/Relatório de Diagnóstico Técnico da Rede de Iluminação Pública de POA, 2017, p. 33). In 2017 the central region had 98.86% of households with public lighting in its surroundings, above the city rate of 85.58%. However, it is also identified as the region with the highest crime rate in the city (PMPA/Relatório de Diagnóstico Técnico da Rede de Iluminação Pública de POA, 2017, p. 23). **Figure 74** shows the POA street lighting map, in which the reddish ("warmer") tones represent a greater concentration of lighting points (PMPA/ Relatório de Diagnóstico Técnico da Rede de Iluminação Pública de POA, 2017, p. 24).

Trees obstructing lighting is one of the main problems. POA is one of the most wooded cities in Brazil (IBGE, 2010), which creates difficulties in compatibility with the public lighting network. Although the municipality offers pruning services, these are carried out in insufficient quantities in relation to the existing demand (PMPA/ Relatório de Diagnóstico Técnico da Rede de Iluminação Pública de POA, 2017, p. 29).

In third place, the "policing quality" was rated by 24% of interviewed residents (of the central region of POA) as excellent/good, by 38% as regular, and by 38% as bad/very bad. It is a general indicator of the crime prevention program (NBR 37120, 2017, p. 40). The number of police personnel in the state of RS was 32,712 in March 2021 (FBSP, 2021), that is, 285 *police officers per 100,000 inhabitants* (NBR 37120, 2017, p. 40), an essential *security* indicator (considering 11,466,630 people, the population of RS estimated by IBGE in 2021).

[55] http://lproweb.procempa.com.br/pmpa/prefpoa/ppp/usu_doc/1_-_diagnostico_tecnico_da_rede_de_iluminacao_publica.pdf

According to the General Command of the Military Brigade of RS, there is a deficit of about 50% of what is considered ideal for policing in RS (GZH, 05/08/2020[56]).

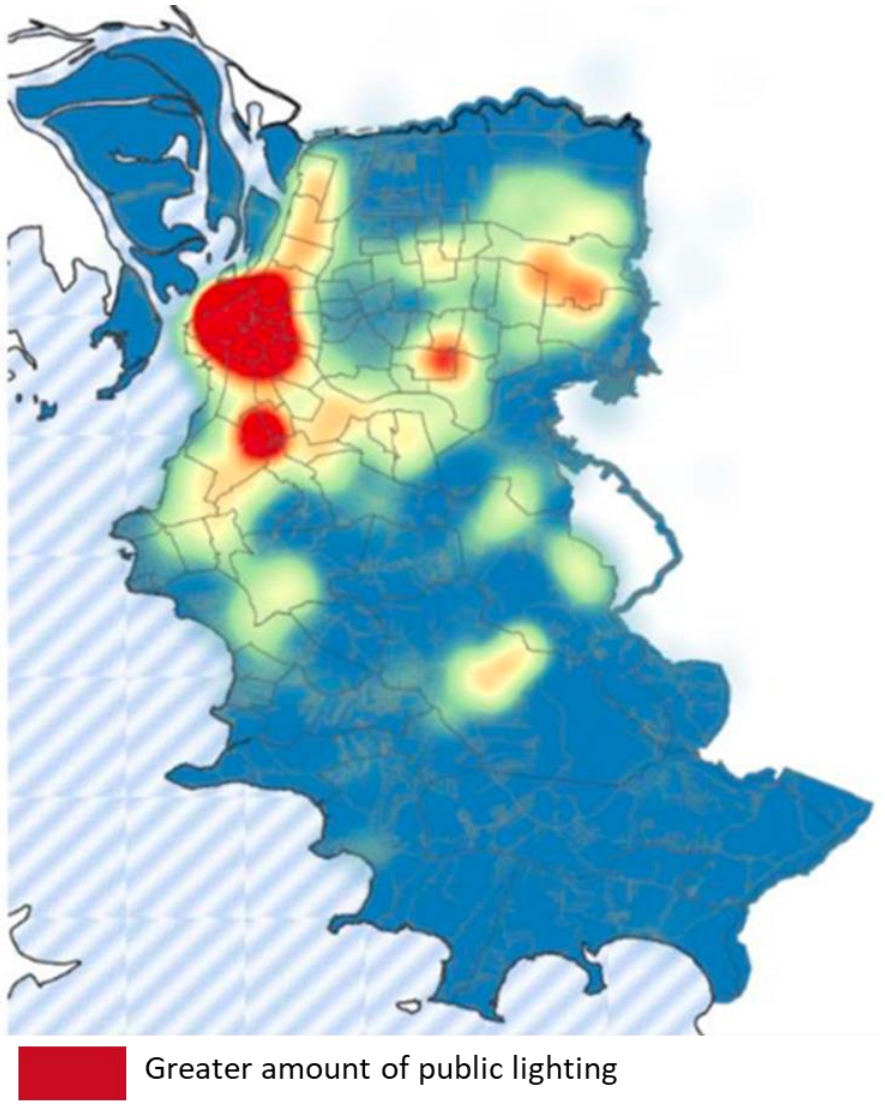

Figure 74 POA street lighting map (PMPA, 2017)

The *police response time from first call* (NBR 37120, 2017, p. 42), a *security* support indicator, could be identified in POA. This is an indicator of how protected a city's residents are from threats to security and physical integrity. It is calculated from the sum of the time between the call and the arrival of the police at the location divided by the total number of calls (expressed in minutes and seconds) (NBR 37120, 2017, p. 42). It was possible to identify only the total number of incidents attended by the military brigade of the state of RS in 2020, which was 800,229 assistances, that is, 2,186 assistances provided per day (SSP/RS, 2020).

[56] https://gauchazh.clicrbs.com.br/seguranca/noticia/2020/05/apesar-de-deficit-historico-brigada-militar-tem-343-policiais-cedidos-para-outros-orgaos-ck9ylkbyj007g015nalm2axs2.html

In the comments (**Table 75**), the residents' concern with the lack of security and thefts (five comments), insufficient public lighting (four comments), and the need for more police officers in the streets, especially at night (four comments), are highlighted.

Table 75 Residents' comments on *security*, organized by building

	3.7 Regarding the previous items (PUBLIC SAFETY), would you like to leave any comments (optional)?
UTOPIA E LUTA	We live at the top of the stairs, near a viaduct. Without any security and with a lot of robberies, and we feel very fragile about security.
	Disregard for public safety, poor service to people. Non-humanized care.
	More policing on the streets
	There are always many "suspicious people" on the stairs, both day and night.
SUL AMÉRICA	Use plainclothes police to gain more efficient access when arresting those who commit crimes.
	More night and night policing.
	During the day I see a lot of police, but at night I don't.
	I suggest that more police officers be made available to the residents of the Historic Centre.
	More security from police on the streets.
	Lack of overt policing and lighting.
BENTO GONÇALVES	Reports that there are robberies, even during the day. He claims that it is dark near the Independência Viaduct (on Salgado Filho). Bad lighting.
20 DE NOVEMBRO	Security as a good relationship and unity between neighbours.
	Street lighting is bad, dark, broken sidewalks.
	There is almost no street lighting.

In fourth place, the "sense of security in public places" was rated by 17% of interviewed residents (of the central region of POA) as excellent/good, by 40% as regular, and by 46% as bad/very bad. In fifth place, the "safety for children and teenagers to experience public places" was rated by 14% of interviewed residents (of the central region of POA) as excellent/good, by 31% as regular, and by 48% as bad/very bad (7% not applicable). In the

state of RS, the number of intentional violent deaths of children and adolescents (between 0 and 19 years old) was 284 in 2019 and 199 in 2020 (FBSP, 2021[57]).

As shown in **Table 76**, regarding all the *security* indicators, it can be inferred that there is *deprivation* (bad subjective = 0.402 + bad objective QoL). Thus, it is necessary to improve the evaluation criteria, include cross-data analysis and seek investments in the area, especially in decreasing the number of crimes and increasing security in public spaces at night.

Table 76 *Security* indicators proposed by NBR 37120 (2017), and the QoL types

SECURITY				
QoL SUBJECTIVE INDICATOR	QoL type (subjective)	NBR 37120/2017 (QoL OBJECTIVE INDICATORS)	QoL type (objective)	QOL type
Feeling of security when accessing your building during the day (3.2)	bad	Violent crime rate per 100,000 inhabitants (14.5)	bad	DEPRIVATION
Quality of public lighting (3.6)	bad		bad	
Policing quality (3.5)	bad	Number of police officers per 100 000 inhabitants (14.1)	bad	
		Police response time from first call (14.4)	bad	
Sense of security in public places (3.1)	bad	Number of homicides per 100,000 inhabitants (14.2)	bad	
Safety for children and teenagers to experience the public places (3.4)	bad		bad	
Feeling of security when accessing your building at night (3.3)	bad	Crimes against property per 100,000 inhabitants (14.3)	bad	

Table 77 summarizes the subjective QoL index and the QoL type (*deprivation*) regarding the *security* dimension.

Table 77 QoL types regarding the *security* dimension

SECURITY		QoL type (subjective)	QoL type (objective)	QoL type
QoL subjective indicator				
Feeling of security when accessing your building during the day (3.2)	0,577	bad	bad	deprivation
Quality of public lighting (3.6)	0,512	bad	bad	
Policing quality (3.5)	0,435	bad	bad	
Sense of security in public places (3.1)	0,381	bad	bad	
Safety for children and teenagers to experience the public places (3.4)	0,339	bad	bad	
Feeling of security when accessing your building at night (3.3)	0,256	bad	bad	

In the analysis by building (**Table 78**), residents of the Sul América had a more positive perception (41% excellent/good), possibly related to the fact that the building has a 24-hour reception (concierge). The other buildings show a negative perception of *security* in the

[57] https://forumseguranca.org.br/anuario-brasileiro-seguranca-publica/

neighbourhood, in the following sequence: 20 de Novembro (64% bad/very bad), Utopia e Luta (54% bad/very bad) and Bento Gonçalves (50% bad/very bad).

Table 78 Results in percentages of the perception of *security* in the neighbourhood, organized by building

Residents' Responses		TOTAL (all buildings)			
QoL subjective indicator		E./G.	Regular	B./V.B.	N.A.
SECURITY	Sense of security in public places (3.1)	17%	40%	43%	0%
	Feeling of security when accessing your building during the day (3.2)	55%	21%	24%	0%
	Feeling of security when accessing your building at night (3.3)	14%	17%	67%	2%
	Safety for children and teenagers to experience the public places (3.4)	14%	31%	48%	7%
	Policing quality (3.5)	24%	38%	38%	0%
	Quality of public lighting (3.6)	38%	33%	29%	0%
	Total	27%	30%	**41%**	2%
SUL AMÉRICA		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
SECURITY	Sense of security in public places (3.1)	27%	60%	13%	0%
	Feeling of security when accessing your building during the day (3.2)	87%	0%	13%	0%
	Feeling of security when accessing your building at night (3.3)	33%	33%	33%	0%
	Safety for children and teenagers to experience the public places (3.4)	13%	60%	20%	7%
	Policing quality (3.5)	27%	67%	7%	0%
	Quality of public lighting (3.6)	60%	27%	13%	0%
	Total	**41%**	**41%**	17%	1%
UTOPIA E LUTA		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
SECURITY	Sense of security in public places (3.1)	7%	43%	50%	0%
	Feeling of security when accessing your building during the day (3.2)	43%	29%	29%	0%
	Feeling of security when accessing your building at night (3.3)	0%	7%	93%	0%
	Safety for children and teenagers to experience the public places (3.4)	14%	21%	64%	0%
	Policing quality (3.5)	21%	21%	57%	0%
	Quality of public lighting (3.6)	14%	**57%**	29%	0%
	Total	17%	30%	**54%**	0%
BENTO GONÇALVES		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
SECURITY	Sense of security in public places (3.1)	29%	14%	57%	0%
	Feeling of security when accessing your building during the day (3.2)	29%	43%	29%	0%
	Feeling of security when accessing your building at night (3.3)	14%	14%	71%	0%
	Safety for children and teenagers to experience the public places (3.4)	14%	14%	57%	14%
	Policing quality (3.5)	43%	0%	57%	0%
	Quality of public lighting (3.6)	43%	29%	29%	0%
	Total	29%	19%	**50%**	2%
20 DE NOVEMBRO		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
SECURITY	Sense of security in public places (3.1)	0%	17%	83%	0%
	Feeling of security when accessing your building during the day (3.2)	33%	33%	33%	0%
	Feeling of security when accessing your building at night (3.3)	0%	0%	83%	17%
	Safety for children and teenagers to experience the public places (3.4)	17%	0%	67%	17%
	Policing quality (3.5)	0%	50%	50%	0%
	Quality of public lighting (3.6)	33%	0%	67%	0%
	Total	14%	17%	**64%**	6%

5.3.1.7 Environmental comfort

The *Environmental comfort* dimension was classified in fourth place in the ranking of relevance for the QoL, with 38% of respondents indicating it. In terms of the perception of residents about the neighbourhood, only 23% showed a positive perception, 30% regular and 47% negative in relation to *environmental comfort* (**Figure 75**). Thus, this construct was the last (out of seven) on the satisfaction scale in the residents' perception. This is seen in some frequent terms in the content analysis such as *noise and air pollution*, *dirty*, and *poorly maintained pavements*.

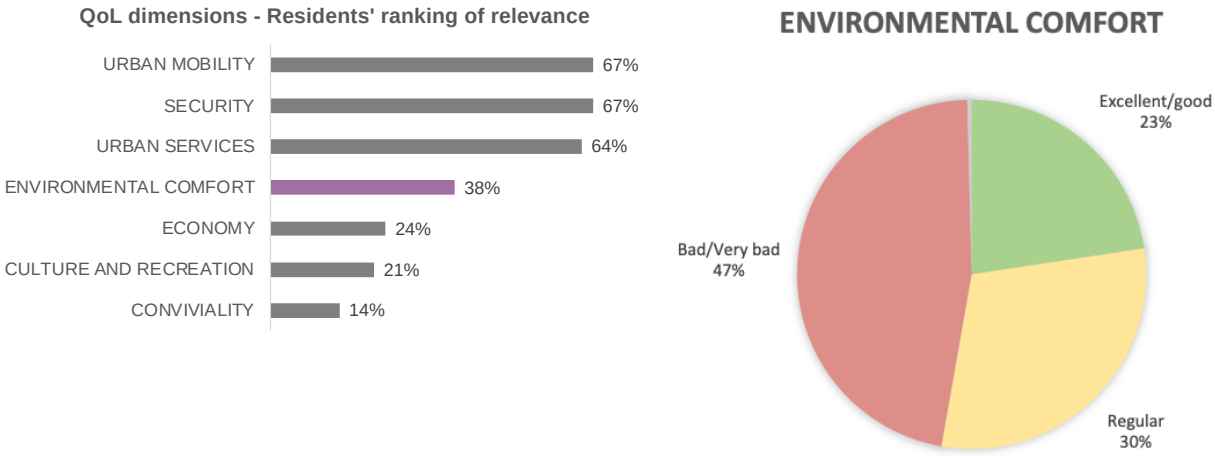

Figure 75 Residents' ranking of relevance for the QoL dimensions and the *environmental comfort* satisfaction graph

In first place, the "view from the window of your apartment (to the external space)" had a more positive perception, with 48% of responses classified as excellent/good, 24% regular, and 26% as bad/very bad (2% not applicable) (**Table 79**).

Table 79 Results of the perception of *environmental comfort* in the neighbourhood

ENVIRONMENTAL COMFORT			QUESTIONNAIRE SCALE						ACCUMULATED SCALE		
QoL subjective indicator			Excellent	Good	Regular	Bad	Very bad	N. A.	E./G.	Regular	B./V.B.
1	View from the window of your apartment (to the external space) (5.6)	0,536	10%	38%	24%	14%	12%	2%	48%	24%	26%
2	Street afforestation (5.3)	0,440	2%	19%	40%	29%	10%	0%	21%	40%	38%
3	Drainage and sewer system (flooding and bad odour) (5.5)	0,440	2%	29%	36%	10%	24%	0%	31%	36%	33%
4	Cleanliness of public places (sidewalks, streets, green areas, etc.) (5.4)	0,411	2%	17%	45%	14%	21%	0%	19%	45%	36%
5	Air pollution (feeling when breathing) (5.2)	0,298	2%	7%	29%	31%	31%	0%	10%	29%	62%
6	Noise pollution (5.1)	0,185	2%	5%	7%	36%	50%	0%	7%	7%	86%
ENVIRONMENTAL COMFORT INDEX		0,396						TOTAL	23%	30%	47%

In second place, the "street afforestation" was rated by 21% of interviewed residents as excellent/good, by 40% as regular, and by 38% as bad/very bad. POA is the fourth placed

Brazilian city in the ranking of urban afforestation, with 82.9% of the area covered, behind only Goiânia (89.5%), Campinas (88.4%), and Belo Horizonte (83%) (IBGE, 2012). It is estimated that there are about 1.3 million trees along public roads, not including green areas (SMAMUS, 2021), with 82.7% of urban households located on public streets with trees (IBGE, 2010). Despite the goal announced by the PMPA of planting a total of 4.7 thousand trees in 2020, it was not possible to identify the *number of trees planted annually per 100,000 inhabitants*, an *urban planning* support indicator suggested by NBR 37120 (2017, p. 61). There seems to be a *dissonance*, which might be related to the dissatisfaction of residents with the small number of trees, and the inadequate pruning of existing vegetation (four comments) (**Table 80**).

Table 80 Residents' comments on *environmental comfort*, organized by building

	5.7 Regarding the previous items (ENVIRONMENTAL COMFORT), would you like to leave any comments (optional)?
UTOPIA E LUTA	Opening the window and seeing everything polluted and grey depresses.
	A lot of noise, pollution.
	Check trees that are too old and are at risk of falling
SUL AMÉRICA	Put grids in the drains, prevent the rubbish from being accumulated there, and improve their cleaning. Encourage campaigns with the people. Place specific bins in front of the Public Market for disposal: light bulbs, batteries, electronic material, oil, plastic, for greater efficiency.
	Planting in the Borges' Democratic Corner construction site and large potted plants on Rua dos Andradas.
BENTO GONÇALVES	He complains about the discomfort generated by the presence of street vendors, as well as the dirt they leave on the pavement, and the smell of sewage on rainy days. View from his apartment: bad, as it is too close to the neighbouring building, and it gets very hot in summer.
	Good noise level as his apartment faces the back (no noise). He mentions the need to prune trees to prevent branches falling.
	Fear of old trees falling. Cleanliness is good, but people are uncooperative.
	Back apartment. People throw a lot of rubbish out the window.
20 DE NOVEMBRO	I would like to live in the countryside, in contact with nature.
	Whenever it rains it floods everything, sewage overflows and many rats and cockroaches come out, it's a horror.
	There should be more trees. There are rats when it rains.
	Dirty streets and poor sanitation.

Also, regarding the comments about *environmental comfort,* the dissatisfaction of residents with the following aspects is highlighted: noise pollution, air pollution (two comments), and dirty streets, sometimes linked to the presence of street vendors.

In third place, the “drainage and sewage system (flooding and bad odour)” was rated by 31% of interviewed residents as excellent/good, by 36% as regular, and by 33% as bad/very bad. NBR 37120 (2017, p. 63-66) suggests the use of five essential *sewage* indicators, which are discussed below and linked to the perception of the residents.

The Municipal Department of Water and Sewage (Departamento Municipal de Água e Esgotos - DMAE) is responsible for the collection, treatment, and distribution of water, as well as for the collection and treatment of sanitary sewage in POA. The percentage of the city’s population served by sewage collection systems (NBR 37120, 2017, p. 63) in POA in 2019 was 91.3%, and *20% of sewage collection in the city did not receive any treatment in 2019* (NBR 37120, 2017, p. 64) (DMAE in Anuário Estatístico POA[58], 2019, p. 99). It was not possible to identify the type of treatment of the 80% of treated sewage (primary, secondary, or tertiary), as suggested by NBR 37120 (2017, p. 64-66).

It is also important to verify the quality of services based on the amount of spillage registered in the sewage collection networks, that is, the undue flow of sewage onto public roads due to the rupture or obstruction of sewage networks. In 2019, POA had 12,293 spillages, with a total duration of 412,816 hours.

In fourth place, the “cleanliness of public places (pavements, streets, green areas, etc.)” was rated by 19% of interviewed residents as excellent/good, by 45% as regular, and by 36% as bad/very bad. According to the PMPA (2021), the Municipal Department of Urban Cleaning (*Departamento Municipal de Limpeza Urbana* - DMLU[59]) carries out (through an outsourced company) the weeding and sweeping of the streets and avenues in POA. The service is extended from October to March, months when the temperature is warmer, and vegetation grows faster (PMPA, 2021).

Moreover, the city's streets and avenues are periodically manually swept, based on the schedule of the Cleaning and Collection Division (*Divisão de Limpeza e Coleta* - DLC), and operated by the Cooperative for Work, Production and Marketing of Self-Employed Workers in the Favelas of POA (Cootravipa). The main streets and avenues are swept daily. However, the streets where the buildings under study are located are not on the list of streets swept daily (DMLU, 2021). In April 2021, the municipality of POA acquired mechanized sweeping equipment, which can sweep up to 12,000 km per year. The work is carried out from 11:00

[58] http://lproweb.procempa.com.br/pmpa/prefpoa/smpeo/usu_doc/AnuarioEstatistico_2019-pronto.pdf
[59] http://www2.portoalegre.rs.gov.br/dmlu/

pm to 5:00 am, so as not to disturb traffic. In addition, manual sweeping, carried out throughout the city, covers 480,000 kilometres per year (DMLU, 2021). There are 0.48 sweepers for every 1,000 inhabitants, covering 1.25 km per day per sweeper (DMLU/SNIS, 2019).

In fifth position, "air pollution" was rated by 10% of interviewed residents as excellent/good, by 29% as regular, and by 62% as bad/very bad. Air quality control is essential to avoid exposure to pollution particles, thereby preventing a series of respiratory and heart diseases (NBR 37120, 2017, p. 18). NBR 37120 (2017, p. 18-20) suggests the use of three essential *air quality (environment)* indicators: concentration of fine particulate material (PM 2.5), concentration of fine particulate material (PM 10), and greenhouse gas emissions, measured in tons per capita. Also, NBR 37120 (2017, p. 21-23) suggests the use of two *air quality (environment)* support indicators: NO2 concentration (nitrogen dioxide), SO2 (sulphur dioxide) concentration, and O3 concentration (ozone).

According to Resolution 03 (1990) of the National Environmental Council (*Conselho Nacional de Meio Ambiente* - CONAMA), the legal entity responsibility for monitoring air quality rests with the state of RS (PMPA, 2021). The air quality indices used by the State Foundation for Environmental Protection (Fundação Estadual de Proteção Ambiental - FEPAM[60], 2020, p. 44) meet the air quality standards of CONAMA Resolution 491 (2018) and coincide with the air pollutants suggested by NBR 37120 (2017). In 2020 there were five automatic monitoring stations in operation in the metropolitan region of POA (FEPAM, 2021, p. 1). The air quality was considered *good* on 95% of days, and *regular* (tolerable) on 5% of days (FEPAM, 2021, p. 2).

In 2009, SMAMS/PMPA started monitoring air quality in POA, with the inauguration of the Central Station, on Avenida Senador Salgado Filho, Azenha Station, inaugurated in 2010, and Humaitá Station, inaugurated in 2013. However, due to lack of investment, since 2015, the POA City Council has deactivated the three existing monitoring stations (PMPA, 2021). As of 2018, through the *Pacto Alegre* initiative, a project that aims to develop innovative actions through partnerships with the government and the private sector, low-cost air quality monitoring stations were installed in the city (two of them in the central area), whose monitoring can be followed online. However, these data are not analysed and made available

[60] http://www.fepam.rs.gov.br/

in a systematic way. Thus, there seems to be a *dissonance*, which might be related to the insufficient number of monitoring air quality stations in the central area of POA.

Finally, with the lowest degree of satisfaction among all aspects of QoL, "noise pollution" is rated 7% excellent/good, 7% regular, and 86% bad/very bad. Decree No. 8185 (1983)[61] establishes standards for emission and emission of noise and vibration in POA and defines *noise pollution* as any emission of sound that is offensive or harmful to the health, safety, and well-being of the community (DECREE 8185, 1983, p.1).

Also, NBR 37120 (2017, p. 23) suggests a *noise pollution (environment)* support indicator: *identify the areas of the city where noise exceeds 55 dB, estimate the population of this area, and divide by the total population of the city (result must be expressed as a percentage).* During the day, maximum exposure to 55 decibels (dB) is recommended and, at night, to avoid sleep deprivation, 50 dB (NBR 37120, 2017, p. 23).

Data released by SMAMS in 2016 showed that several POA regions had noise emissions above acceptable levels. The central area was the most critical, with results between 75 and 80 dB, especially around the main bus station and in the three perimeter avenues (greater flow of vehicles), especially in the location of viaducts (PMPA/SMAMS, 2016). However, POA does not have a systematic control of noise pollution.

According to NBR 10151 (2000)[62], the environmental noise for mixed-use commercial and administrative locations, such as the central area of the POA, must be a maximum of 60 dB during the day and 55 dB at night. In a study released in 2018, which included 352 measurements, the average of the central region of POA was 71.3 dB, above the recommended level of 60 dB (Schimitt et al., 2018). The area adjacent to the main Bus Station, at the Rui Barbosa terminal and at the Conceição Viaduct, had sound pressure levels close to 80dB. Conversely, there are quieter green spaces, such as Farroupilha Park, which had a sound pressure level of 56 dB. Thus, on the one hand, vehicle traffic on the road system is the main source of noise, hence the importance of proper inspection. On the other hand, green areas offer hearing relief in urban centres (Schimitt et al., 2018). This study points out the urgent need for specific legislation for the elaboration of the Porto Alegre Noise Map (Schimitt et al., 2018).

[61] http://www2.portoalegre.rs.gov.br/netahtml/sirel/atos/decreto%208185.pdf
[62] https://www.sema.df.gov.br/wp-conteudo/uploads/2017/09/NBR-10151-de-2000.pdf

Table 81 presents the QoL types regarding the *environmental comfort* dimension, in which the "street afforestation", and "air pollution" can be highlighted, with QoL type *dissonance*.

Table 81 *Environmental comfort* indicators proposed by NBR 37120 (2017), and the QoL types

ENVIRONMENTAL COMFORT				
QoL SUBJECTIVE INDICATOR	**QoL type (subjective)**	**NBR 37120/2017 (QoL OBJECTIVE INDICATORS)**	**QoL type (objective)**	**QOL type**
View from the window of your apartment (to the external space) (5.6)	bad			
Street afforestation (5.3)	bad	Percentage of native species (8.8)		
		Number of trees planted annually per 100,000 inhabitants (19.2)	good	DISSONANCE
Drainage and sewer system (flooding and bad odour) (5.5)	bad	Percentage of the city's population served by sewage collection and removal systems (20.1)	bad	DEPRIVATION
		Percentage of sewage collection in the city that has not received any treatment (20.2)	bad	
		Percentage of sewage in the city that receives primary treatment (20.3)		
		Percentage of sewage in the city that receives secondary treatment (20.4)		
		Percentage of sewage in the city that receives tertiary treatment (20.5)		
Cleanliness of public places (sidewalks, streets, green areas, etc.) (5.4)	bad		bad	DEPRIVATION
Air pollution (feeling when breathing) (5.2)	bad	Concentration of fine particulate matter (PM 2.5) (8.1)	good	DISSONANCE
		Concentration of particulate matter (PM 10) (8.2)		
		Emission of greenhouse gases, measured in tons per capita (8.3)		
		NO2 (nitrogen dioxide) concentration (8.4)		
		SO2 (sulphur dioxide) concentration (8.5)		
		Concentration of O3 (ozone) (8.6)		
Noise pollution (5.1)	bad	Noise pollution (support indicator) (8.7)	bad	DEPRIVATION

Table 82 summarizes the subjective QoL index and the QoL types regarding *environmental comfort* dimension.

Table 82 QoL types regarding the *environmental comfort* dimension

ENVIRONMENTAL COMFORT QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
View from the window of your apartment (to the external space) (5.6)	0,536	bad		
Street afforestation (5.3)	0,440	bad	good	*dissonance*
Drainage and sewer system (flooding and bad odour) (5.5)	0,440	bad	bad	deprivation
Cleanliness of public places (sidewalks, streets, green areas, etc.) (5.4)	0,411	bad	bad	deprivation
Air pollution (feeling when breathing) (5.2)	0,298	bad	good	*dissonance*
Noise pollution (5.1)	0,185	bad	bad	deprivation

In the analysis by building (**Table 83**), the perception regarding the *environmental comfort* is negative in all buildings: Utopia e Luta (50% bad/very bad), 20 de November (50% bad/very bad), Sul America (46% bad/very bad) and Bento Gonçalves (40% bad/very bad). In 20 de November, unlike the other buildings, the negative perception in relation to the "drainage and

sewage system (flooding and bad odour)" stands out, with 83% of bad/very bad responses, possibly related to bad smell and flooding on rainy days (three comments).

Table 83 Results in percentages of the perception of *environmental comfort* in the neighbourhood, organized by building

Residents' Responses		TOTAL (all buildings)			
QoL subjective indicator		E./G.	Regular	B./V.B.	N.A.
ENVIRONMENTAL COMFORT	Noise pollution (5.1)	7%	7%	86%	0%
	Air pollution (feeling when breathing) (5.2)	10%	29%	62%	0%
	Street afforestation (5.3)	21%	40%	38%	0%
	Cleanliness of public places (sidewalks, streets, green areas, etc.) (5.4)	19%	45%	36%	0%
	Drainage and sewer system (flooding and bad odour) (5.5)	31%	36%	33%	0%
	View from the window of your apartment (to the external space) (5.6)	48%	24%	26%	2%
	Total	23%	30%	**47%**	0%
SUL AMÉRICA		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
ENVIRONMENTAL COMFORT	Noise pollution (5.1)	7%	7%	87%	0%
	Air pollution (feeling when breathing) (5.2)	13%	33%	53%	0%
	Street afforestation (5.3)	20%	33%	47%	0%
	Cleanliness of public places (sidewalks, streets, green areas, etc.) (5.4)	13%	60%	27%	0%
	Drainage and sewer system (flooding and bad odour) (5.5)	47%	33%	20%	0%
	View from the window of your apartment (to the external space) (5.6)	40%	20%	40%	0%
	Total	23%	31%	**46%**	0%
UTOPIA E LUTA		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
ENVIRONMENTAL COMFORT	Noise pollution (5.1)	0%	0%	100%	0%
	Air pollution (feeling when breathing) (5.2)	0%	21%	79%	0%
	Street afforestation (5.3)	0%	57%	43%	0%
	Cleanliness of public places (sidewalks, streets, green areas, etc.) (5.4)	7%	57%	36%	0%
	Drainage and sewer system (flooding and bad odour) (5.5)	21%	50%	29%	0%
	View from the window of your apartment (to the external space) (5.6)	50%	36%	14%	0%
	Total	13%	37%	**50%**	0%
BENTO GONÇALVES		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
ENVIRONMENTAL COMFORT	Noise pollution (5.1)	29%	0%	71%	0%
	Air pollution (feeling when breathing) (5.2)	14%	43%	43%	0%
	Street afforestation (5.3)	86%	0%	14%	0%
	Cleanliness of public places (sidewalks, streets, green areas, etc.) (5.4)	29%	29%	43%	0%
	Drainage and sewer system (flooding and bad odour) (5.5)	29%	**43%**	29%	0%
	View from the window of your apartment (to the external space) (5.6)	43%	14%	43%	0%
	Total	38%	21%	**40%**	0%
20 DE NOVEMBRO		**E./G.**	**Regular**	**B./V.B.**	**N.A.**
ENVIRONMENTAL COMFORT	Noise pollution (5.1)	0%	33%	67%	0%
	Air pollution (feeling when breathing) (5.2)	17%	17%	67%	0%
	Street afforestation (5.3)	0%	67%	33%	0%
	Cleanliness of public places (sidewalks, streets, green areas, etc.) (5.4)	50%	0%	50%	0%
	Drainage and sewer system (flooding and bad odour) (5.5)	17%	0%	83%	0%
	View from the window of your apartment (to the external space) (5.6)	67%	17%	0%	17%
	Total	25%	22%	**50%**	3%

5.3.2 Summary and discussion of the Data Confrontation between Subjective and Objective Indicators

This section presents the summary and discussion of the data confrontation between subjective and objective indicators presented in Section 5.3.1. The following aspects can be highlighted.

Regarding the assessment of the *objective QoL* in the urban centre of POA, 78 of the 100 indicators proposed by NBR 37120 (2017) were considered, in addition to the urban analysis carried out. However, the lack of targets and control values for the proposed indicators of NBR 37120 (2017) is one of its limitations in evaluating the QoL. Another limitation of the standard is the exclusion of indicators related to *cultural* and *conviviality* aspects.

Hence, from the difficulties in identifying the objective indicators in the Brazilian context, the following can be pointed out: dispersion of indicators in different sources, greater difficulty in finding specific data from POA (only available from states in Brazil), different measurement units used, and lack of updated data, especially for the city of POA. It was not possible to identify objective indicators of *conviviality*. This can therefore be pointed out as a limitation in assessing the objective QoL.

As for the assessment of the *subjective QoL* in the urban centre of POA, the residents' ranking of relevance for the QoL vertical dimensions, and its relation with the results of the satisfaction survey is summarized in **Table 84**. It helps to understand what is most relevant in the perception of residents and how these living conditions are perceived in their experience in the neighbourhood. In the ranking of relevance for the QoL vertical dimensions, *urban mobility* (67%), *security* (67%) and *urban services* (64%) were the dimensions identified as most important for QoL. *Urban services* stand out as the dimension of greatest satisfaction (63% excellent/good responses), however, the compiled results of the satisfaction survey (**Figure 76**) shows that *security* (41% bad/very bad responses), in sixth place, needs more investment, especially in preventing crime and increasing security at night. *Environmental comfort* (47% bad/very bad responses), in last place of the survey, also needs more investments, especially in reducing noise and air pollution.

Table 84 Residents' ranking of relevance of the QoL vertical dimensions and the relation with the results of the satisfaction survey

QoL vertical dimensions: Residents' ranking of relevance			**Subjective QoL:** Survey of satisfaction results		Excellent /good	Regular	Bad/Very bad	Not applicable
1	URBAN MOBILITY	67%	3	URBAN SERVICES	63%	21%	13%	2%
2	SECURITY	67%	5	ECONOMY	58%	19%	18%	5%
3	URBAN SERVICES	64%	6	CULTURE AND RECREATION	49%	25%	22%	4%
4	ENVIRONMENTAL COMFORT	38%	1	URBAN MOBILITY	48%	27%	20%	4%
5	ECONOMY	24%	5	CONVIVIALITY	43%	23%	22%	12%
6	CULTURE AND RECREATION	21%	2	SECURITY	27%	30%	41%	2%
7	CONVIVIALITY	14%	4	ENVIRONMENTAL COMFORT	23%	30%	47%	0%

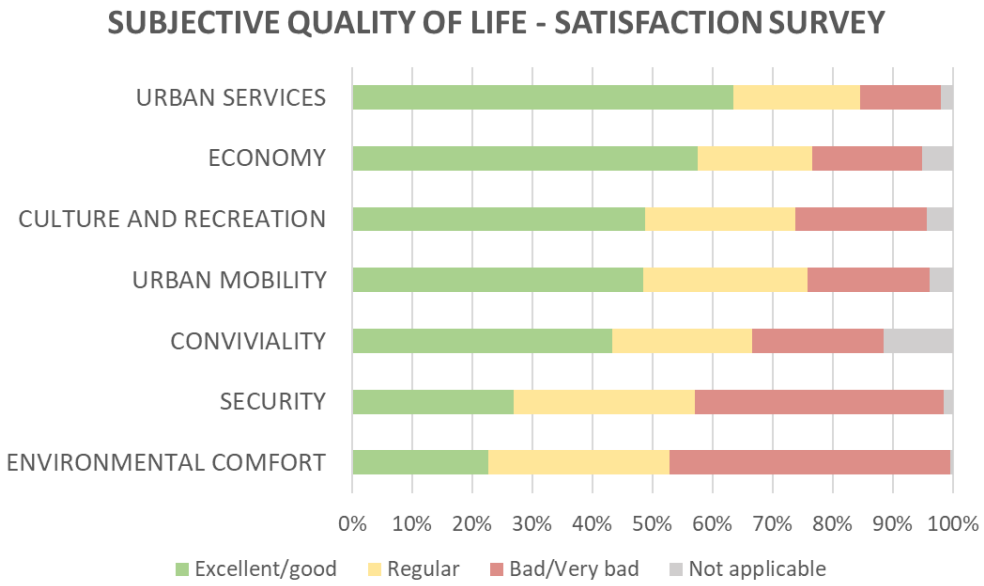

Figure 76 Compiled results of the satisfaction survey

The identification of the *QoL types*, based on Zapf's (1979) welfare model (as presented in Section 5.1.1), was carried out. This analysis should consider just two categories, that is, *good QoL* (0.600 to 1.000 QoL index), and *bad QoL* (0.000 to 0.599). As this study does not propose an objective QoL index, the identification of the objective QoL types was carried out through measures considered adequate in the existing literature on urban indicators.

Thus, *well-being* (good subjective and objective QoL), which may be considered an ideal situation, was identified in ten of the 42 QoL indicators; *deprivation* (bad subjective and objective QoL), which may show where more investment is necessary, was identified in 23 of the 42 QoL indicators; *resignation* (good subjective and bad objective QoL) was identified in two of the 42 QoL indicators; and *dissonance* (bad subjective and good objective QoL) was identified in five of the 42 QoL indicators. **Table 85** presents the QoL types for all the 42 QoL indicators.

Table 85 QoL types for all the 42 QoL indicators

	URBAN SERVICES QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
1	Electrical energy supply (6.3)	0,774	good	good	well-being
2	Water supply (6.2)	0,679	good	bad	*resignation*
3	Solid waste collection (6.1)	0,649	good	good	well-being
4	Health services (6.5)	0,631	good	good	well-being
5	Education services (6.6)	0,571	bad	bad	deprivation
6	Internet services supply (6.4)	0,524	bad	good	*dissonance*
	URBAN SERVICES INDEX	0,708			

	ECONOMY QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
1	Diversity of commercial establishments (8.5)	0,935	good	good	well-being
2	Access to credit (payment conditions facilitated in commercial establishments) (8.4)	0,625	good	good	well-being
3	Existence of professional courses (computer, craft, hairdressing, etc.) (8.3)	0,601	good	good	well-being
4	Existence of activities related to tourism (8.6)	0,536	bad	bad	deprivation
5	Job opportunities (8.1)	0,512	bad	bad	deprivation
6	Cost of living (8.2)	0,429	bad	bad	deprivation
	ECONOMY INDEX	0,667			

	CULTURE AND RECREATION QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
1	Existence of places for cultural activities (artistic events, museums, theatres, cinemas) (4.4)	0,708	good	good	well-being
2	Number of urban green areas (parks) (4.1)	0,649	good	good	well-being
3	Existence of places for the practice of outdoor sports (4.3)	0,589	bad	bad	deprivation
4	Opportunities to participate in free cultural and artistic events (4.5)	0,506	bad	good	*dissonance*
5	Conservation of cultural heritage (buildings, houses, and public spaces) (4.6)	0,435	bad	bad	deprivation
6	Quality and maintenance of urban green areas (4.2)	0,417	bad	good	*dissonance*
	CULTURE AND RECREATION INDEX	0,625			

	URBAN MOBILITY QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
1	Ease of moving around on foot (to carry out daily activities) (2.4)	0,821	good	good	well-being
2	Ease of going from your home to other parts of the city (work, study, friends' houses, etc.) (2.3)	0,815	good	bad	*resignation*
3	Availability of public transport (number of lines and schedules) (2.2)	0,583	bad	bad	deprivation
4	Quality of public transport (comfort) (2.1)	0,571	bad	bad	deprivation
5	Quality and location of cycle paths (2.5)	0,381	bad	bad	deprivation
6	Quality and maintenance of sidewalks (2.6)	0,292	bad	bad	deprivation
	URBAN MOBILITY INDEX	0,583			

	CONVIVIALITY QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
1	Identification with the neighbourhood and people's pride in living in it (7.6)	0,613	good	good	well-being
2	People's respect for cultural, sexual, religious and political differences (7.5)	0,518	bad		
3	Opportunities to participate in condominium decisions (7.3)	0,512	bad	bad	deprivation
4	Conviviality and interaction with homeless people (7.2)	0,488	bad	bad	deprivation
5	Conviviality and interaction with the neighbourhood residents (7.1)	0,470	bad	bad	deprivation
6	Opportunities to participate in community activities (associations, artistic, religious groups, etc.) (7.4)	0,363	bad	bad	deprivation
	CONVIVIALITY INDEX	0,542			

	SECURITY QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
1	Feeling of security when accessing your building during the day (3.2)	0,577	bad	bad	deprivation
2	Quality of public lighting (3.6)	0,512	bad	bad	
3	Policing quality (3.5)	0,435	bad	bad	
4	Sense of security in public places (3.1)	0,381	bad	bad	
5	Safety for children and teenagers to experience the public places (3.4)	0,339	bad	bad	
6	Feeling of security when accessing your building at night (3.3)	0,256	bad	bad	
	SECURITY INDEX	0,458			

	ENVIRONMENTAL COMFORT QoL subjective indicator		QoL type (subjective)	QoL type (objective)	QoL type
1	View from the window of your apartment (to the external space) (5.6)	0,536	bad		
2	Street afforestation (5.3)	0,440	bad	good	*dissonance*
3	Drainage and sewer system (flooding and bad odour) (5.5)	0,440	bad	bad	deprivation
4	Cleanliness of public places (sidewalks, streets, green areas, etc.) (5.4)	0,411	bad	bad	deprivation
5	Air pollution (feeling when breathing) (5.2)	0,298	bad	good	*dissonance*
6	Noise pollution (5.1)	0,185	bad	bad	deprivation
	ENVIRONMENTAL COMFORT INDEX	0,396			

The analysis of the *inconsistent QoL type*, that is, *resignation* (good subjective and bad objective QoL) and *dissonance* (bad subjective and good objective QoL), are summarized in

Table 86. This can help to identify the causes of problems in the urban space, as well as guide future solutions and urban improvements.

Table 86 Analysis of inconsistent QoL type (resignation and dissonance)

QoL subjective indicator	QoL type (subjective)	QoL type (objective)	QoL type	Analysis
Water supply (6.2) (urban service)	good	bad	*resignation*	The resignation may be related to lack of culture of having access to clean water in public spaces, and government absorbing water loss expenditures.
Ease of going from your home to other parts of the city (2.3) (urban mobility)	good	bad	*resignation*	The resignation may be related to the existence of many bus lines in the central region of POA, although there is no subway system.
Internet services supply (6.4) (urban service)	bad	good	*dissonance*	In POA in 2019, 96.51% of households had access to internet services (IBGE, 2019). However, the download rate was 80% of the service contracted by the customer (Barão, 2018, p.132).
Opportunities to participate in free cultural and artistic events (4.5) (culture and recreation)	bad	good	*dissonance*	There are several free cultural options in the central area of POA. The dissonance seems to indicate the need for greater promotion of these places and events to the community.
Quality and maintenance of green urban areas (4.2) (culture and recreation)	bad	good	*dissonance*	In 2019, PMPA announced the revitalization of more than 600 green areas in the city, in an investment that would reach R$ 24 million. The dissonance may be linked to the fact that the renovation of the POA's green areas is still a recent project.
Trees on street (5.3) (environmental comfort)	bad	good	*dissonance*	POA is the fourth Brazilian city in the ranking of green area, with 82.7% of urban households located on public streets with trees. The dissonance might be related to the dissatisfaction of residents with the small number of trees in the central area, and inadequate pruning of existing vegetation.
Air pollution (5.2) (environmental comfort)	bad	good	*dissonance*	The dissonance might be related to the insufficient number of monitoring air quality stations in the central area of POA.

The “water supply” *resignation* (good subjective QoL = 0.679 + bad objective QoL) may be related to lack of access to clean water in public spaces, and government accepting high water loss expenditures. The occasional lack of water and the inadequate sewage treatment were also pointed out in the residents’ comments.

The “ease of going from your home to other parts of the city (work, study, friends' houses, etc.)” *resignation* (good subjective QoL = 0.815 + bad objective QoL) may be related to the existence of many bus lines in the central region of POA, although there is no subway system. The great need for a high-capacity public transport system in POA can be highlighted.

The “internet services” *dissonance* (bad subjective QoL = 0.524 + good objective QoL) seems to be related the download rate of 80% of the service contracted by the customer in the central region of POA, which is legally accepted, despite not being the nominal value contracted for the service (Barão et al., 2018, p. 132). Hence, it seems necessary to increase the mobile broadband signal distribution points, thus guaranteeing the use of 100% of the package contracted by the user (Barão et al., 2018, p. 132).

The “opportunities to participate in free cultural and artistic events” *dissonance* (bad subjective QoL = 0.506 + good objective QoL) as the central region of POA offers several free cultural options (such as visits to museums and cultural centres, street theatre festivals, street market options, musical shows at Parque Farroupilha and Parque Orla Moacyr Scliar, musical performances from Porto Alegre Symphony Orchestra, guided walks), seems to indicate the need for greater promotion of these places and events to the community, which could be organized by the City Council.

POA has 684 green areas, and, since November 2019, the maintenance and cleaning teams have been expanded from 10 to 24, reducing the gap between maintenance from 100 days to 45 days. In addition, in 2019 the municipal government (PMPA) announced the restoration of more than 600 green areas in the city, with an investment of BRL 24 million[63]. Hence, the “quality and maintenance of urban green areas” *dissonance* (bad subjective QoL = 0.417 + good objective QoL) may be linked to the fact that the renovation of the POA’s green areas is still a recent project and has not reached the green areas of the urban centre, with the exception of Praça Marechal Deodoro (Praça da Matriz), currently undergoing renovation.

POA is the Brazilian city with the fourth most green area, with 82.7% of urban households located on public streets with trees. Hence, the “trees on street” *dissonance* (bad subjective QoL = 0.440 + good objective QoL) might be related to the dissatisfaction of residents with the small number of trees in the central area and inadequate pruning of existing vegetation.

[63] USD 4,339,963 (on 18 November, 2021).

Air quality control is essential to avoid exposure to pollution particles, preventing a series of respiratory and heart diseases (NBR 37120, 2017, p. 18). There were five automatic monitoring stations in operation in 2020, located in the metropolitan region of POA (FEPAM, 2021, p. 1), and the air quality was considered *good* on 95% of days, and *regular* (tolerable) on 5% days (FEPAM, 2021, p. 2). However, these data are not analyzed and made available in a systematic way in POA. The "air pollution" *dissonance* (bad subjective QoL = 0.298 + good objective QoL) might be related to the insufficient number of monitoring air quality stations in the central area of POA.

5.3.3 Assessment of the Multidimensional Method to Evaluate the Urban Quality of Life (QoL)

The assessment of the proposed method was carried out through two focus groups by videoconference, due to the COVID-19 pandemic, and it is presented as follows.

5.3.3.1 Utility of the multidimensional method to evaluate the urban QoL

According to specialists from PROPUR/UFRGS, the *perception of the usefulness of the method and its results* is presented below. The focus group included the discussion on whether the proposed method can help in decision making related to planning and urban policies, as well as the location of social housing and improvement of the urban QoL.

The multidimensional urban QoL assessment method combines objective and subjective data. This is useful and advances in relation to existing methodologies in the Brazilian context, which tend to prioritize only objective data from secondary sources, sometimes limiting the usefulness of the methods available to the responsible institutions. Thus, the main potential of the method is related to its usefulness in directing actions and public policies in POA and in other Brazilian cities. In addition, the study collaborates by investigating the urban indicators proposed by NBR 37120 (2017).

The results of the method can be used to guide public policies, especially with regard to the location of social housing in the city. Moreover, they can drive urban improvements (regarding urban infrastructure and services) and investments in historic city centres, areas that is often underserved. The results are clear and precise through the adopted methodology and can be used to improve housing location. Public policies, therefore, can be guided by the

results represented by the indexes, aiming to improve the urban QoL. Additionally, once the aspects that generate lower QoL are identified, it is possible to generate a set of information to improve the urban integration of housing. The effective use, however, of this information requires joint action by public institutions.

Another highlighted potential advantage of the method is related to the inclusion of different areas of urban and human development, generating multidimensional results. The replicability of the method allows it to be applied in different cases and realities, enabling the identification of the users' perceptions of the urban environment and adequate housing conditions. In this way, the results can be used as a tool for urban planning. Moreover, the study collaborates with the mapping of buildings renovated for social housing in the urban centre of POA, presenting a diagnosis of perception and secondary data on the state of housing and inhabitants.

The method, therefore, seems to be suitable to evaluate the urban QoL. However, future studies, such as the identification of neighbourhoods and locations in the city that need greater investment and urban improvements that can positively impact the urban QoL, with greater participation of municipal public managers, are needed to verify the practical usefulness of the method. As for, the presentation of data, the word cloud clearly and visually presents the QoL results obtained in the assessment. This is an interesting contribution in relation to existing QoL methodologies. The use of hierarchy through different colours and word thicknesses can show public managers the most urgent urban improvements needed to enhance QoL.

According to public managers of the Municipal Planning Department (SMPAE) of the PMPA, the *perception of the usefulness of the method and its results* are aligned with the current need of the municipality to identify the perception of citizens in relation to urban conditions. The 156+POA[64] application could become a communication channel between public managers and POA citizens, but it is still under study. This is the official application of the SMPAE/PMPA, which aims to provide citizens with access to important information and public services offered by the city council.

Public managers believe that the assessment of QoL in POA is of great importance, not only in the central area but also in other neighbourhoods of the city. NBR 37120 (2017) seems to

[64] https://play.google.com/store/apps/details?id=br.gov.rs.portoalegre.app&hl=pt_BR&gl=US

be a good starting point for structuring urban indicators for POA. The opportunity to better discuss the possibilities of applying the method to assess QoL on the city scale was thus pointed out, and this is planned for 2022, together with other PROPUR researchers. From the focus group held with public managers, the opportunity to expand the exchange of information and contributions between PROPUR/UFRGS and the PMPA, regarding the assessment of urban QoL in POA, was mentioned.

5.3.3.2 Applicability of the multidimensional method to evaluate the urban QoL

According to specialists from PROPUR/UFRGS, the *perception of the method's ease of use*, and *the perception of ease of understanding the results* is presented below. The multidimensional urban QoL assessment method, despite its complexity, was considered easy to understand. The approach of subjective QoL (users' perceptions) together with the objective QoL, joined to the analysis of inconsistencies (dissonances and resignations), makes the method and results very clear. The representation of the framework of the method also shows that it needs to be revised as well as refined, especially with regard to indicators. This was pointed out as an essential step, considering the replication of this method in other urban contexts in Brazilian cities and states.

The identification of objective QoL was pointed out as a more viable stage of implementation. The identification of subjective QoL, however, may become unfeasible in practice. In addition to the partnership with the municipal public managers, it might be necessary to include the participation of social movements and other entities involved in issues related to social housing and urban QoL.

The results were identified as easy to understand, especially in the proposal of subjective QoL index values for each dimension and indicator. Thus, it is possible to identify more clearly which urban aspects need to receive investments and improvements. Furthermore, there was a suggestion to present the results more clearly for each building evaluated. The use of a single panel to present the results was also suggested as a strategy to facilitate their understanding and encourage discussion between those involved.

In addition, managers from the SMPAE/PMPA, also agreed with the *method's ease of use and the ease of understanding the results* and mentioned the following considerations. The continuous implementation of the method was identified as an opportunity by public

managers of POA, especially in sectors related to housing. The existence or not of a sector that could be responsible for this application was raised, and therefore, it might be of interest to set up a group of experts in the PMPA to develop the QoL assessment in POA, probably linked to ObservaPOA. Therefore, for future studies, a diagnosis with the PMPA can be considered, thus better identifying the demands and needs of the municipality. The discussion of results could be more relevant in view of the joint work between university and municipal public bodies.

Public managers also emphasized that the results of the method, especially from the proposal of QoL indexes, facilitate the understanding of which QoL dimensions need more investment. Given limited public resources, they pointed out that it is important to be able to have an overview of urban living conditions, which can guide decision-making. Thus, public policies and urban improvements must be proposed with great caution, foreseeing a suitable contribution to the improvement of urban conditions and public resources.

The importance of using visual devices and panels for the summarized presentation of results was also underlined. A few aspects were pointed out as limitations of the study, such as the non-representative sample of the study population, as well as the difficulty in identifying objective indicators related to the *conviviality* dimension of the urban QoL.

5.3.4 Multidimensional Method to Evaluate the Urban Quality of Life (QoL): final version

As a refinement of the method presented in Stage 2 (Section 5.2.2), after the analysis carried out in Stage 3, a final version of *the multidimensional method to evaluate the urban QoL* is proposed. The data collection with the residents and analysis of the collected data, as well as the evaluation of the proposed method with specialists from PROPUR/UFRGS and PMPA contributed to this refinement. The proposed method contributes to the multidimensional urban QoL assessment by identifying a set of QoL dimensions and indicators to evaluate the urban living conditions, including both the objective and the subjective QoL.

As presented in **Figure 77**, the method includes three main steps, which are discussed as follows: (a) Preparation for the evaluation of the multidimensional urban QoL; (b) Multidimensional urban QoL evaluation; and (c) Communication of results and discussion.

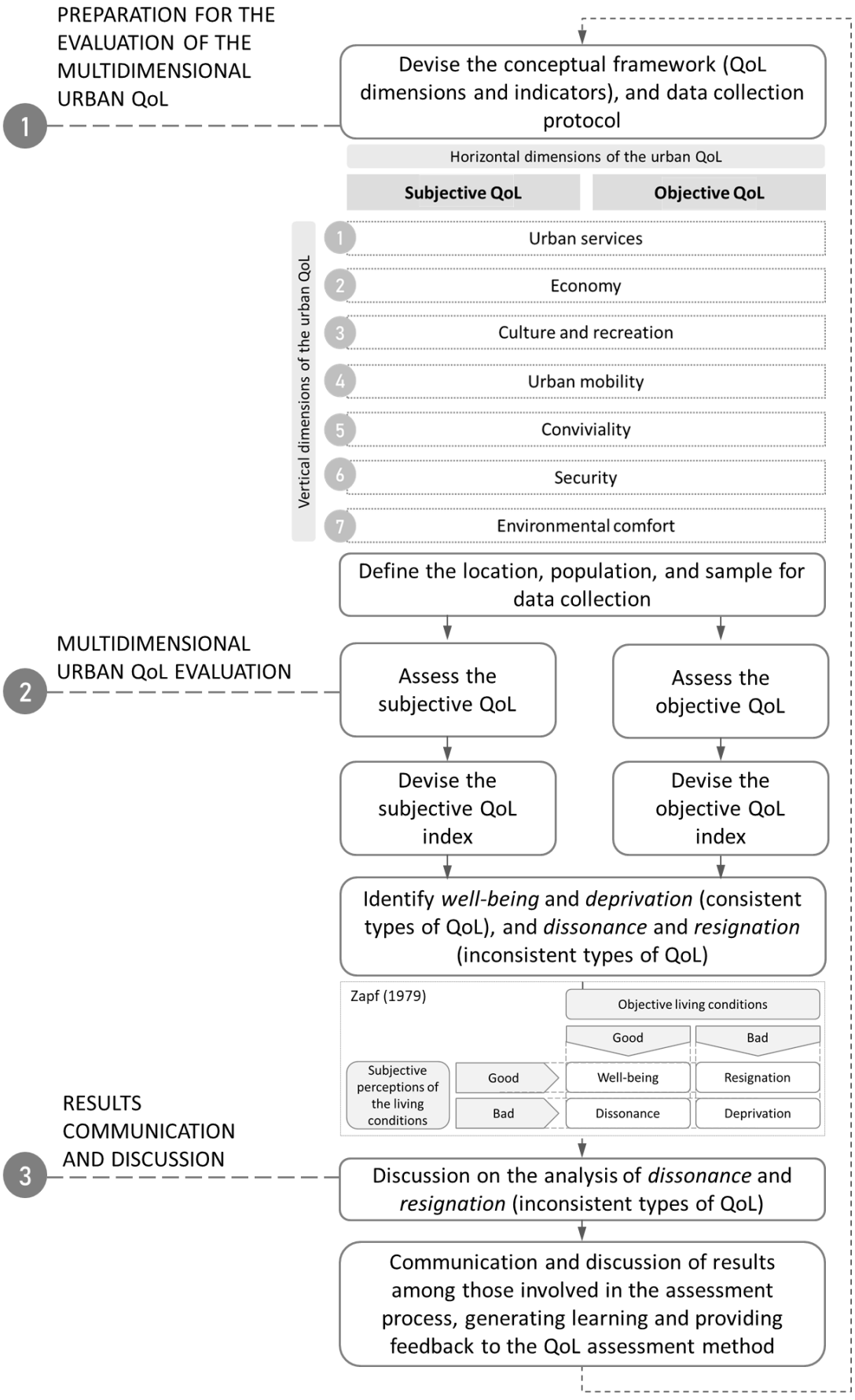

Figure 77 The final version of the multidimensional method to evaluate the urban QoL

5.3.4.1 Preparation of the multidimensional urban QoL evaluation (Step 1)

The *preparation of the multidimensional urban QoL evaluation* (Step 1 of the method) includes the elaboration of the conceptual framework (as previously presented in Section 5.2.1), in which the dimensions and indicators of the multidimensional urban QoL are defined. As *horizontal dimensions,* this method includes the objective and subjective QoL. As *vertical dimensions,* this method proposes the evaluation of seven dimensions related to the living conditions in urban centres (urban services; the economy; culture and recreation; urban mobility; conviviality; security; and environmental comfort). The vertical dimensions should be evaluated by the horizontal dimensions, that is, they should be objectively and subjectively evaluated. For each vertical dimension, six indicators of the urban QoL were proposed (42 in total) and are the basis of the data collection protocol (Appendix 3) to evaluate the subjective urban QoL of the residents.

Thus, these relevant aspects of the urban life should be objectively and subjectively assessed (external and internal evaluations). All dimensions are considered equally relevant in the QoL assessment: objective living conditions, satisfaction with living conditions, and the importance of these living conditions in people's lives (Felce & Perry, 1995). The conceptual framework can vary according to the specific historical and cultural aspects of each location to be analyzed. Therefore, in Step 1, the location and population for data collection must be defined, thus enabling the planning of the sample to be collected.

5.3.4.2 Multidimensional urban QoL evaluation (Step 2)

Multidimensional urban QoL evaluation (Step 2 of the method) is to *collect, organize and analyze data*. Initially, the data collection with the residents or users of the location to be analyzed is carried out, in order to identify their QoL perceptions of the neighbourhood, that is, to *assess the subjective QoL*. It should show whether people are satisfied or not with their living conditions, based on the conceptual framework devised in Step 1. In the case of this study, data collection was held with residents of four social housing buildings in the central urban area of POA. This data is then organized and analyzed throughout descriptive analysis, content analysis, and cluster analysis (multidimensional subjective QoL analysis presented in Section 5.2.3).

The subjective QoL index is then devised (as presented in Section 5.2.6), based on the methodology of the Human Development Index. The subjective QoL index generates a single metric that allows a simple aggregation across the multidimensions of the urban QoL, as well as a single metric for each subjective indicator. It is thus possible to represent satisfaction responses on a scale from 0 to 1.000 (with 1.000 being the highest QoL); 0 to 0.199 very low QoL; 0.200 to 0.399 low QoL; 0.400 to 0.599 medium QoL; 0.600 to 0.799 high QoL; and 0.800 to 1.000 very high QoL. The subjective QoL index allows for better communication, representation, and understanding of the collected data.

The objective indicators are then identified, usually based on government data (such as IBGE, PMPA, etc.). The indicators presented in NBR 37120 (2017) were therefore the starting point for identifying indicators to *assess the objective QoL*, that is, the objective life conditions in the central urban area of POA. The method also includes the elaboration of the objective QoL index, which, although not developed in this study, is suggested for future research and implementation.

At the end of the Step 2, the data confrontation between subjective and objective indicators is made, as presented in Sections 5.3.1 and 5.3.2. First, the identification of the QoL types, based on Zapf's (1979) welfare model, was carried out. This analysis should consider just two categories, that is, good QoL (0.600 to 1.000 QoL index), and bad QoL (0.000 to 0.599). As this study does not propose an objective QoL index, the identification of the objective QoL types was carried out through measures considered adequate in the existing literature on urban indicators.

5.3.4.3 Results communication and discussion (Step 3)

Results communication and discussion (Step 3 of the method) includes the discussion and analysis of the inconsistent QoL types, that is, to better understand examples of *resignation* (good subjective and bad objective QoL) and *dissonance* (bad subjective and good objective QoL), as presented in Section 5.3.2. For this reason, it is also suggested that in-depth interviews are made with the interviewees, in order to better identify the causes of these inconsistencies and the more abstract aspects that guide the experience of the city, that is, the user's values or desired end-states (ends). In this study, in-depth interviews were not performed due to restrictions imposed by the COVID-19 pandemic.

The development of visual devices to present the results of the multidimensional urban QoL evaluation can facilitate the interviewees' comprehension. It is also recommended that the evaluation be carried out in a systematic way, that is, with the planning of the data collection, clearly determining the frequency and steps of the application of the method. The results can then be compared from one year to another, for example, as well as between different neighbourhoods and different cities.

The method also suggests the discussion of the results by public managers and, subsequently, they be published and made available in the local community, and this can allow the refinement of the QoL indicators to match the real concerns of urban life. The communication and discussion on the objective living conditions and people's subjective perception of their own living conditions can contribute to a better understanding of the relevant aspects of the urban QoL and hence can help in the improvement of the urban QoL. Additionally, the dissemination and discussion of results between those involved in the assessment process can generate learning and provide feedback to the urban QoL evaluation method, which must be continually refined and adapted to the context to be evaluated.

Finally, despite not being part of the scope of the proposed method, its potential to contribute to the development of urban and housing policies is identified, aimed at better understanding urban living conditions, as well as the appropriate location for social housing. Moreover, the continued application of the method could contribute, not only to the assessment of the urban QoL, but to identify opportunities to improve urban living conditions, the adequate targeting of public investments, and the control of impacts generated in the city from these improvements. Furthermore, the systematic application of the proposed method and the adequate analysis of its results can generate periodic comparisons between different locations, such as neighbourhoods and cities. Thus, the results should be presented and discussed with potential users of the resulting information, that is, with public managers involved in urban planning.

6 CONCLUSIONS

This chapter presents the main conclusions and theoretical contribution of this study, as well as the main results. Finally, in order to contribute to research on the urban quality of life, suggestions for future research are indicated.

6.1.1 Conclusions and theoretical contribution

This study presents as a starting point the need to assess the impact of the built environment (aspects of the neighbourhood and housing environment) on the QoL of its residents, and by the lack of an instrument to assess the urban QoL that combines objective indicators and the perception of users (subjective indicators), especially in the context of renovated buildings for social housing in urban centres. Hence, this study originated from a gap in literature concerned with the need for new contributions to propose methods to assess the urban QoL.

Therefore, it aims to *propose a multidimensional method to evaluate the urban QoL in the context of the renovation of buildings for social housing*. Its specific aims are: (a) to propose a set of QoL indicators, considering the context of urban centres; and (b) to propose the inclusion of the users' perceptions in the assessment of the urban QoL (subjective QoL indicators).

This study addressed three main axes as a theoretical framework: (a) social housing and the opportunity to renovate underutilized buildings in urban centres; (b) the urban QoL and the contribution of the perception of value to better define and understand the multidimensional urban QoL; and (c) the assessment of the QoL of multidimensional urban life, including its objective and subjective dimensions, which are widely discussed in the studies on QoL assessment. The main theoretical contributions are now presented.

There is a wide discussion in the literature about the difficulty in defining QoL due to its complex nature. Many studies point to the diversity of the QoL definitions in the literature (Baker & Intagliata; 1982; Berhe et al., 2014; Cummins et al.; 1994; Dissart & Deller, 2000; Felce & Perry, 1995; Gomes et al., 2010; McCrea et al., 2006; Sirgy et al., 2006). Thus, a systematic literature review (SLR) on QoL was carried out (Chapter 3), aiming at a better understanding of the urban QoL approach, including its objective and subjective dimensions, to identify the urban QoL indicators and its evaluation methods.

The main results of the SLR are related to the identification of the need to assess the QoL considering the following three dimensions: objective living conditions, satisfaction with the living conditions, and the importance of the factors of living conditions in people's lives (Felce & Perry, 1995). This study therefore defines the QoL as a multidimensional concept, that is, several interrelated dimensions that constitute a holistic representation of a complex phenomenon (Sánchez-Fernández & Iniesta-Bonillo, 2007, p. 430) such as the QoL. Hence, the concept of QoL is broader than material aspects, economic production, or living standards: it is a multidimensional concept as it includes a variety of factors that people value in life (Rogge & Van Nijverseel, 2019, p. 766). As an important contribution, the multidimensional approach was also better understood through the literature's relation of perceived value (Sánchez-Fernández & Iniesta-Bonillo, 2007, p. 430) to the urban QoL.

This study proposes that the multidimensional urban QoL includes the *horizontal dimensions* (objective and subjective dimensions) and *vertical dimensions*, including relevant aspects of the living conditions, that should be objectively and subjectively assessed (people's perception). In this sense, it can be inferred that the objective and subjective dimensions have different assessment methodologies for certain living conditions: they are different perspectives of the evaluation of living conditions (external and internal evaluations). All dimensions are considered equally relevant in the QoL assessment. As defined by Gomes et al. (2010, p. 577), the urban QoL is an individual perception of the socio-territorial environment that should consider the subjective and objective, including individual and collective preferences and behaviours related to the urban environment.

In terms of the multidimensional QoL definition and assessment, a new approach is proposed: (a) the *objective QoL* is related to universal metrics expressed and understood by the individuals of a society or a group (the exogenous living conditions); and the *subjective QoL* is related to the endogenous perception of these living conditions by people (e.g., level of satisfaction). The concepts of the objective and subjective dimension were also better understood through the literature's relation of perceived value (Tillmann & Miron, 2020) to the QoL.

As its main contribution, thus, *this study proposes a multidimensional urban QoL evaluation method*, which includes three main steps (Chapter 5): (a) preparation for the evaluation of the multidimensional urban QoL; (b) multidimensional urban QoL evaluation; and (c) communication of results and discussion.

Preparation of the multidimensional urban QoL evaluation (Step 1 of the method) includes the elaboration of the conceptual framework, in which the dimensions and indicators of the multidimensional urban QoL are defined, based on the SLR. As *horizontal dimensions*, this method includes the objective and subjective QoL. As *vertical dimensions*, this method proposes the evaluation of seven dimensions related to the living conditions in urban centres: urban services; the economy; culture and recreation; urban mobility; conviviality; security; and environmental comfort. For each vertical dimension, six indicators of the urban QoL were proposed (42 urban QoL indicators in total).

Multidimensional urban QoL evaluation (Step 2 of the method) is to collect, organize, and analyze data. Data collection (primary data) with the residents or users of the location to be analyzed should be carried out, in order to identify their QoL perceptions of the neighbourhood, that is, to *assess the subjective QoL*. The subjective QoL index then generates a single metric that allows a simple aggregation across the multidimensions of the urban QoL, as well as a single metric for each subjective indicator. This is considered an important contribution of this study.

The objective indicators are then identified based on government data (such as IBGE, ObservaPOA, etc). The indicators presented in NBR 37120 (2017) were therefore the starting point for identifying indicators to assess the objective QoL, that is, the objective life conditions in the central urban area of POA. Thus, 78 of the 100 indicators proposed by NBR 37120 (2017) were considered. However, the lack of targets and control values for the proposed indicators of NBR 37120 (2017) is one of its limitations in evaluating the QoL. Another limitation of the standard is the exclusion of indicators related to cultural and conviviality aspects. This study highlights the importance of the inclusion of indicators related to social-cultural aspects, which have a great effect on QoL when assessing the multidimensional urban QoL.

Hence, when identifying the objective indicators in the Brazilian context, the following difficulties can be pointed out: dispersion of indicators in different sources; greater difficulty in finding specific data from POA (only available from states in Brazil); different measurement units used; and lack of updated data, especially for the city of POA. It was not possible to identify objective indicators of conviviality. This can therefore be seen as a limitation in assessing the objective QoL. The method framework also includes the elaboration of the objective QoL index, which, although not developed in this study, is

suggested for future research and implementation. At the end of Step 2, the data confrontation between subjective and objective indicators is made, in order to identify the QoL types, based on Zapf's (1979) welfare model. Therefore, another main contribution of this study is to propose a method that enable data confrontation from micro and macro evaluation of urban QoL.

The *communication of results and discussion* (Step 3 of the method) includes the discussion and analysis of the inconsistent QoL types, that is, to better understand examples of resignation (good subjective and bad objective QoL) and dissonance (bad subjective and good objective QoL). For this reason, it is also suggested that in-depth interviews are made with the interviewees in order to better identify the causes of these inconsistencies and the more abstract aspects that guide the experience of the city, that is, the user's values or desired end-states (ends). In this study, in-depth interviews were not performed due to restrictions imposed by the COVID-19 pandemic.

Another major contribution of this study concerns the implementation of the method with residents of four social housing buildings in the urban centre of POA, and the proposal of the subjective QoL index, between 0 and 1 (the closer to 1, the better the QoL), for each vertical dimension of the subjective QoL. Based on the residents' perceptions of the neighbourhood, the subjective QoL final index is 0.568, that is, a "medium subjective QoL". The most positive perception is related to *urban services* (0.708) *economy* (0.667), and *culture and recreation* (0.625). A medium QoL can be linked with *urban mobility* (0.583), *conviviality* (0.542), and *security* (0.458). The most negative perception (low QoL) is related to the *environmental comfort* (0.396).

Considering all the QoL indicators (42 in total), the economy indicator *diversity of commercial establishments* had the highest index of 0.935 (very high QoL), followed by the urban mobility indicators *ease of moving around on foot* (0.821 - very high QoL) and *ease of going from your home to other parts of the city* (0.815 - very high QoL). Therefore, aspects related to diversity, connectivity, and accessibility are characteristics that are positively perceived in the neighbourhood. Conversely, in the final positions in the ranking are the environmental comfort indicator *noise pollution* (0,185 - very low QoL), the security indicator *feeling of security when accessing your building at night* (0,256 - low QoL), and the urban mobility indicator *quality and maintenance of pavements* (0,292 - low QoL).

From the analysis by building, Sul América presents the best QoL index (0.595 – medium QoL), with emphasis on the high QoL for urban services (0.750), economy (0.708), and culture and recreation (0.667). Next, the Utopia e Luta and Bento Gonçalves buildings obtained a medium QoL index, with 0.577 and 0.548, respectively. The 20 de Novembro Squat stands out for the lowest QoL index of 0.277 (low QoL), with *conviviality* (0.188), *security* (0.167) and *culture and recreation* (0.104) with the lowest indexes, probably related to the fact that this building has not yet been renovated, negatively impacting the residents' perception of the neighbourhood.

Moreover, the identification of the QoL types, based on Zapf's (1979) welfare model was carried out. This analysis should consider just two categories, that is, good QoL (0.600 to 1.000 QoL index), and bad QoL (0.000 to 0.599). As this study does not propose an objective QoL index, the identification of the objective QoL types was carried out through measures considered adequate in the existing literature on urban indicators. Thus, well-being (good subjective and objective QoL), which may be considered an ideal situation, was identified in ten of the 42 QoL indicators; deprivation (bad subjective and objective QoL), which may show where more investment is necessary, was identified in 23 of the 42 QoL indicators; resignation (good subjective and bad objective QoL) was identified in two of the 42 QoL indicators; and dissonance (bad subjective and good objective QoL) was identified in five of the 42 QoL indicators. Incorporating the Zapf's model into a multidimensional method is an unprecedented contribution to QoL research.

Finally, despite not being part of the scope of the proposed method, the potential of the study to contribute to the development of urban and housing policies is highlighted in order to identify opportunities to improve urban living conditions, the appropriate location for social housing, the adequate targeting of public investments, in order to control the impact generated in the city from these improvements and to generate periodic comparisons between different locations, such as neighbourhoods and cities. The use of urban indicators can be a learning, communication, and management tool for different users like local government, citizens, researchers, and the private sector (Alibegović & Villa, 2008, p. 66) and can provide a background for the elaboration of strategies (Mora, 1997, p. 66), such as public policies for local development to improve well-being. Hence, it is expected that this method will contribute to QoL and housing research, as well as to housing policies.

This study therefore responds to its main goals, proposing a multidimensional method to evaluate the urban QoL in the context of the renovation of buildings for social housing, in central urban areas, which proposes 42 urban QoL indicators, including the objective and the subjective dimension (residents' perception) of the QoL.

6.1.2 Suggestions for future research

Based on this study, suggestions for future research related to the urban QoL are presented:

a) To propose better defined and applicable objective QoL indicators and QoL index, and to further investigate the indicators presented in NBR 37120 (2017) standard in order to better understand their application in Brazilian cities, as well as the possibility of establishing a scale of values to monitor these indicators (goals and indexes);

b) To expand the analysis of perceived value (use of value hierarchy map, not just user satisfaction survey) and of the relation (of “consistency” and “inconsistency” QoL types) between subjective and objective indicators through in-depth interviews;

c) To refine the proposed method (conceptual framework, data collection protocol, data processing, and presentation of results) based on its application with a greater number of people, with other segments of the society, in different urban contexts;

d) To systematically apply the QoL method in different Brazilian neighbourhoods and cities, proposing its use together with municipal public managers.

e) To expand the evaluation of the applicability and utility of the method, carrying out this step with a greater number of public managers; and

f) To present the results in a more systematic way, from the inclusion of visual devices, and highlighting the particularities of each building in the study.

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APPENDIX 1

St Basils staff semi-structure interview

St Basils staff semi-structure interview

Introduction

1. What is your job role in the housing association and main activities developed?
2. How long have you worked for this housing association?

Identification of the clients

1. Could you briefly describe the history of the housing association?
2. How Young homeless adults or potential homeless can find out about the work of this housing association?
3. Who are the main customers (i.e. tenants) of this housing association?
4. Could you briefly describe the housing unit provided to the tenants?

Understanding the housing development process

1. Could you tell us about the design process of new buildings and or refurbishment for housing schemes? Which are the main stages of the process, who are the parties involved and estimate a duration for each of them?
2. Within the context of the development of the housing schemes, which are the most critical moments or main challenges?
3. How does the briefing process occur? Which are its main activities and who is involved? (design briefing and specific design briefing)
4. Could you describe how is the process for identifying the buildings to be refurbished for social housing? Is the location of those buildings an important criterion of choice?
5. How are the needs and expectations of tenants considered in the design process?
6. After delivering the briefing to the developing partner (i.e. architects, house building company…) how is St. Basils involved in the design process of the housing schemes? Is there any practice in the housing association that allows following up the requirements from the proposed briefing?
7. Can you point out the main reasons of people's satisfaction and dissatisfaction?
8. From your perspective, is it important to evaluate the well-being of people helped by St. Basils?
9. What aspects are taken into account in the process of choosing the location of the houses?
10. From your perspective, would be helpful to include aspects related to the urban environment that can affect QoL, such as satisfaction with public services and urban infrastructure, on the satisfaction survey, to help with future choices regarding the housing location?

APPENDIX 2

Report of the Research Committee of UFRGS (*Comissão de Pesquisa* - COMPESQ)

PARECER CONSUBSTANCIADO DE PROJETO DE PESQUISA

Trata-se da análise do projeto de pesquisa nº 37930 intitulado "Qualidade de vida no contexto de edificações reabilitadas para habitação de interesse social em áreas urbanas centrais" sob responsabilidade da pesquisadora JOSANA GABRIELE BOLZAN WESZ qualificada em 19 de junho de 2019 pelo Programa de Pós- Graduação em Planejamento Urbano e Regional - PROPUR, com orientação da Professora Drª. Luciana Inês Gomes Miron.
O projeto possui como objetivo geral Propor um método para avaliar o impacto da reabilitação de edificações para HIS em áreas centrais urbanas, visando analisar os efeitos no ambiente construído e na qualidade de vida dos habitantes.
1) MÉRITO-CIENTÍFICO: o projeto possui mérito-científico? (X) SIM
2) RESUMO: apresenta resumo consoante com o projeto? (X) SIM
3) FUNDAMENTAÇÃO TEÓRICA: o projeto fornece a identificação da proposta, justificativa, relevância do tema, e caracteriza o problema a ser abordado com o uso de referências atuais e relevantes? (X) SIM
4) OBJETIVOS E QUESTÃO DE PESQUISA: os objetivos e a questão de pesquisa estão adequados para o tipo de pesquisa a ser realizada? (X) SIM
5) METODOLOGIA / MATERIAIS E MÉTODOS:
- A metodologia esta adequada aos objetivos traçados? (X) SIM
- Apresenta as considerações e aspectos éticos referentes à pesquisa? (X) EM PARTE
Comentário: Apenas consta que passará pelo comitê de ética, mas não apresenta as considerações para a pesquisa.
- Apresenta o delineamento do estudo? O mesmo está adequado ao objetivo do estudo? (X) SIM
- Define a população e amostra que será estudada? (X) SIM
- Apresenta como os participantes serão selecionados (critérios de elegibilidade)? (X) SIM
- Descreve o local onde os participantes serão selecionados e avaliados? (X) SIM
- Apresenta e define as variáveis (desfechos) que serão estudadas (os) e a forma como as (os) mesmas (os) serão avaliadas? (X) SIM
- Define o protocolo do estudo? (X) SIM:
- Define como a (s) intervenção (ões) será (ão) estudada (s)? (X) SIM
6) CRONOGRAMA: o projeto apresenta cronograma adequado ao período do estudo? (X) SIM
7) TERMO DE CONSENTIMENTO E DECLARAÇÕES DIVERSAS:
- Apresenta Termo de Consentimento Livre e Esclarecido? (X) SIM:
RELEVÂNCIA DO TRABALHO, PONTOS FORTES: O projeto se propõe a realizar uma investigação sobre as edificações desocupadas em áreas centrais e sua reabilitação para atender à habitação de interesse social. Neste contexto se mostra a importância e validade da pesquisa para a situação do nosso País.

CONCLUSÃO
Face ao exposto:
(X) Recomendo aprovação sem alterações
SUGESTÕES:
- Arrumar os títulos de algumas tabelas e figuras que ficaram de página diferente do elemento em questão.
- Fazer menção no corpo do projeto que possui o TERMO DE CONSENTIMENTO LIVRE E ESCLARECIDO E AUTORIZAÇÃO PARA GRAVAÇÃO DE VOZ.
- Encaminhar para o comitê de ética de pesquisa da instituição.

Porto Alegre, 03 de outubro de 2019.
Prof. Fábio Lúcio Lopes Zampieri; Relator.

APPENDIX 3

Residents' questionnaire (data collection protocol)

AVALIAÇÃO DA QUALIDADE DE VIDA URBANA

Você está sendo convidado(a) a responder voluntariamente um questionário, de aproximadamente 10 minutos, sobre QUALIDADE DE VIDA NO CONTEXTO DE EDIFICAÇÕES REFORMADAS PARA HABITAÇÃO EM ÁREAS URBANAS CENTRAIS, pesquisa desenvolvida no Programa de Pós-Graduação em Planejamento Urbano e Regional da Universidade Federal do Rio Grande do Sul (**UFRGS**), sob responsabilidade da arquiteta **Josana Gabriele Bolzan Wesz (Tel.: 51 984029742).**

A pesquisa tem como objetivo avaliar o impacto da reabilitação de edificações para habitação de interesse social em áreas centrais urbanas, visando analisar os efeitos no ambiente construído e na qualidade de vida dos habitantes, tendo sido aprovada pela Plataforma Brasil - CAAE 24490919.3.0000.5347.

A pesquisa trará como benefício à comunidade o aprofundamento do conhecimento acerca da qualidade de vida na área central de Porto Alegre - RS, um espaço urbano muito relevante para a cidade. Quando concluída, estará disponível na biblioteca da UFRGS, podendo ser acessada por qualquer pessoa que tenha interesse em seu conteúdo. Eventuais riscos referem-se a um possível cansaço decorrente do tempo do questionário e/ou expectativas de que haja a solução de qualquer problema existente no espaço urbano avaliado.

Saiba que:

1. Os dados obtidos serão utilizados para fins estritamente acadêmicos e seu nome não será identificado na pesquisa, garantindo sua privacidade;
2. A qualquer momento você poderá desistir de participar e retirar seu consentimento e suas respostas, sem nenhuma complicação;
3. Estaremos sempre à disposição para esclarecimento de dúvidas com relação à pesquisa e todas as ações envolvidas. Basta que entre em contato através do e-mail **josanawesz@gmail.com** ou luciana.miron@ufrgs.br.

Caso você aceite participar, assinale abaixo a resposta "SIM, aceito participar da pesquisa", e responda as questões nas páginas seguintes.

Você aceita participar da pesquisa?

○ SIM, aceito participar da pesquisa

Preferências no bairro

1.1 O que você **MAIS GOSTA** em seu bairro?

_____

_____

1.2 Por que você gosta do item citado acima (opcional)?

_____

_____

1.3 O que você **MENOS GOSTA** em seu bairro?

_____

_____

1.4 Por que você não gosta do item citado acima (opcional)?

_____

_____

1.5 O que você considera mais importante para uma boa QUALIDADE DE VIDA? **Assinale 3 itens.**

- ○ Mobilidade urbana (transporte público, facilidade de deslocamentos, etc.)
- ○ Segurança pública
- ○ Opções e locais para cultura e lazer
- ○ Conforto ambiental (nível de ruído, limpeza das ruas, etc.)
- ○ Equipamentos e serviços urbanos (saúde, educação, fornecimento de energia elétrica/água, etc.)
- ○ Convivência e interação entre as pessoas
- ○ Economia (oferta de empregos, comércio local, etc.)

MOBILIDADE URBANA

Como você classifica seu bairro em relação aos seguintes aspectos? Marque com um "X" ao lado de cada item abaixo.

						Não aplicável
2.1 Qualidade do transporte público coletivo (conforto)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
2.2 Quantidade de transporte público coletivo (linhas e horários)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
2.3 Facilidade de ir da sua casa até outros pontos da cidade (local de trabalho, estudo, casa de amigos, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
2.4 Facilidade de deslocamentos a pé (para realizar atividades cotidianas)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
2.5 Qualidade e localização das ciclovias	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
2.6 Qualidade e manutenção das calçadas e ruas	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )

2.7 Em relação aos itens anteriores (MOBILIDADE URBANA), você gostaria de deixar algum comentário (opcional)?

_____

_____

_____

SEGURANÇA

Como você classifica seu bairro em relação aos seguintes aspectos? Marque com um "X" ao lado de cada item abaixo.

	☺		😐		☹	Não aplicável
3.1 Sensação de segurança nos locais públicos (calçada, rua, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
3.2 Sensação de segurança no acesso ao seu edifício durante o dia	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
3.3 Sensação de segurança no acesso ao seu edifício durante a noite	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
3.4 Segurança para crianças e adolescentes vivenciarem o bairro (passear, brincar, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
3.5 Oferta e qualidade de policiamento	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
3.6 Qualidade da iluminação pública (calçadas, ruas, praças, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )

3.7 Em relação aos itens anteriores (SEGURANÇA PÚBLICA), você gostaria de deixar algum comentário (opcional)?

_____

_____

_____

CULTURA E LAZER

Como você classifica seu bairro em relação aos seguintes aspectos? Marque com um "X" ao lado de cada item abaixo.

						Não aplicável
4.1 Quantidade de praças e parques	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
4.2 Qualidade e manutenção de praças e parques	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
4.3 Existência de locais para prática de esportes ao ar livre	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
4.4 Existência de locais para atividades culturais (eventos artísticos, museus, teatros, cinemas)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
4.5 Oportunidades de participação em eventos culturais e artísticos gratuitos	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
4.6 Conservação do patrimônio histórico, artístico e cultural (edifícios, casas e espaços públicos)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )

4.7 Em relação aos itens anteriores (CULTURA e LAZER), você gostaria de deixar algum comentário (opcional)?

_____

_____

_____

CONFORTO AMBIENTAL

Como você classifica seu bairro em relação aos seguintes aspectos? Marque com um "X" ao lado de cada item abaixo.

						Não aplicável
5.1 Nível de ruídos (barulho)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
5.2 Qualidade do ar (sensação ao respirar)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
5.3 Arborização das ruas (existência de árvores)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
5.4 Limpeza dos locais públicos (calçadas, ruas, praças, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
5.5 Sistema de drenagem e esgoto (alagamentos/ odores)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
5.6 Vista da janela do seu apartamento para o espaço externo (rua/pátio)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )

5.7 Em relação aos itens anteriores (CONFORTO AMBIENTAL), você gostaria de deixar algum comentário (opcional)?

_____

_____

_____

SERVIÇOS E EQUIPAMENTOS URBANOS

Como você classifica seu bairro em relação aos seguintes aspectos? Marque com um "X" ao lado de cada item abaixo.

						Não aplicável
6.1 Coleta de lixo	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
6.2 Fornecimento de água	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
6.3 Fornecimento de energia elétrica	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
6.4 Fornecimento de serviços de internet	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
6.5 Serviços relacionados à saúde (hospitais, postos de saúde, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
6.6 Estabelecimentos de educação (escolas, creches, universidades, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )

6.7 Em relação aos itens anteriores (SERVIÇOS e EQUIPAMENTOS URBANOS), você gostaria de deixar algum comentário (opcional)?

_____

_____

_____

CONVIVÊNCIA

Como você classifica seu bairro em relação aos seguintes aspectos? Marque com um "X" ao lado de cada item abaixo.

						Não aplicável
7.1 Convivência e interação com a vizinhança (moradores do bairro)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
7.2 Convivência e interação com moradores de rua	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
7.3 Oportunidades de participação nas decisões do seu condomínio	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
7.4 Oportunidades de participação em atividades na comunidade (associações, grupos artísticos/religiosos, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
7.5 Respeito das pessoas pelas diferenças culturais, sexuais, religiosas e políticas	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
7.6 Identificação com o bairro e orgulho das pessoas por morar nele	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )

7.7 Em relação aos itens anteriores (CONVIVÊNCIA), você gostaria de deixar algum comentário (opcional)?

_____

_____

ECONOMIA

Como você classifica seu bairro em relação aos seguintes aspectos? Marque com um "X" ao lado de cada item abaixo.

						Não aplicável
8.1 Oferta de emprego	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
8.2 Custo de vida (gastos com moradia, alimentação, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
8.3 Oferta de cursos profissionalizantes (informática, cabeleireiro, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
8.4 Acesso à crédito (condições de pagamento facilitadas em lojas e comércio)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
8.5 Variedade de estabelecimentos comerciais e de serviços (mercados, lojas, restaurantes, bancos, etc.)	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )
8.6 Existência de atividades relacionadas ao turismo	Ótimo ( )	Bom ( )	Regular ( )	Ruim ( )	Péssimo ( )	NA ( )

8.7 Em relação aos itens anteriores (ECONOMIA), você gostaria de deixar algum comentário (opcional)?

_____

_____

_____

Perfil

9.1 Qual é o seu edifício?

- 20 de Novembro
- Utopia e Luta
- Umbu
- Sul América
- Arachã
- Bento Gonçalves
- Charrua

9.2 Qual é o número do seu apartamento (opcional)? _____

9.3 Quantas pessoas moram em sua residência, incluindo você?

- 1 a 2 pessoas
- 3 a 4 pessoas
- 5 a 6 pessoas
- 7 a 8 pessoas
- 9 pessoas (ou mais)

9.4 Qual o seu sexo?

- Feminino
- Masculino
- Outro: _____

9.5 Qual a sua idade?

- Menos de 25 anos
- 25 a 34 anos
- 35 a 44 anos
- 45 a 54 anos
- Mais de 54 anos

9.6 Considerando a classificação do IBGE, como você define a sua cor?

- Branca
- Preta
- Amarela
- Parda
- Indígena
- Outro: _____

9.7 Qual seu grau de escolaridade?

- Analfabeto
- Ensino Fundamental incompleto
- Ensino Fundamental completo
- Ensino Médio incompleto
- Ensino Médio completo
- Superior incompleto
- Superior completo
- Pós-graduação incompleta
- Pós-graduação completa

9.8 Somando a sua renda com a renda das pessoas que moram com você, quanto é, aproximadamente, a renda familiar mensal?

- Nenhuma renda
- Até R$ 1.045,00
- De R$ 1.045,00 até R$ 3.135,00
- De R$ 3.135,01 até R$ 6.270,00
- Mais de R$ 6.270,00

9.9 Qual é a sua ocupação?

- Assalariado com emprego formal (carteira assinada)
- Assalariado sem emprego formal
- Aposentado
- Desempregado
- Autônomo
- Estudante
- Militar
- Dono(a) de casa

9.10 A família possui veículos? Pode marcar mais de uma opção.

- Não possui carro
- 1 carro
- 2 carros
- Mais de 2 carros
- Moto
- Bicicleta

Permanência no bairro

10.1 Desde que ANO você mora no local atual?

_____

10.2 Qual a localização da sua moradia anterior (CIDADE)?

_____

10.3 Qual a localização da sua moradia anterior (BAIRRO)?

_____

10.4 Você tem vontade de mudar de bairro?

- Sim
- Não
- Outro: _____

10.5 Se marcou sim na resposta anterior, por que você deseja mudar de bairro?

_____
_____
_____
_____

Fim.

MUITO OBRIGADA PELA SUA PARTICIPAÇÃO!

APPENDIX 4

Semi-structure interview to assess the proposed method (focus group)

UTILITY OF THE METHOD

a) In your opinion, is the method useful for the assessment of multidimensional urban QoL (objective and subjective)?

b) In your opinion, how can the results of the evaluations be used in decision-making for urban policies?

c) In your opinion, how can the results of the evaluations be used to improve the urban insertion of HIS?

d) Please point out, if possible, other relevant points about the usefulness of the presented method.

APPLICABILITY OF THE METHOD

a) In your opinion, is the evaluation process (collection, analysis and dissemination of information), i.e., the method as a whole, easy to understand?

b) In your opinion, is the evaluation process (collection, analysis and dissemination of information), that is, the method as a whole, easy to apply in practice?

c) In your opinion, are the evaluation results easy to understand?

d) Please point out, if possible, other relevant points about the applicability of the presented method.