“Urban and Social Equity Impacts from transport. Evidence and approaches from Santiago de Chile”.

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I, Beatriz Mella Lira, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the work.

BEATRIZ MELLA LIRA
Abstract

Nowadays, there is a global problem regarding growing social inequality and important gaps in needs that must be addressed to achieve better levels of equity. In this context, the research narrows down the discussion of social issues into the transport planning scenario, exploring concepts such as social equity, social justice, opportunities, well-being and fairness.

The case study used for locating the discussion is Santiago de Chile, city with one of the highest levels of inequality in terms of socioeconomic distribution. Over the years, not only the need to travel but journey times and travel distances have increased in Santiago as a consequence of social inequalities. Both users of private and public transport have been affected in terms of travel efficiency and journey times, but especially in terms of their daily travel experience and quality of life.

Through a mixture of quantitative and qualitative methods, the research aims to examine, through a critical appraisal of theoretical approaches and empirical evidence, the factors that result in impacts associated with social equity. It explores the potential of reducing gaps of social inequality, proposing paths for incorporating these factors into the design and assessment processes.

This research recognises the shortcomings of transport project appraisal based on cost-benefit analysis and its emphasis on journey time savings. It thus seeks to expand the criteria on which the merits of projects are assessed. To this end, the Capability Approach has been the primary theoretical approach for configuring the research methodology.

The revision of both conceptual and empirical evidence allowed the research to explore existing inequities of income distribution and opportunities. The results show that inequalities are accentuated by long
travel distances and for not having an adequate public transport system. Public transport users and low income segments are usually disadvantaged when compared to any of the other modes of transport. The research ends up discussing points towards the development of transport policies and projects, which more thoroughly consider the range of social, well-being and health impacts.
Impact Statement

The research has developed an extensive and diverse literature that has extended the nexus between equity and concepts such as social justice, poverty, social exclusion, social capital, well-being and fairness. The contribution and impact of academia relate to the development and discussion of key concepts of social equity and justice. Opportunities and resources, mental and physical health, personal feelings, emotions, freedom and happiness are some of the concepts that have been explored in the discussion. The examination of literature in social equity and justice do not belong just to the field of transport, and therefore nurtures the academic discussion in other fields, through scholars that have examined the potential reduction of social exclusion from diverse edges.

The research also has the potential of benefiting the academia, as it has explored a range of methodologies that have facilitated the analysis of diverse and complementary problems of the current transport project appraisal. The methods used questionnaires, semi-structured interviews and participatory workshops with diverse agents in transport. The questionnaire, based on the capability approach, allowed exploring issues that have been often overlooked - as a consequence of project appraisal has focused on economic efficiency goals. Furthermore, the discussion about real opportunities, expectations, well-being and health-related issues in transport moves the discussion of transport impacts beyond the current status of the art. In this extent, the research is relevant both for academia and for practice as it discusses the principles for the use, analysis and consideration of these subjective perceptions in transport appraisal.

Through the analysis of Santiago as the case study, the research impacts locally (Santiago), regionally (Latin America), and internationally
(considering, for instance, the Global South) as the problem analysed belongs to other similar contexts. The research allows a transferability of knowledge of theoretical and empirical work. Even though most of the precedents are from the Global North, the research approaches these theories assessing social equity in the context of the global south. The extent of which the research impacts these contexts, is also the extent to which impacts to diverse individuals, communities and organisations. The linkages made with policymakers have strengthened these opportunities, as they have been informed and they are aware of the analysis and results of this research.

Finally, the results of these research are expected to be disseminated through several academic publications in book chapters and peer-reviewed articles. Although these results have been preliminary shared in conferences and academic circles, will be the first step for engaging public policymakers and practitioners, or through collaborations between academic and non-academic institutions.
To Damian and Rafael, my love and life,
and to my parents, Patricia and Francisco.
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<th>Description</th>
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<tbody>
<tr>
<td>BMI</td>
<td>Body mass index</td>
</tr>
<tr>
<td>CA</td>
<td>Capability approach</td>
</tr>
<tr>
<td>CAE</td>
<td>Annual equivalent cost</td>
</tr>
<tr>
<td>CBA</td>
<td>Cost-benefit analysis</td>
</tr>
<tr>
<td>CEA</td>
<td>Cost-effectiveness analysis</td>
</tr>
<tr>
<td>CHC</td>
<td>Central Human Capabilities</td>
</tr>
<tr>
<td>DIPRES</td>
<td>Budget Office, Ministry of Finance</td>
</tr>
<tr>
<td>DTPM</td>
<td>Metropolitan Public Transport Board</td>
</tr>
<tr>
<td>EFJ</td>
<td>Equity, fairness and justice</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>MAMCA</td>
<td>Multi-actor multi-criteria analysis</td>
</tr>
<tr>
<td>MCA</td>
<td>Multi-criteria analysis</td>
</tr>
<tr>
<td>MDS</td>
<td>Ministry of Social Development</td>
</tr>
<tr>
<td>MTT</td>
<td>Ministry of Transport and Telecommunications</td>
</tr>
<tr>
<td>MIDEPLAN</td>
<td>Ministry of Planning</td>
</tr>
<tr>
<td>MINVU</td>
<td>Ministry of Housing and Urbanization</td>
</tr>
<tr>
<td>NAP</td>
<td>Nueva Alameda Providencia</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-profit organisation</td>
</tr>
<tr>
<td>OCUC</td>
<td>Observatorio de Ciudades Universidad Catolica</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Co-operation and Development</td>
</tr>
<tr>
<td>PIAAC</td>
<td>Programme for the International Assessment of Adult Competencies</td>
</tr>
<tr>
<td>PTUS</td>
<td>Urban Transport Plan for Santiago</td>
</tr>
<tr>
<td>SECTRA</td>
<td>Secretary of Transport, Ministry of Transport and Telecommunications</td>
</tr>
<tr>
<td>SERVIU</td>
<td>Housing and Urbanisation Services</td>
</tr>
<tr>
<td>SUMO</td>
<td>Observatory of Sustainable Mobility, Universidad Diego Portales</td>
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<tr>
<td>SNI</td>
<td>National Investment System</td>
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<tr>
<td>SWB</td>
<td>Subjective well-being</td>
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<td>TECHO</td>
<td>Techo para Chile</td>
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<tr>
<td>VAC</td>
<td>Current cost value</td>
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<td>VAN</td>
<td>Current net social value</td>
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<td>WebTAG</td>
<td>Website for Transport Analysis Guidance</td>
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<tr>
<td>WHO</td>
<td>World Health Organisation</td>
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Published papers and book chapters that use material from this thesis:


1. Introduction

1.1. Why social inequalities in transport?

Nowadays, there is a worldwide problem regarding growing social inequality and there are significant gaps in needs that must be addressed to achieve better levels of equity and social justice in cities. Stiglitz (2012) reminds us of the financial crisis in 2007-08, the problems of unemployment, house repossessions, homelessness, student debt, and the difficulties of the market economy in contributing to greater income equality over the last three decades:

We are paying a high price for our large and growing inequality, and because our inequality is likely to continue to grow – unless we do something – the price we pay is likely to grow too. Those in the middle, and especially those at the bottom, will pay the highest price, but our country as a whole – our society, our democracy – will also pay a very high price (Stiglitz, 2012, p.104).

However, economic welfare and differences in income are just some of the dimensions that must be addressed in order to change the injustice precepts, and should be interpreted in relation to the contexts, circumstances and the underlying opportunities (Atkinson, 2015). Prosperity, measured in terms of GDP outcomes and other economic indices, has not been enough to capture wide-ranging social issues, despite being the most used metric of ‘progress’ in industrialised and many emerging countries. The economist and Nobel Prize Amartya Sen (1999) has argued that we should instead examine the freedoms that people enjoy as well as their choices in order to fulfil their personal development, a reflection that has been aligned with the decision of institutions such as the World Bank for the use of wide-ranging Millennium Development Goals. Wider equity measurement parameters are needed for solving issues of social welfare such as health and well-being
(Jackson, 2009), considering shifting the attention “from material standards and economic growth to ways of improving the psychological and social wellbeing of whole societies” (Wilkinson and Pickett, 2009, p.4).

Starting from these ideas and motivations, this research has a strong social component, focused on the way people’s motivations, experiences, preferences and self-assessments can define (and even strengthen) the gaps between diverse social groups. The research examines the relationships between transportation projects and social equity, through the understanding of the approaches and factors that might help to achieve better standards of social equity relative to transport interventions. The research is of direct interest to urban planning and transport and should also be of relevance to other disciplinary explorations either in the fields of engineering, design, architecture or social sciences.

Concepts of equity and social justice have been increasingly more appealing to transport in the last years (Banister, 2018; Beyazit, 2011; Pereira et al., 2017; Di Ciommo & Shifman, 2017). Scholars have also discussed about broadening the concept of equity in transport, through the understanding of how accessibility and mobility play a role in social exclusion (Lucas, 2004; Preston & Raje, 2007; Cass, Shove and Urry, 2005; Church, Frost and Sullivan, 2000). Even though these are some examples of a more extended spectrum of transportation research, all their empirical and theoretical work is a relevant step for entering on the problem of inequalities. Expressions of how justice and social equity relate to urban development have been considered more widely in Young (1990; 1998; 2011) through a critical analysis of theories of justice, and their conceptualisation about social movements, labour and marginalised groups – especially in disadvantaged contexts. Central for this research is the relationship between justice and social differences, as well as their solutions within the urban spectrum.
Definitions are relevant, as will be further developed in the next chapter of this research. The tensions between equity and the redistribution of goods will be discussed through Harvey (1973) and Rawls (1971). Nevertheless, the analysis has gone further in questioning whether the redistribution of goods is the most pertinent for discussing social justice. Young (1990), for example, questions the relevance of the discourse of distributive economies versus distributional justice, especially when certain groups experience deprivation in the exercise of their capacities. Next chapters build on Sen's (1985) definitions, discussing the concept of capability and its application in transport planning. The following chapters develop how capabilities translate into opportunities for people to exercise their freedom and pursue what they value.

Most of the work has been done in the western context (Lucas, 2012), with conclusions that highlight the relevance of emerging research debates focused on issues of social, spatial and environmental justice for transforming the existent paradigms. However, there is some relevant work from the Latin American context (Levy & Davila, 2017; Tiznado-Aitken et al., 2018; Sagaris & Tiznado-Aitken, 2017) showing a wide range of topics that develop the social problems and impacts related to transportation – from the examination of the institutional, socio-economic and political factors, to intermodal approaches constituting a new transport planning revolution.

1.2. Santiago as case study

The context selected for the research has been Santiago de Chile, a city that frames the motivation of this research, as it has been strongly fuelled by personal experiences. The Chilean economy has had a sustained and stable increase similar to other Latin American countries as Peru or Brazil from the 1990s. However, Santiago is the capital city of one of the countries with the highest levels worldwide of inequality in terms of socioeconomic distribution. Despite the continued economic growth of
the country by 6% annually on average, and despite being one of the currently most robust economies in Latin America, the income distribution is the most unequal of all countries of the Organization for Cooperation and Economic Development (OECD). The percentage of ownership of GDP that 1% of the richest people have is a good measure for picturing the inequalities of income distribution in the country. The 1% of the richest people in Chile owns 30.5% of the national GDP, contrasting with countries as Sweden where the 1% wealthiest own a 9.1%, in Spain it owns a 10.4%, and even compared with USA (21%) Chile is more unequal (Lopez, Figueroa & Gutierrez, 2013).

In the mid-seventies a strategy of economic liberation and development of capitalism was promoted. Suburbanization intensified and a high regressive income distribution produced “an extremely fragmented and segregated city” (De Mattos, 1999). The problems of income distribution throughout those years, affected the way land uses were distributed within the metropolitan region of Santiago de Chile (Rodriguez & Winchester, 2001), resulting in a well-known segregated city (Agostini, 2016).

The spatial inequalities have led to social, cultural and normative implications, that have affected the outcomes of the transport policies trying to provide accessibility to the whole city (Tznado-Aitken, Muñoz & Hurtubia, 2018). Over the years, not only the need to travel, but journey times and travel distances have increased as a consequence of social inequalities (Herrera & Razmilic, 2018). These inequalities have also affected the rise on housing prices in central and well-connected areas (Agostini, 2016). Urban daily mobility is a massive, recurrent and complex social practice, but it has been due both to the high levels of inequality (Jiron, Lange & Bertrand, 2010) and to the poor functioning of the Transantiago system (Ureta, 2015). Both users of private and public transport have been affected in terms of travel efficiency and journey times, but especially in terms of their daily travel experience and quality
of life (Gajardo et al., 2012). As consequence, the capital (as well as other cities in the country) has had a significant increase in car ownership due to the lack of incentives for using public transport – together with large incentives for money loans for vehicle purchases (INE, 2017). Figure 1.1 shows in the left quadrant the variation of private motorised cars from 2008 to 2017, considering the national and the Metropolitan Region level. The percentage in the Metropolitan Region reaches 90% of private cars – more than the national percentage – which remains in a constant increase in the following years. The right box of Figure 1.1 illustrates the comparison of the percentage increase for the region and at the national level. Since 2008, the possession of motorised vehicles for private purposes has increased on average by 5.5% per year in the Metropolitan Region of Santiago. At the national level, this trend is similar, with an average increase of 6.6% per year.

![Figure 1.1. Total motorised private vehicles in Metropolitan Region (orange) and national level (blue), 2008 – 2017. Source: own production based on National Statistics Institute (INE), 2017.](image)

Existing inequities of income distribution and opportunities are accentuated by long travel distances and the inconveniences of not having a public transport system adequate enough to cover the demands of distance, comfort and flexibility of use.
1.3. Alternative approaches based on opportunities and freedoms

This research recognises the shortcomings of transport project appraisal based on cost-benefit analysis and its emphasis on journey time savings. It thus seeks to expand the criteria on which the merits of projects are assessed. To this end, the theoretical approach adopted is the Capability Approach (CA), initially developed by Amartya Sen. CA is radical in the way it analyses the development, opportunities and capabilities of the individual. Although it is a broad conceptual and theoretical framework, it does not necessarily refer directly to application in the transport context. Indeed most of the applications of the CA have been in human development studies and there are few uses in transport.

First, it is important to clarify that the central concepts considered for this approach are functionings and capabilities. Functionings, according to Sen, are the various things a person may value doing and being, and the achieved actions by the person that she manages to do or to be. In transportation this could be interpreted as the actual travel that allows a person to participate in their daily activities. Capabilities, in turn, represent the various combinations of doings and beings (functionings) that a person can feasibly achieve, and is thus largely synonymous with the person’s freedoms and opportunities. Initially, understanding the functionings – what the person is being or doing – is fundamental for determining what the real capabilities (opportunities and freedoms) of a person to achieve those functionings are. Therefore, functionings are crucial elements in the evaluation of capabilities. An example of how functionings are limited by transport is if a person decides not to travel to her personal activities because she cannot afford transportation, or because a route is deemed not safe and an alternative route or no trip is undertaken. The assessment of capabilities requires an assessment of the range of relevant opportunities, given the person’s characteristics (so, for instance, taken as given a person’s skills or income level while
defining her range of capabilities). Thus, even if these parameters do not change, the evaluation of her capabilities is likely to be broader and closer to the real opportunities that she can reach. From this example, three elements can be distinguished: functionings, capabilities, and the gap between them (see Figure 1.2 below).

![Diagram of concepts capability approach](source)

**Figure 1.2. Diagram of concepts capability approach. Source: own production.**

Considering these definitions, the CA allows extending the range of the usual parameters used to assess transport projects, moving beyond profitability or utility. Furthermore, the advantage of having both concepts of functionings and capabilities, is the different types of information they reveal and the independence they give in their use. Understanding the opportunities for travel and participation in activities allows us to assess the structure of society and how this affects behaviour; in relation to actual travel and participation which is modified by a range of barriers. All of these factors are important to the use of transport systems and the quality of peoples’ lives. However, the measurement of capabilities is the most challenging aspect for the operationalization and use of CA in transport – i.e. it is difficult to assess what the real opportunities for travel are, or what the real opportunities of access to activities are.

Another important concept proposed in CA is effective freedom, the capability to choose. An example of this, specifically in the case of the provision of public transport, is the option for people to use the public transport bus network. In Santiago, bus supply allows both high and low-
income areas to access it. The difference is that for most high income users, using the bus is a matter of choice, while for low-income people this is the only feasible alternative to travel over larger distances. Having valuable options for people is relevant in this case.

However, deprivation of capabilities does not only depend on socioeconomic profiles. The previous section reflected on how Young's (1990) writings conceptualise distributive justice going beyond socioeconomic income problems. Thus, understanding capability depends on the contexts and the possibility of appropriation that individuals have of their choices. Levy (2013) warns that transport users' identities "are deeply embedded in social relations and urban practices" (p.47), defined mainly in the use of public space. The use of the common space makes the exercise of their choices not only individual but also collective, so that "travel choice" is relative to access to certain types of activities and goods. The capacity of choice for users such as women, children and the elderly, is more likely to be vulnerable as a consequence of distributive justice that transcends the socioeconomic component.

People with reduced mobility or mobility impairments are typically also in a position of disadvantage. For them, accessing the public buses could be much more complicated compared to people without mobility impairments, and it could even mean for them to reduce their trips up to the point of becoming immobile. For both groups, the lack of freedom to choose what is valuable can lead to a capability deprivation, persisting and aggravating the original condition.

Now, even if people could freely choose the transport mode that best suits their needs, not everyone has the ability to convert the advantages of mobility into valuable functionings. In the framework of the CA, this is called ‘conversion factors’. Being in the position of belonging to a culture that restricts the mobility of certain groups due to their gender, age, ethnicity or race, can be as restrictive as the position of being economically disadvantaged. For example, issues related to safety and
security in public spaces and transport modes are addressed differently for women experiencing more violence and physical/sexual abuse while travelling by bus or walking (Levy, 2013, p.57). From the side of transportation planning, improving the access to certain modes does not necessarily imply that people can reach valuable opportunities – understanding the broad concept of valuation that can happen to reaching opportunities. Hence, it is unclear how valuable such transport decisions would be.

Achieving transport equity through the enhancement of capabilities means that people are able to perform the activities that fulfil their lives, irrespective that activities vary across groups, segments and individuals. It also means having a minimum degree of respect for people’s dignity. The use of any available transport mode should not act to the detriment of the quality of life of other people, e.g. as a result of traffic pollution or pedestrian accidents. The level of accessibility to goods and services should not be a barrier for people to convert those resources into something valuable for them. For example, some results on Chapter 6 show gender barriers in the use of public transport, since it does not live up to the requirements of use and activities of women, turning public transport into a barrier rather than an enabler for women. The CA assesses people’s quality of life so that various dimensions can be incorporated.

The CA framework is based on real opportunities for people to achieve what they value and want to be (or do). This framework has a strong link with the concepts of freedom and opportunities, which is fundamental in considering the benefits people derive from the existence and use of mobility infrastructures and services. The radical and comprehensive perspective of evaluating the benefits and burdens on the individual is something that the CA has in common with these approaches – which go beyond the evaluation of the ‘net present value’ or ‘benefit-cost ratio’ of transport projects. This research therefore provides an alternative to the
mainstream evaluation approach, by providing a coherent logic of the measurement of functionings and capabilities, and the presentation of an application in Santiago de Chile.

1.4. Focus of the research

The research aims to examine, through a critical appraisal of empirical evidence and theoretical approaches, the factors that configure the development of transportation projects that can potentially reduce the social gaps of social inequality. The research also uncovers paths for helping to incorporate these factors into the design and assessment processes.

The main question of the research is as follows:

**Which factors in transport projects can reduce the gaps of social inequality, and how can they be incorporated in the planning and assessment process?**

Four secondary questions – explored in detail in the methodological Chapter 0 (p. 76) – have guided the development of each research chapter, contributing to the understanding of the research aim:

1. What are the perceptions of policymakers about incorporating new metrics of social equity in transport appraisal?
2. How might social equity be measured in its relation to transport projects?
3. Who are the most vulnerable groups affected by transport and how do they perceive these inequalities?
4. How can decision/making processes and transport appraisal effectively be improved in the current context?
1.5. Structure of the research

The following Chapter 2 defines the main research concepts through an extensive literature review. The first part of the chapter explores connections between the concepts of social equity and distributive justice, and contextualises the theoretical discussion within the Latin American context, reviewing scholars of the local context. The second part of Chapter 2 explores the Capability Approach thoroughly, as a new approach to the concepts of social equity, and reviews the concepts of equity and social justice through the lens of capabilities, opportunities, personal freedoms and choices.

Chapter 3 outlines the research process that has been carried on the development of the thesis. It shows the methodological decisions and provides information about the quantitative and qualitative methodologies used along the research.

Chapter 4 establishes a context in which the research has been grounded. It explores the issues of socioeconomic distribution; the differences in the built environment and the modal split; the benefits and costs of the differentiated fare; and reveals hints for understanding how transport project appraisal operates in Chile.

Chapter 5 contextualises the research. It aims to explore how transport policymakers perceive the strengths and limitations of current project assessment tools for improving equity, and what is their perception on incorporating new measures in the analysis (as users experiences, attitudes, needs, capabilities, among others). Some of the findings show that they agree both on the relevance of discussing equity in transport and also on the need for solving institutional barriers along the process.

Chapters 6 and 7 aim to answer two of the secondary questions drawn by the research, regarding the search of new sources of measurement
for social equity and reflecting on how inequalities mostly affect vulnerable groups. Chapter 6 delves into how Capability Approach can be measured in transport planning. It primarily focuses on aspects of physical and mental health affecting transport users, taking in consideration the list of Central Human Capabilities (Nussbaum, 2009). It analyses the differences in the self-assessment of health-related factors based on the application of the Capability Approach across different types of transport users and population groups in various neighbourhoods of Santiago. The chapter develops the concept of ‘weighted functionings’, innovative use of the capabilities framework that allows the assessment of actual activities based on the priority given by users. Chapter 7 develops how the concept of capability can be applicable in relation to the concept of wellbeing. It recognises subjective well-being factors, mainly through the analysis of journey experience and enjoyment of commute — the data proceeds from the same survey of transport users in Santiago used in chapter 6. The relevance of the chapter is proposing a shift from a utilitarian perspective on transportation (based on time savings and efficiency measured with travel satisfaction surveys) towards a more comprehensive consideration of subjective well-being as a fundamental component of travel. The exploration uses an analysis of dissonance, based on the mismatch between the actual mode and the mode that enables users to experience positive affective/emotive or instrumental factors.

Chapter 8 moves the discussion into the appraisal area challenging how the main approaches deal with social impacts. The chapter studied how the BRT project “Alameda Providencia” through the use of a Multi-actor multi-criteria analysis (MAMCA). MAMCA is used as a way for appraising projects while centring the attention on social equity issues. Findings show the possibility of these type of participatory approaches for helping with a more comprehensive way of introducing social equity in transport appraisal, incorporating views and catering for different needs.
Chapter 9 finally proposes conclusions and reflections for the research. It includes commentary on the main lessons for future research; lessons learnt from the analysis of the Capability Approach; reflections about the transport appraisal and the applicability of social equity concepts in transport; and the main contribution and originality of the research.

Although the research has developed around the case of Santiago, it examines issues and problems applicable to other cities in the Latin American context - and even in circumstances of other developing and developed countries. Most of the literature review comes from studies performed in developed cities of the Global North, so the research has had to realistically and carefully recognise the transferability of knowledge into the local context. This has allowed generating conclusions that nourish back the academic discussion and will enable to expand the boundaries of understanding around topics that increasingly require conceptual, theoretical and practical development. The data produced from the case study have been obtained directly in Santiago, so the research promotes the creation of new knowledge in the context of Chile. On the other hand, the questions that have risen from the results have opened potential new lines of research in the near future, both in the Chilean context and internationally.
2. Literature Review on equity, justice, capabilities and opportunities. Setting up the concepts.

2.1. Introduction

Social equity issues in transport planning, particularly the linkages between transport and social exclusion over the last 30 years has been increasingly the focus of research (Lucas, 2004; Lucas & Jones, 2012). Social inequalities have been expressed through social exclusion of particular disadvantaged groups, whether in the area of socioeconomic income, physical (geographical) accessibility, physical or mental disability, belonging to ethnic groups or social minorities, among other aspects. The higher the level of inequality between groups, the greater the social exclusion, and therefore the higher the challenge of solving that everyone has the same access to opportunities and quality of life. One of the keys is to understand that transport policies, focused on the efficiency and operation of the system, do not necessarily meet users’ requirements of accessibility, needs and opportunities.

Solving problems of social inequities challenges the construction of a framework that could respond to more fundamental questions, involving the origins and the correct solution of the problem. In the UK, for example, social exclusion has been related to the ‘inability to fully participate in the economic and social activities that are necessary to maintaining a reasonable quality of life’ (Lucas, 2004). In the UK context, multiple appraisal criteria in WebTAG (Web-based Transport Appraisal Guidance) has intended to cover the inequality gaps through enhancing accessibility. However, the coverage of social impacts is very weak; there is still too much focus on the economic efficiency of projects in ante (before the fact) and post (after the fact) appraisal and evaluation. Social impact assessment, in turn, aims to better address questions of
environmental justice in decision-making through stakeholder participation and the systematic analysis of the social impacts and benefits of the projects.

Another way of understanding social inequality issues in transport planning is through the territorialization of the problem – the regional and distributional focus of social equity is fundamental in transportation planning (Preston and Rajé, 2007). Furthermore, scholars have considered the many barriers experienced by some groups with transport disadvantages (Hine and Mitchell, 2001, 2003; Hine, 2007) and the relevance of users’ perceptions to facilitate the understanding of their social inclusion (Rajé, 2007). Understanding the vision of the transport user, as well as the non-user and potential user, is critical. This is not only to understand the differences between diverse cohorts but their needs and the equity gap existing between them. The empirical chapters of this research account for this.

This chapter of revision of literature, addresses the main research concepts used throughout the document, exploring connections, debates and interpretations between concepts as social equity, distributive justice, capabilities and opportunities. Even though socioeconomic groups highly define the propensity to have an advantageous or disadvantaged situation with respect to society, Chapter 6, for example, suggests that other factors, as gender, are much more relevant for defining how vulnerable a group might be when using public transport. Although the primary transport mode and socioeconomic background influence the definition of the disadvantages for this group, gender is a variable that has not been widely considered in the generation of transport policies. Another misleading interpretation of how to detect inequalities is assessing based only on the level of accessibility. Accessibility planning promotes in this measurement the solution for solving inequalities – which later will be discussed as one of a wider range of determinants.
The second part of this chapter deeply explores the Capability Approach (CA) as a new (and complementary) approach to the concepts of social equity when transferred to the transportation planning context. The CA is discussed in its relationship with the concepts of equity and social justice, opportunities, personal freedoms, choices, and discusses possibilities for measurement. The chapter also deepens in the analysis of the quantification and measurement of capabilities for further exploration throughout the document.

2.2. Social equity and Social justice

The idea of the just distribution of goods and gains is relevant to a variety of fields such as health, transport, education, housing, etc. In all those fields, there is a commonly asserted normative claim in society that relates to the equal rights of having equal claims on benefits, as much as the right of equal levels of benefit. For example, Fainstein (2010) has described the process by which the concept of social justice has ended up as a social construct accepted and used by an important proportion of participants of society. She has suggested that the key for justice to become a universal principle has been a high level of articulation in terms of a communicative consensus – people having to agree on what is just. Therefore, the concept of social justice applied to a society, should then be attributed to a complex and dynamic set of conditions, benefits, rights, coverage requirements, among other aspects that arise from the proper functioning of the whole social system. Social justice is then a relative concept, so it might vary by geographic location or timeframe depending on where it is located (Harvey, 1973). In contrast to social justice, social equity does not necessarily emerge from a universal principle and neither proceeds towards a positive meaning in all contexts, but it is one of the pillars that sustain the construction of fairer societies. In fact, this concept is constituted in the relation with others. In a general universe of elements and particular individuals, the equity concept seeks to provide to all people the same access to different positive elements of the system,
placing them in the fairest position. The equity exploration requires then placing the discussion into a specific context, with common elements that could allow measuring the relationship between individuals and these elements.

These concepts go much further back in time. Since Ancient Greece, different perspectives have been developed on the concepts of social equity and justice. Aristotle’s Nicomachean Ethics, for example, written in 350 BC (Aristotle & Taylor, 2006), proposes a relationship between social justice and social equity, and explores the differences between the two concepts. For example, he discusses justice as a superior concept than equity, and defines the importance of moral praxis for acting truly and rightly. There is a challenge of incorporating these definitions applied in transport, thus the section analyses and brings together some of these universal concepts. Aristotle puts forward the concept of virtue as central to eudaimonia, beyond the narrow aspirations of increased income, suggesting that wealth serves only as means. Social justice, social equity and social equality divert not much in nature but application. However, equity is different from equality, even though there are usually used indistinctively. Social equality is the state in which all people, independently of their status, group or affiliation, have the same opportunity to access to civil rights, freedom, property, and equal access to goods and services. In this sense, equality is not that we are all the same, but that we all have the same opportunity to live the life we value. Both equity and equality differences are crucial. Having access to equal goods is essential, but when the starting point might be different for the members of a cohort, the same resource might not be enough for covering the lack of resources for someone. While equality is focused on the means for providing the same amount of resources, independently of the outcome; equity focuses on the outcome in which everyone can access to the same final amount of resources. Generally, in transport planning, the provision of transport considers parameters of equality, especially when defining access to public transport. For example, public
transport network can be spread homogeneously, without considering how people will use it for their personal outcomes. If we were to propose to develop public transport under the equity paradigm, the provision of the services should vary considering the needs, requirements, activities, skills, among other aspects of the potential users of the transport system. On the other hand, the equitable provision of transport should consider that the limitations in the use of the network do not depend only on the cultural and socioeconomic background of the individuals. Interpreting Young's (1990) writings on justice and social equity, the equitable distribution of transportation should consider the possibility of individuals to exercise their capacities effectively. An example of this, and going back to the case of the provision of public transport, a woman living in an affluent neighbourhood may also feel restrictions on the use of public transport, in the same way as a woman living in a vulnerable neighborhood - both due to lack of safety in the use of spaces and public transport.

Social justice implies a fair and just relation between the individual and society, including the distribution of wealth, opportunities, social privilege, participation in democracy, relationship with other in the private and public domain, among others. In this sense, one possible exercise of social justice in transport might address the alternative of accessibility planning. However, suggesting that the solution goes only through the enhancement of the physical level of accessibility is an incomplete interpretation of the problem.

The following questions help to assess the outcome of exercising social justice:

- *What is distributed?* Which relates to the idea of distributed goods and resources. Distributed goods depend on the context, level of development and societies, and are concerned with existing wealth, power, respect or access to opportunities.
• *How is this distributed?* Relates to the way goods and resources are distributed. Equally, meritocratically, according to social status, according to needs, property rights or other mechanism. Measurement or thresholds of how resources are distributed follow this discussion, as the proper measurement should lead to a proper definition of mechanisms of distribution.

• *Who benefits from the distribution?* This relates to the idea of the entities, particular population cohorts, the members of a particular country or jurisdiction, particular members of the society that are receiving the goods and resources that are distributed. This is probably the most important question of the three presented, for the development of the research – centred in the transport user and people who receive less benefits from transport.

Even though these questions may allow different interpretations, there is some common basis for the principles of social justice, such that all individuals and cohorts in society may have a basic level of value, access to activities and participation in life. Although there is debate over whether there exists a measurable, objective standard of social justice and the optimal route to achieve such an objective. Some scholars reject the idea as meaningless, self-contradictory and unfeasible to realise. Hayek (1982, p.78), for example: “There can be no test by which we can discover what is 'socially unjust' […] [social justice] does not belong to the category of error but to that of nonsense”. But, of course, this thesis rejects such notions – and attempts to give a clearer picture on an important, but complex, topic.

Rawls (1971), in particular, helps us in unravelling what is just or not. He defines ‘the original position’ as the starting point for a hypothetical situation in which free, equal and rational persons come to an agreement regarding the principles and application of social justice. All participants of the agreement act according to their principles of justice, regardless of their personal situation. This could be compared to a chess game without
a board, where actors do not know the pieces that correspond to them. They do not know how they are located across the society by the time they make decisions on their social agreement. Rawls defines ‘the veil of ignorance’ as the key for the actors to apply principles of justice, with an impartiality of judgement, where actors are deprived of all knowledge of their personal characteristics and social and historical contexts. This means that individuals make objective decisions, weighted in relation to their contexts, wealth or individual possessions.

The hypothetical exercise of using the veil of ignorance to solve injustice issues is the starting point for Rawls to define primary goods. He divided them into two categories:

- Natural primary goods: including intelligence, imagination, health
- Social primary goods: including rights (civil rights and political rights), liberties, income and wealth, self-respect

The definition of the primary goods, then led towards the development of the two principles of justice (Rawls, 2003: 42-43), where:

1. Each person has the same indefeasible claim to a fully adequate scheme of equal basic liberties, which scheme is compatible with the same scheme of liberties for all (the liberty principle).

2. And the statement that social and economic inequalities are to satisfy two conditions:
   - They are to be attached to offices and positions open to all under conditions of fair equality of opportunity;
   - They are to be to the greatest benefit of the least-advantaged members of society (the difference principle).

---

1 This is particularly complicated to be carried out as an exercise in policy making. Chapter VII presents an exercise of multi-actor multi-criteria weighting, where the asset is the impartiality of participants.
Even though at the level of society these principles have a direct applicability, the theory of Rawls has not been well used in transport planning. Martens (2016) incorporates some of the thinking, suggesting that accessibility could be incorporated as a sixth primary social good, as it is fundamental for societies and individuals. As the concepts of primary goods are difficult to be incorporated into transport planning, he suggests that the theory itself should incorporate accessibility into the equation. The problem relates to the difficulties of fair distribution of goods, especially when considering the most vulnerable groups. He suggests that:

(Rawls’ theory) cannot provide clear demarcation points regarding a fair distribution of accessibility (...) Even if only the situation of the least-advantaged group is taken into consideration, improvements in accessibility will have to be weighed against improvements in income and wealth (Martens, 2016: 81).

Although Rawls theory might not necessarily provide direct applicability for the transport field, it can be suggested that both principles of justice should be considered in the configuration of transport policies. The first principle aims to sustain the basic rights and liberties applicable to all citizens equally – hence is egalitarian in approach. In transport, all users must be treated with the same equalitarian consideration, no matter the income, wealth, ethnicity, race or origin – transport schemes should not be developed that favour usage by certain cohorts, such as higher income groups. The second principle is relative and seeks to be progressive and it probably guides the spirit of this research, as the least-advantaged members of society should benefit.

Harvey (1973) takes forward some of Rawls’ thinking, commenting that governmental action and the correction of market structures are not enough to avoid social injustices:
“Programmes which seek to alter distribution without altering the capitalist market structure within which income and health are generated and distributed, are doomed to failure” (Harvey, 1973, p.110).

However, from a perspective that goes far beyond the typically explored structures of power and economical concepts, Harvey links problems of moral judgement with application in the regional science and spatial planning. It can be questioned then if ethical dimensions can be applied into the transport and urban planning context, or if these concepts can be linked to social justice. Can mobility or accessibility be equitable? Can standards or thresholds of social equity or social justice be developed and applied? The extrapolation of Harvey’s conceptions about justice or ethics into urban planning field is just one of the windows of the entire discussion. If some of the questions are assumed from an affirmative perspective, transport planning should built on the basis of moral and ethical principles that could positively impact on people’s lives. This is the basis for developing this research, considering that concepts of social justice and equity should be indeed considered in the design and implementation of public policy.

In this scenario, Harvey (1973) has looked for the relationship between physical space and its impact on people, pointing out that there’s a physical space impact on cognitive processes that define people’s behaviour, being important to consider its symbolic meaning. This complex understanding of social space could be partially achieved through the integration of geographic and sociological variables in order to understand the complexity of social processes. In this regard, one of the challenges to point out is the necessity to identify tools to quantify and qualify these processes. These tools should encourage multidisciplinary work involving knowledge from spatial and sociological perspectives, to promote collaborative results.
Hay (1995), for instance, who distinguishes eight key concepts from different interpretations of Equity, Fairness and Justice (EFJ). All are applied through geographical space, although they could also be located in a conceptual and non-geographic sphere. From the list of these eight concepts, it is possible to identify that there are two main categories: a first group of concepts inherent to people and a second group aiming to the consequences of applying equity. There are distributional consequences in the application of equity, affecting either through a positive or adverse impact on individuals, population groups and society as a whole. For example, substantive equality (an equality of outcomes for all) allows detriment in procedural fairness (proper adherence to the rules) and even formal equality (similar benefits or burdens are enjoyed or suffered by all persons, e.g. illustrated through taxation mechanisms). Equal choice (there are similar choices available to all) considers the preconditions to an equitable outcome and just deserts (a reward or punishment) are concerned with the actions following and linked to previous performance. ‘Needs’ is the most interesting concept presented by Hay. Certain needs are so basic that the failure to meet them is an injustice. Thus, a correct identification of needs is required. The complexity lies in the wide variety of needs arising from different individuals and population cohorts. There are many nuances to the assessment according to the individual, that could be also arguable that the concept of needs is relative as it depends on how arises.

In accordance with this idea, Harvey (1973) suggests transport as one of those relevant needs for the just distribution of equity, thus they can be defined in terms of minimums quantities or qualities that must be provided to individuals. Harvey points out, for example, that a person who has few resources, but no physical disability, may have more advantages than a rich person or a person who has more resources but some physical disadvantage. This reflects the intrinsic capabilities of people and how these affect the development of routine activities. Physical disability can become, in terms of transport, a major barrier in the choice
and use of modes and provides a significant challenge in determining local transport strategies. On the other hand, there are disparities between different or within the same geographies produced by transport (Beyazit, 2011).

In this sense, equalitarian distribution of goods (or the attainment of these needs) could be established as a possible response to poverty and social exclusion through the guarantee of accessibility and affordability of all types of services for people, as well as the fairer distribution of gains. This was the basis for much of the work on transport and social exclusion in the UK (Social Exclusion Unit, 2003; Lucas, 2012) and the associated development of accessibility planning. Hence, the emphasis in this case arises from equal choice and formal equality, and not really on substantive equality (outcome) – although it is assumed that this would follow.

Over time there has been much interest in defining sets of indicators that can be used in the assessment of transport policies and projects designed to increased mobility and reduce exclusion (Church et al., 2000). Accessibility planning itself has developed various ways to measure accessibility to different services (Geurs and Van Wee, 2004). Additionally, concepts used in the wider social equity field have been applied in transport to consider how accessibility might change across population groups, such as the Gini-coefficient and Lorenz curve, which are conventionally used to show income distribution across populations (Van Wee and Geurs, 2011; Delbosc and Currie, 2011; Lucas et al., 2015). In this regard, one of the key challenges is identifying tools to quantify and discuss the different interpretations and applications of social equity, and also to focus on issues of substantive equity.
2.3. Social equity and the links with social exclusion in transport planning

The pursuit of more equitable distributional effects will depend on several agents influencing diverse political, social and economic spheres. From a political and economic perspective, Hill (1996) presents the very conventional policy-making debate, considering two positions, about whether income support and welfare benefits should be a responsibility of the State, or a problem to be solved mainly by individuals themselves. The very well-known discussion is interesting in this context, as it starts with the idea that the market is the organiser of social activities. As the individuals have to purchase their goods and services (as health, education, food, etc.), they will know what to obtain (or purchase) according to their needs. Pricing mechanisms will be imperative in this situation, so the market regulates itself according to the demands of people. Unfortunately, the position relies on income earnings which is not equal for everyone as not all jobs receive the same monetary restitution. Individuals do not start from the same starting line, and more interestingly, the pricing mechanisms work based on the individual's self-interest. The hopes rely then upon a second position. Hill explains that the second position involves the State as a regulator of activities according to the order of inequalities produced as a consequence of individual's purchase of goods and services. Both disappointing when referring to the issues arising from and outcomes generated by disparities.

However, there is also a third position, that relates to the dichotomy presented by Young (1997) in relation to Fraser's work (1995) about the representativeness and association of groups mobilised around their identities. Fraser recognises two types of injustice, the socio-economic, and the cultural or symbolic, and the ways of solving them act through Redistribution and Recognition. She proposes the construction of a framework that opposes culture and political economy, differentiating the
problems that arise from both. However, although the distribution of wealth, resources and labour are not the only circumstances to consider, it is essential to note that generally, these social groups do tend to converge in social, economic, cultural, among other dimensions – especially when it comes to vulnerable groups. Young (1997) criticises the construction of a dichotomy, which although allows a better identification of these contradictions, in reality fails on acknowledging that "recognition is a means to the economic and social equality and freedom that she brings under the category of redistribution" (p.152).

The discussion makes sense in a context in which political visions have changed from government to government. This adds to a background in which the role of the different actors in the transportation provision process has not been resolved, as well as the responsibilities of operators and government at the national, regional and communal levels. However, and regardless of any political position, the discussion about transport provision has been widely located in the spectrum of costs and impacts. The correct measurement of these impacts is essential in order to achieve accurate outcomes for addressing and improving equity. These costs or impacts (costs from an economic perspective and impacts from a social perspective) may involve money, time, loss of benefits, among other resources. Impacts and externalities considerations in transport are necessary for distinguishing an optimal comparison between different transport modes and demand management options. But more importantly, when costs or transportation impacts are underestimated, there is a risk of reduction in welfare solutions aimed at resolving equity gaps (Litman, 2007).

Since the early 1990s, research aiming to connect both academia and decision-makers has increased for solving social disadvantages. At least in the UK and other European countries, the interest to provide results showing the consequences of distributional impacts on the well-being of the most vulnerable groups with fewer resources has growth. Social
exclusion research then has emerged as a widespread policy (Lucas, 2004; 2012). Some responses to this problem have emerged from scholars working with the idea of increasing mobility to reduce social exclusion. Church et al. (2000), for example, have examined indicators for assessing policy outcomes designed to reduce exclusion through mobility increase. From a policy-making perspective, they have found that multi-agency and multi-level strategies are needed to tackle difficulties in transport so that individuals can obtain physical access to opportunities to participate in society. Church et al. (2000) show the list of seven categories they have provided, considering physical factors that may limit the mobility of socially excluded people:

<table>
<thead>
<tr>
<th>Exclusion factors</th>
<th>Definitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Exclusion</td>
<td>Physical barriers related to the nature of the transport system and the built environment that exclude people because of their physical and psychological difficulties.</td>
</tr>
<tr>
<td>Geographical Exclusion</td>
<td>It is produced by poor transport provision resulting in spatial inaccessibility and isolation of local communities by effects of geography.</td>
</tr>
<tr>
<td>Facilities Exclusion</td>
<td>Lack of access to facilities produced by constraints in the use of transport services. This cost is bigger in case of non-car users.</td>
</tr>
<tr>
<td>Economic Exclusion</td>
<td>Income and transport network constraints on accessing labour market information that may affect on work travel patterns, affecting labour market processes.</td>
</tr>
<tr>
<td>Time-based Exclusion</td>
<td>Difficulties of organising commitments to allow adequate time for travel that might affect on mobility decisions.</td>
</tr>
<tr>
<td>Fear-based Exclusion</td>
<td>Difficulties based on the nature of fear in public and private spaces related to transport network that may vary according to social characteristics, especially gender.</td>
</tr>
<tr>
<td>Space Exclusion</td>
<td>Difficulties coming from design, surveillance and management of public spaces that might affect the sense of ownership amongst some excluded groups.</td>
</tr>
</tbody>
</table>

Table 2.1. Exclusionary factors by Church et al. (2000).

Delbosc & Currie (2011) have explored spatial differences in transport measurements of social exclusion and impacts on well-being in the case of Melbourne, Australia for car dependent areas. They have understood the influence of the geographical context in the mobility and displacements between different locations, with an especial interest in
metropolitan and regional areas in car reliance. They consider transport and travel characteristics in diverse areas and distances to business zones, through the measurement of walkability, public transport availability, car ownership, daily travels and split mode. The correlation analysis between transport disadvantage and well-being were consistent for researches amongst the regional sample. While this research is primarily located in private modes, in a previous research Currie (2010) alerts about the spatial gaps in public transport provision for people who are socially disadvantaged, through the measurement of public transport supply and needs.

<table>
<thead>
<tr>
<th>Domains</th>
<th>Sub-domains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resources</td>
<td>Material/Economic resources</td>
</tr>
<tr>
<td></td>
<td>Access to public and private services</td>
</tr>
<tr>
<td></td>
<td>Social Resources</td>
</tr>
<tr>
<td>Quality of life</td>
<td>Health and well-being</td>
</tr>
<tr>
<td></td>
<td>Living environment</td>
</tr>
<tr>
<td></td>
<td>Crime, harm and criminalization</td>
</tr>
<tr>
<td>Participation</td>
<td>Economic participation</td>
</tr>
<tr>
<td></td>
<td>Social participation</td>
</tr>
<tr>
<td></td>
<td>Culture, education and skills</td>
</tr>
<tr>
<td></td>
<td>Political and civic participation</td>
</tr>
</tbody>
</table>

*Table 2.2. Domains and sub-domains of potential social exclusion by Levitas et al. (2007).*

As shown in Table 2.2, Levitas et al. (2007) describe social exclusion as a complex and multidimensional process that involves not only resources and lack of goods, but also the impossibility to participate in diverse social activities in different spheres from people’s lives. In this sense, social exclusion would be detrimental to the quality of life, social cohesion and equity. They propose three domains of social exclusion: 1) material/economic resources, 2) social resources (quality of life), and 3) access to public and private services (participation) (see Levitas et al., 2007). The main themes developed later in this chapter will be structured based on Levitas’ classification of the main dimensions of social exclusion, exploring: 1) the resources and barriers from current transport
policy appraisal; 2) the quality of life of vulnerable groups, focused on gender, economic and physical inequalities; and 3) the participation of the civil society, NGOs and communities.

The potential reduction of social exclusion through transport interventions (Church et al., 2000; Lucas et al., 2001; Lucas, 2006, 2012) has been already examined in the context of the Global North. However, this has also been studied in recent years in the Latin American context. In Colombia, for example, Bogotá has exhaustively developed research aimed at measuring the impacts of the public transport system (Bocarejo et al., 2016; Guzman & Oviedo, 2018; Guzman et al., 2018; Rodriguez et al., 2017; Rodriguez & Targa, 2004). Also in the Colombian context, research in Medellín has generated a clear understanding of how the development of transport and new social infrastructure improves the quality of people's lives (Bocarejo et al., 2014; Guzman et al., 2017). In other cities such as Cali, research is actively progressing into establishing links between the academy and government agencies. Developing better transport infrastructure can balance existing social inequalities (Delmelle & Casas, 2012; Jaramillo et al., 2012; Oviedo et al., 2019).

The regional and geographical focus of the conceptualization of equity and social justice is relevant. This is not only because it is about the mobility component, but it is about the distribution of impacts, goods, services and opportunities in space. Understanding the global definitions, applied in these specific contexts is essential for this research.

2.4. New approaches to social equity and the Capability Approach

Economic theory has developed the idea that people's preferences are predecessors of their choices. This would mean that, if a person prefers the bicycle over other modes, it is probable that the person will end up choosing the bicycle as the primary transport mode. The same would
happen with a person who, prefers the car, so she ends up choosing the car instead of using public transport or active transport. However, economic theory is wrong, since individual elections do not always represent preferences.

While Sen does not define a set of core capabilities – as noted by many authors (Nussbaum, 1995; Robeyns, 2003, Kronlid, 2008) and Sen himself – Levy (2013) suggests the freedom of movement as a core capability. Even though her idea builds specifically around a gender perspective, it applies to all social relations of ethnicity, age, and socioeconomic factors, as well as the physical and psychological states of the person, among others. Before transport user, the person is a being that interacts with others in public spaces and later in collective spaces that can be public transport. The choice of travel, both in its individual and collective dimensions, responds to the ways in which people can interact in these spaces. The focus is then in the actual possible movement of people and the choices they make, considering far beyond the socioeconomic profile and the ‘optimal’ travel choice proposed by transport planners.

The assumption that the freedom of movement is a core capability helps to define a wide range of interpretations that can be obtained from the understanding of the CA. In this case, Levy (2013) recognises that travel choices are far from the ones transport planning usually assumes, which means a constant trade-off from men and women about the use of transport. She highlights how the appropriation of users “through equal access to necessities and opportunities in the city are both conceptual and practical” (p.58), and suggests that this appropriation can contribute to build notions of collective power.

As already referred in the first introductory chapter of this research, Stiglitz (2012) reminds us that the development of GDP has not been
sufficient to cover all impacts on human life. Similarly, modal choices and increased accessibility must be measured based on conditions beyond the economic reward. In this regard, the Capability Approach (CA) and the Happiness Approach (HA) share a similar basis, both reflecting a focus on the social matters. Both share the conceptions of inquiring and highlight the individual elections, while also strength the idea that human well-being is developed beyond the concept of economic well-being. And, both CA and HA have developed different measures and evaluations for promoting human well-being (see Bruni et al. (2008) for more extensive similarities and differences of both approaches).

Both the CA and the eudaimonic version of HA aim at identifying the fundamental contributing factors to autonomous aspects of well-being and development. (Bruni et al., 2008; p. 4)

However, just as the similarities between CA and (the eudaemonic version of) HA are evident, so are the differences. On the one hand, the CA is normative and uses the capabilities and functionings to deliver the information that allows evaluating the actions. In general, CA emphasizes the achievement of equality. On the other hand, the HA analysis focuses on a more empirical and less normative interpretation of the problem, based mainly on the interpretations of psychological aspects and related to people's behaviour (Bruni et al., 2008). This difference is essential in the decision measurement or using the measurement and analysis instruments of this research based on the CA and not the HA.

There is another reason why the development of CA makes more sense in the context of this research: the conversion factors. The CA establishes that there are certain conversion factors, which are those that allow a person to translate their resources or assets into functionings (states of being and doing). The effective conversion depends on social, personal, environmental, family, labour factors, everything that has to do
with the context of the person. All of them constrain the abilities of individuals in obtaining what they need for their life.

Resources are imperfect indicators of human well-being, because human diversity makes conversion rates (of resources into realizations) different for distinct individuals. Thus, one particular level of opulence could be related to totally different levels of well-being if the individual's personal or social circumstances are associated with different abilities of converting resources into valuable states of being. (Bruni et al., 2008; p. 2)

Recent studies focused on the relationship between transport and CA (Hickman et al., 2017; Ryan et al., 2015, 2019; Nordbakke, 2013; Nordbakke & Schwanen, 2014) have found that this is a relevant approach that can help to solve social equity issues in transport planning. Hananel & Berechman (2016) already address some justice considerations in decision-making, where CA can contribute to broadening the lack of justice and equity considerations in traditional transport planning. With the purpose of examining specific cases, the work of Ryan et al., (2015) discusses the mobility resources and transportation for elderly segments of the population, highlighting the possibilities of further explorations and employment of the CA as a conceptual framework within transport research. A similar discussion has been already presented in relation to the capabilities among older women and other cohorts, especially elderly people (Ryan et al., 2019; Nordbakke, 2013; Nordbakke and Schwanen, 2014). In the context of regional and rural planning, Smith et al. (2012) explore the minimum transport needs framed in terms of transport disadvantage and the CA. And from an infrastructure provision scale, Wismadi et al. (2014) use the Capability Approach to define the opportunity to mobility as a non-income indicator, through Spatial Preference Modelling.
In developing contexts, the use of the capability approach in transport is even scarcer. Hickman et al., (2017) have attempted to understand the capabilities, functionings and travel in different socioeconomic neighbourhoods in Manila, Philippines. Cao & Hickman (2019) have recognised the differences between functioning and capabilities in the case of three station areas in Beijing using Martha Nussbaum’s interpretation of the CA, in order to understand how these factors impact in the attainment of opportunities in life.

Other approaches such as Social Capital (Robison et al. 2002; Adler and Kwon 2002; Adam and Roncevic 2003; Field et al. 2000) or Motility (Kauffman et al., 2004; Shliselberg and Givoni, 2017; De Witte et al., 2013; Cuignet et al., 2019), also share a similar basis, and concepts that speak of development and constriction factors similar to those mentioned. However, these aspects have not been as widely considered in this research as much as the CA.

2.4.1. CA, social equity and justice

The Capability Approach (CA) (Sen 1985, 1999, 2001, 2009) has developed an understanding of the social dimensions of equity, based not only on access to resources or people’s possessions, but also on the opportunities that people have, relative to their contexts. The approach is only beginning to be considered in the transport field, and this section suggests how CA might be used as an instrument for assessing the social components of transport projects. First, CA is discussed in view of the wider literature on social equity. Secondly, a framework is developed for using CA in transport, based on upon the concepts of capabilities and functionings. Finally, suggestions are made on how this might be applied through a survey and in-depth interviews. I argue that CA could be a complementary evaluation method for assessing the social impacts of transport projects, based on the analysis of users’ expectations and attitudes towards transport and daily activities, which they are able to
perform.

CA was originally developed by Sen (1985; 2009) as a response to the lack of understanding on the social dimensions of equity, related not just to material resources but also to the opportunities that people have. In CA, the main focus is on what individuals are able to do, taking us beyond the role of institutions and the identification of ideal social arrangements. The framework is focused on two dimensions of substantive equity (Hickman et al., 2017):

- **Capabilities**: represent the “alternative combinations of doings and beings [functionings] that are feasible [for a person] to achieve” (Sen, 1999, p.75): Capabilities are located in the field of the person’s freedoms and opportunities of the things she can do or be. The definition of capabilities strongly relies on the understanding and attainment of functionings.

- **Functionings**: defined by Sen as the “various things a person may value doing and being” (Sen, 1999, p.75), which includes the actions that individuals are able to perform and achieve. In transport, this could be interpreted as the person’s experienced levels of accessibility, and the actual travel and participation in activities.

CA can be useful within transport as it moves beyond concepts of social inclusion or use of accessibility planning. The CA elaborates an understanding of substantive equity, considering: “not only the various things we succeed in doing, but also in the freedoms that we actually have to choose between different kinds of lives.” (Sen, 2009, p.18). The “different kinds of lives” also represents a challenge when elaborating on the psychological and societal dimensions that shape individual’s freedoms. Some aspects to consider include: ability, income, education, aspiration, political and cultural context and societal norms. Hence, the understanding of capabilities takes us beyond the conventional framing
of social impact assessment in understanding the shaping of individual capabilities, and also in the understanding of the actual achievement. The CA progresses beyond conventional accessibility planning, focused on the theoretical accessibility to particular activities, by considering the obstacles that might stop people from using the accessibility provided. Accessibility planning was a major step forward conceptually from the more conventional mobility planning, yet is limited in assuming that there is a ‘free choice’ in using the accessibility provided. Issues such as income, education, aspiration, etc. limit the free choice. Hence there is a link back to Harvey (1973), who is insistent on the importance of structural factors to urban development and, by implication, transport.

In the literature, there are additional overlaps with more recent research in transport planning, such as the importance of individual attitudes (Anable, 2005) and societal influences (Urry, 2007; Shove, 2012) relative to travel, which suggests there are psychological and societal dimensions to travel. However, the CA focuses the attention on the achievement of opportunities, that can be seen as predecessors of quality of life for individuals (Anand, Hunter, & Smith, 2005). What people achieve “plays a crucial role in determining the relation between capability and well-being” (2005, p. 12). Therefore, the CA has potential in bringing together different approaches in the emerging transport field and applying them in terms of social equity. The freedom to choose our opportunities, within certain constraints, also brings with it responsibilities, to the extent that each activity is a selected action (Sen, 2009) – where there is some relation back to the Socratic notion of virtue.

Outside the transport field, Robeyns (2005) also reflects on some of the important characteristics of CA as a normative, interdisciplinary and multidimensional concept. Robeyns suggests that the key to CA is in understanding the differences between the means and the ends of well-being and development (Robeyns, 2005, p. 95). In transport, this relationship between means and ends can be a useful distinction. For
example, accessibility is a means rather than an end. No one aspires “to be accessible”, but having accessibility allows achieving and reaching activities and resources. The “end” is the actual functioning – the realisation of substantive equity. In this conceptualisation, accessibility (and transport provision) might be seen as a means to achieve social equity or justice, modified by particular individual’s capabilities.

This difference and interdependence between capabilities and functionings is then of special interest. In particular, defining (or measuring) the gap between them might determine the existent level of equity between individuals (or social segments), alongside the actual levels of capabilities and functionings. This information can help understand what these groups expect to perform and what they are actually able to do, with transport as one element in the means to reach the required outcomes. Despite the positive contribution that CA generates from the individual’s perspective, Sen (2009, p. 295) remind us about the limitations of this approach:

(…) Capability is only one aspect of freedom, related to substantive opportunities, and it cannot pay adequate attention to fairness and equity involved in procedures that have relevance to the idea of justice. (…) The central issue here concerns the multiple dimensions in which equality matters, which is not reducible to equality in one space only, be that economic advantage, resources, utilities, achieved quality of life capabilities (Sen, 2009, p. 295).

2.4.2. CA, personal freedoms and choices

The freedom to choose is a relevant aspect considered by Sen related to how people are able to manage their own lives. In this regard, the capability to perform different activities is valuable in itself, as well as people having to decide how to use the freedom they possess. Poor transport networks or services often limit the choice of modes, impacting
The individual freedom to choose implies at the same time the consideration of the subjectivity for each individual. In this regard, Sen highlights the importance of the use of objective reasoning in the field of feelings in order to think about issues of justice and injustice (Sen, 2009, p. 41). This is partially because it could be argued, from the analysis of subjective elements from users’ feelings and preferences, that some elections are not necessarily related to rationality but emanate from the efficiency of systems.

Personal elections and freedoms are relevant aspects considered by Sen (1985) in order to inform how people are able to manage their own lives. The capacities of reasoning and choosing – inherent to human beings – are tested and even constrained under institutional frameworks ruled by inflexible norms. Sen himself recognises the limits of choice based on false consciousness and the social position of user, that is, their class, gender and other intersectional identities (Sen, 1999). These limits of choice are in tension with the concept of "travel choice" (Levy, 2013) applied in forecasting modelling by transport planners. The limits of choice affect individual’s scope of action when transportation do not meet individuals’ needs and requirements. On the contrary, the provision of a wide range of transport alternatives, in terms of modes and trips flexibility, allows people having more opportunities and freedoms to perform their activities and meeting their needs.

The significance given to personal elections has shaped an important
criticism of CA, regarding its individualistic focus which places individual requirements over collective demands. Personal needs have the potential, of course, to be directly encouraged to be consistent with societal requirements. Sen (1985) takes this into account, criticising the principles of justice from Rawls (1971), giving more weight to equal individual liberties rather than the distribution of communitarian resources. Even though the Rawlsean approach was mainly focused on primary goods rather than income, this is the reason that sustains Rawlsean theory, prioritising liberty over social justice assessment. On the contrary, the CA brings more attention to the opportunities that individuals might have from the ownership of those goods, adapting and adjusting those resources into characteristics of good living.

The dichotomy between personal choice and collective demands has importance in the applicability of CA in transport. How could a collective transport system of goods, services and people, be planned under these principles? Can individual needs be aggregated into a communitarian context? How much focus should we give to the user perspective? In transport, perhaps the difference is not so stark – that individual and collective advantages are close to the idea of the common good.

2.4.3. CA, opportunities and resources

There is a strong association between poverty and transport, and this has been well researched (Beyazit, 2015; Lucas et al., 2001; Lucas, 2004; Church et al., 2000; Preston and Rajé, 2007; among others). However, socio-economic factors are just one of the valuable aspects regarding the opportunities that can be attained by people. A lack of income may even lead to a different range of activities that could be a match with well-being — indeed there is evidence that the focus on GDP growth has not led to increases in well-being and that the gains from higher wealth on individual happiness tail off at a relatively low threshold (Layard, 2005; Wilkinson and Pickett, 2010). One of the fundamental points made by Sen (1985) concerns the inadequacy of the utilitarian approach to
capture the different and heterogeneous aspects of development.

Adaptive preferences are a concept that can facilitate the understanding of this critique towards utilitarianism (see for example Teschl & Comim, 2005). Adaptive preferences are the preferences of individuals who have been created in unfavourable circumstances, rooted in the lack of restriction of options. Utilitarianism does not take into account the adaptive preferences of users. For example, lower income groups (or fewer opportunities to generate that income) tend to restrict their number of trips for being located in less accessible areas. The lack and vulnerability of users as a result of using certain transport modes (as is the case of Santiago with the use of buses in certain areas) determine their preferences. This preference, then, is a result adapted from the inadequate and negligent care of the conditions for using these modes. The use of concepts such as opportunities and capabilities goes beyond the adaptive preferences of users. Although it does not dismiss these conditions, it focuses on subjective evaluation at a level more significant than the hedonic value – closer to the notion of eudaimonic value instead.

Nussbaum (2011), developing Sen’s work, considers people’s conditions as a strong factor in the attainment of development goals. Nussbaum often works directly with gender, considering the deficiencies not only in the utilitarian approach but also in CA. However, these adaptive preferences are not considered in the equation when using evaluation tools for transport projects such as the CBA or single actor MCA. It does not consider, for example, the reasons of users who could potentially choose a particular mode, but who do not do so for specific reasons restricting their preference.

Regarding opportunities and resources, these may be cut down by different factors related (or not) to individuals, and capabilities are: “no more than a perspective in terms of which the advantages and disadvantages of a person can be reasonably assessed.” (Sen, 1985, p. 296). Sen defines the real poverty as the lack of opportunities, which can
be a result of capability deprivation. In this sense, disadvantaged groups, such as the elderly, ethnic, racial or sexual minorities could have even more difficulties than low-income groups – although they are intersecting identities. In the transport field, these specialist needs should be taken into account in terms of configuring plans where less advantaged people can stretch and achieve their capabilities as well as people without these restrictions.

2.5. Quantifying and applying the CA in transport planning

The idea of quantifying capabilities is relevant for suggesting this approach in policymaking. A quantitative approach that seeks to distribute just goods and impacts might get things more straightforward than the pursuit of measuring the capabilities and opportunities of people for living better lives.

Nussbaum (2011), when considering fundamental entitlements, suggests that there is a minimum level of capability that must be accomplished as a response to the ambiguity in the quantification of capabilities. The problem of the ambiguity of the concepts used in Sen’s work is evident when attempting to operationalise the theory in an applied field such as transport. Functioning seems fairly straightforward in terms of being represented by actual travel, but capability can be interpreted in transport in various ways. It could be the aspiration of individuals to access particular activities, which are then moderated by various constraints to produce the actual functioning. Each person’s capability is moderated by physical and attitudinal attributes and by the political and cultural context and societal norms. It could also be represented by the highest capabilities experienced in a sample group, with other respondents compared relative to these levels of freedom. This chapter takes the former approach, but the difficulty still remains in determining the level of theoretical capability for each individual.
The space of capabilities provides the most fruitful and ethically satisfactory way of looking at equality as a political goal […] [however] equality of resources falls short because it fails to take account of the fact that individuals need differing levels of resources if they are to come up to the same level of capability to function. (Nussbaum, 2011; p.35)

In Nussbaum’s work there is a link made between the goals of development and individual needs as presented above. Hence the capability could be a target level. From the perspective of equality, the problem of needs coverage – either from the individual’s perspective or the systemic societal perspective – relies not only on the lack of resources but also on the abilities that individuals possess to take advantage of resources. The analysis of constraints that might affect individual’s abilities could be analysed through multi-level perspectives, such as developed by Geels (2011; 2012) and others (Whitmarsh, 2012; Nykvista & Whitmarsh, 2009). These respond mainly to socio-technical regimes grounded in norms that have oriented the activities of social groups. Informative, educational and communicational skills also play an important role in the attainment of social abilities as well as physical skills that might be constraints especially in terms of transportation abilities.

The work of Alkire (2005) in this regard is interesting for discussing the question of the applicability and operationalization of the capability approach. She suggests “even if we acknowledge the considerable value of the ‘more general’ framework, the pragmatic and insistent questions about how to use the approach in different contexts are still well worth asking for a number of reasons” (p.116). This is particularly important for the developing of the research, as it experiments with the possibility of applying CA in a Latin American city.

Defining the more operational part of the CA – which leads more easily to the application of it on the field of transport planning – requires us to
revisit the main objectives: the expansion of the freedoms of deprived people, for them to enjoy ‘valuable beings and doings’, which brings both justice and poverty reduction. This comes along with the fundamental access to the necessary resources and people’s possibility to make their own choices (Akire 2005, p. 117).

The openness in terms of interpretations and lack of indicators from the CA produce certain levels of uncertainty for measuring and using this approach in an empirical context. The opportunities and capabilities potentially executable are more difficult to measure in terms of impacts in order to be translated into public policy.

One of the main problems of CA is to find an approach to measurement and hence application. In this regard, the levels and differentiation between capabilities and functioning are of special interest, as this might determine the level of equity relative to what individuals expect to perform and what they are actually able to do – and also between individuals. The problem of measuring transport equity might be tackled from this angle – the levels and difference between capability and functioning can be viewed as ‘transport equity’, with higher levels and a reduced gap being more equitable. Physical accessibility would be at a higher level than capability, modified into the capability by various factors that affect the ‘free choice’ of accessibility, such as physical ability, income, education, aspiration, political and cultural context and societal norms.

The impact and measurement of functionings can also be explored more in depth. Chapter 4 expands on an approach for measuring functionings in health-related factors affecting transport users in their daily commutes, distinguishing between functionings and ‘weighted functionings’. Weighted functionings consider the levels of assessment and the value people assign to the factors assessed. This allows understanding the gap between people’s current states and their aspirations, which lead towards their capabilities. This consideration has revealed significant differences
between segments, especially in disadvantaged groups as public transport users, women and low-income segments.

The variation between capabilities and functionings between individuals, neighbourhoods and other jurisdictions, and the gap between capabilities and functionings are all of interest – hence there is much potential for fruitful analysis. Kronlid (2008) explores the relationship between capabilities and mobility, suggesting that this relationship strengthens the significance towards the individual’s well-being. This definition of mobility is based essentially in the same theoretical structure to CA, but associating physical movement to opportunities. He argues that mobility should be in the list of capabilities, as being mobile could be considered as an opportunity, placing the practical reasons for its incorporation in the work of Alkire and Black (1997).

Martens (2016) replaces mobility with accessibility, and this research supports this as the stronger position to take. The concepts presented are interesting as they locate mobility as an intrinsic element of peoples’ well-being. Although Kronlid (2008) suggests a relationship between social and spatial mobility, none of the authors have presented, so far, a solution to the complexity of measurement of capabilities in transport. This consequently leads us to consider to what extent the concepts presented may help to articulate a transport planning approach based on the parameters of CA. In that sense, Chapter 3 of this research delves on the methodological aspects of the use of capabilities. The method describes the design of a qualitative tool based on the list of central human capabilities developed by Nussbaum (2003). The list was modified for considering the transport and urban planning context. Nussbaum’s list is a comparative quality of life measurement and as a proposal for measuring capabilities. She considers the list of 10 capabilities as central requirements of a life with dignity in different spheres of life, where intrinsic to these capabilities is the idea of the “minimum account of social justice”:
1. Life  
2. Bodily health  
3. Bodily integrity / comfort and built environment  
4. Senses, imagination and thought  
5. Emotions  
6. Practical reason / planning one’s life  
7. Affiliation: respecting, valuing, appreciating people / social interaction / discrimination  
8. Species / nature  
9. Play / recreational activities  
10. Control over environment / able to influence decisions in the local area

The first group of capabilities, as constituted by the concepts 1, 2 and 3 in the list above (life, bodily health and bodily integrity) are located within the strengths and weaknesses of health, so they are part of an internal or external diagnosis of the physical condition the individual. In terms of transport they might be related to age, educational level, disabilities (including physical conduct and the use of space), the physical and mental impacts produced by the interactions between people using transport modes (including casualties), or the physical consequences produced by the interaction of the people with the surrounding built environment.

The second group of capabilities, numbers 4 to 7, constitute the concepts of senses, imagination and thoughts; emotions; practical reason; and affiliation. These are mainly considered in terms of personal feelings, for example in terms of the inner or personal result of the interaction with the chosen mode, others during the journey, or possible internal feelings and emotions produced during the journey. In terms of transport, these issues could also be related to freedoms and feelings relating to the trip itself.

The third group of Nussbaum’s capabilities, numbers 8 to 10, consider the concepts of nature and species, play and recreational activities and control over the environment. These are mainly based on contextual and
material dimensions. These are related to the relationship between the individual and flora and fauna, as well as the local area where the individuals live. In terms of transport, these capabilities might be related to natural (biodiversity) corridors, closeness to parks and natural elements within the city and the extent of impacts on natural elements related to individual travel. Regarding the local area where the individuals live, there are issues related to the sufficiency of recreational and cultural facilities concerning the choice of travel and during the trip. There is also the relation between individuals and the political context as part of the control of their own environments.

Nussbaum (2003) recognises, in her list of Central Human Capabilities, the basis of the construction of an effective or successful society, in essence, the components of Socratic eudemonia. The issues might be applied into different areas of life – transport amongst them. Once the Central Human Capabilities are translated into transport visualizations, it is possible to define a measurement method to delimit a range of impact and weight for each concept.

2.6. Relevance on the context, conversion factors and policymaking

Considering the concepts of functionings and capabilities described above, the conversion factors then allow a person to translate their resources or assets into states of being and doing – or functionings. The different abilities a person has for converting these resources will be part of the context and will affect in the realisation of her wellbeing. This concept is especially relevant in the context of this research, as it starts from the basis that the society is tremendously unequal. All the characteristics of socioeconomic and sociodemographic groups are so uneven, that the capacity to convert their assets will be also variable. For example, having access to the bicycle for someone living in the centre or living in the periphery will determine a different asset – people living in the periphery will be less likely to travel by bicycle if they have to
commute long distances. But what happens if the comparison does not depend on location or income? Same example about the use of the bicycle but considering different gender. Young (1998), for example, suggests that people’s social constructs (considering gender, race, ethnicity, among others), define their exercise of their capacities and might result on deprivation beyond economic constraints. For instance, a woman and a man living both in the same area, commuting a similar distance; for the woman, the factors associated to gender will affect in her capacity to convert her resource and fully exercise her capacity using the bicycle. She might have to look after a safe route, avoiding unlighted places, she might be a victim of harassment in the streets while cycling, and she might have to cycle faster to get to pick her kid up at the nursery. All those conditions will determine different outcomes when compared to a man without those obligations and constraints. In policymaking these conversion factors or disadvantaged groups seem not to be considered in most cases.

The translation of concepts from the Central Human Capabilities into transport would be an important conceptual step forward in assessing the social impacts of transport infrastructure. Considering the CA categories, or similar, would be beneficial in that wider, are inherent aspects of transport affecting individuals would be revealed relative to the conventional social impact assessments carried out in transport. This would increase our level of understanding, relative to approaches such as WebTAG, including categories such as impacts on feelings and emotions. These types of impacts are likely to be important to various modes, including walking and cycling, and to the travel experience and the well-being of travellers. As argued earlier in this chapter, the increase in well-being has its ultimate goal as the attainment of happiness.

There is difficulty in applying CA in transport planning, largely in terms of quantifying the capability dimension. The functioning element is relatively straightforward, representing actual travel – and is the part that transport
planners usually measure in analysis. However, the reason for choosing CA as a complementary instrument is based on the idea that the evaluation of social justice in transport should include an assessment of potential physical (and perhaps social) mobility as well as actual mobility. The main problem is in data collection, and this thesis presents the possibility of using surveys and interviews and in-depth interview based on CA criteria, to be incorporated in the process of a widened participatory approach to project development and impact assessment. The process is, however, more than a revised set of criteria covering social issues – it also requires some judgement, quantification and discussion on capabilities and functionings, and to the gap in between.

CA can be used as an inclusive tool, using a bottom-up approach from the users’ perspective, and as a mechanism for evaluating required and real access to opportunities and activities through the use of transport, as far as there can be an effective measurement of functionings and capabilities. To achieve this, it is necessary to openly ask people about their current requirements and achievements relative to travel. The scoring of criteria, weighting and impact scoring allows the user to reflect on their travel behaviours, including the opportunities and constraints impacting on these processes. Beyazit (2011; p.123) has established an interesting perspective for transport as a means that can articulate more than one function:

“If individuals can get more than one functioning from a good, then a transport system can propose several functionings that a person can get from them’.

2.7. Conclusion
The research focuses on the exploration of critical appraisal and empirical evidence to understand the factors that can potentially reduce gaps in social inequality through transportation projects. Within the framework of the concepts that define the literature review, the CA has
been selected as a suggestion for exploring these inequities considering factors that have not been conventionally used to acknowledge these problems. The bases and the argumentation of several academics in different areas of knowledge about capabilities, allow inquiring deeply and richly this theoretical approach. Although other researchers have suggested its use in transport planning such as Beyazit (2011), Pereira et al. (2017) and Priya Uteng (2006) (for others see Error! Reference source not found.), there is not enough empirical evidence that could place CA as an accurate and reliable alternative in the reduction of inequalities through transport projects. This chapter presented the theoretical and conceptual bases that will guide the extend of this research, as well as the methodological proposal that will frame the exploration within the next following chapters.

In terms of the content, the chapter began by questioning why the CA can offer an alternative for transport project assessment. Three arguments are proposed concerning the changes in the way current transport project assessment works, under the analysis of normative and ethical considerations, building on social equity’s concepts; looking upon personal freedoms and choices; and recognising the attainment of individual's opportunities.

1. CA allows understanding, measuring and using concepts such as capabilities and functions, enabling to measure the differences between individuals and societal cohorts. The lower the levels and higher the gap between the current and expected achievement of opportunities, the farther we are from achieving equity.

2. CA reflects on the importance of individual decisions, attributing value to the preferences and freedoms that people require. A public transport network, for example, must be flexible enough to allow room for the exercise of these freedoms. The mode choice, as well as the scope of the needs and activities that people perform, are some examples of this.
3. CA goes beyond the commonly placed associations between deprivation and lack of economic resources. The CA allows measuring the development of a person, group or community, through the opportunities that people can achieve.

Transport should be understood as facilitator in the development of fairer societies. If transport is the *means* that supports some social transformations, then equity and social justice should be seen as critical goals in transport planning and need much strengthened definition and debate. However, there is difficulty in applying CA in transport planning, largely in terms of quantifying the capability dimension. The functioning element is relatively straightforward, representing actual travel – and is the part that transport planners usually measure in analysis. However, the reason for choosing CA as a complementary instrument is based on the idea that the evaluation of social justice in transport should include an assessment of potential physical (and perhaps social) mobility as well as actual mobility. The process is, however, more than a revised set of criteria covering social issues – it also requires some judgement, quantification and discussion on capabilities and functionings, and on the gap between.

The CA, through the distinction between capabilities and functioning, might determine existing levels of equity in terms of what individuals wish to do and what they are actually able to perform. However, the significance given to personal elections – considering also the importance of freedom and personal subjective elements – has shaped an important criticism of CA. In transport, as well as other public goods, the accomplished differentiation of individual and collective advantages should be closer to the idea of the common good, and from the CA perspective, collective needs must be matched to the attainment of collective solutions and opportunities. If a policy target is used as the capability, then this is made clearer. However, it is also important to consider abilities that individuals have in order to take advantage of their
resources – societal goals are also played out at the individual level.

If capabilities can be measured effectively, then CA might be used in the planning and appraisal of transport, indeed in wider public policy interventions. This provides us with a much stronger accomplishment-based understanding of social justice. If inequity is rising in many contexts, then we would expect that transport inequity is too, yet there is little evidence to help us conclude on this topic. Accessibility planning, whilst a major progression from mobility planning, has not been used to the extent it might have been – and is underestimating the problem. CA offers us a way forward to consider social equity in transport more effectively, focusing the analysis on the freedoms we might like to choose in our lives.

The following sections show the process of evolution of the research. The revision of concepts suggested by the first literature review opened a series of research questions that would trigger the development of the thesis. The search for methodologies and the first pilot survey conducted in Chile in 2016 initiated a second derivative of the problem about equitable transport. This meant a new search for bibliographic material and references in the literature that have formed the basis of the analysis. These new concepts that have emerged from a second literature review have then been developed in detail in the empirical chapters. The decision to locate these bibliographical references within the empirical chapters and not in the literature review, responds to the fact that they have emerged from the exploration of the CA. The CA has been, then, the underlying theoretical engine that has framed the search for other principles, theories and approaches that allow responding to the common instrumental and utilitarian view towards transport.
3. Methodology

3.1. Introduction

This chapter outlines the research process that has been adopted in the development of the thesis. The duration of the process has helped in framing and re-framing some methodological aspects and decisions during the course of the PhD. The first step has been the understanding and contextualisation of the different concepts and complexities related to equity and justice issues in transport. Then, the measurement and operationalisation have been relevant for looking at ways of applying and implementing changes in this regard. A mixture of research methods has been used throughout the research to understand these complexities, giving value to the different quantitative and qualitative aspects that helped answering the research questions.

In this sense, this chapter unravels the process of making methodological decisions and taking steps to fulfil the objectives of the research. It starts referring to the structure used for looking for sources and references in the process of building a literature review. The structure mentions the non-linearity of the process of discovering the authors and scholars that have guided the research. It follows with the definition of the main and secondary questions that have outlined and helped conduct the empirical chapters, and the consequent development of the research.

The decision of working both with qualitative and quantitative data have been grounded on the nature of the outcomes. It was suspected from the beginning that understanding the impacts of transport in equity would have required both aggregated results from a large sample of population, as well the understanding of the underlying reasons, opinions and motivations leading the decision of policy makers. This shaped two pathways for developing the data collection and the analysis of results. The chapter will follow up with the different techniques used for analysis:
statistical analysis and regression models, content analysis and multi-criteria analysis. Quantitative analyses are employed using surveys and qualitative analysis with interviews – both are necessary to develop a thorough understanding of transport and social equity issues in Santiago. This led to a reflection of the use of diverse methods on research: the advantages and disadvantages, and how this opens new windows of opportunities for future research.

3.2. Research Aims and Questions

The aim of the research is:

To examine, through a critical appraisal of theoretical approaches and empirical evidence, the factors that configure the development of transport projects, and resulting impacts associated with social equity, that can potentially reduce the gaps of social inequality; and to propose paths for incorporating these factors into the planning and assessment processes.

Thus, the main question for this purpose is as follows:

Which factors in transportation projects can reduce the gaps of social inequality, and how can they be incorporated in the planning and assessment processes?

With the purpose of facilitating the development of the research, the main question was disaggregated into four secondary questions that have framed each research chapter (see Table 3.1). These questions guided the analysis of the following chapters covering four broad areas, as outlined below.

1. What are the perceptions of policymakers about incorporating new metrics of social equity in transport appraisal? This question will set up the understanding of the context in which the decisions of transport appraisal are taken.
Understanding policymakers’ awareness and priorities in relation to social impacts is relevant for re-shaping the metrics, tools and policies intending to improve equity. This question has been addressed in Chapter 5, unravelling policymakers perceptions on equity issues in transport. The methodological approach taken to answer this question was primarily qualitative, using interviews and thematic analysis.

2. **How might social equity be measured in its relation to transport projects?** This question seeks to define the measurement tool and equity indicators. Along the research, this question will build upon the concepts of capabilities and well-being. Empirical Chapter 6 applies the capability approach in the transport domain, particularly considering transport-related health issues. Empirical Chapter 7 studies emotive and utilitarian factors of the subjective well-being, and how these factors relate to modal choice. A quantitative approach has guided both chapters, using a survey carried out with different profiles of users.

3. **Who are the most vulnerable groups affected by transport and how do they perceive these inequalities?** This question relates to the gaps of social equity that must be addressed through transport improvements. In both Chapters 6 and 7, there is an exploration of different socio economic profiles and population cohorts with the most vulnerable groups in society, and the impacts transport produces in their lives. As presented in the previous question, a quantitative approach has been used for the recognition of these groups, using a survey conducted in Santiago. The analysis has been carried out through statistical analysis and multinomial logistic models.

4. **How can decision/making processes and transport appraisal effectively be improved in the current context?** Considering some of the most revealing concepts founded as research
outcomes, the fourth question is centre on the applicability and potential changes of the current context – both normative and on appraisal. Chapter 8 explores how transport policymakers perceive the strengths and limitations of current project assessment and what is their perception on incorporating new measures in the analysis for improving equity.

<table>
<thead>
<tr>
<th>Secondary questions</th>
<th>Chapter</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Q1</strong> What are the perceptions of policymakers about incorporating new metrics of social equity in transport appraisal?</td>
<td>Chapter 5</td>
<td>Interviews with experts, Thematic Analysis</td>
</tr>
<tr>
<td><strong>Q2</strong> How might social equity be measured in its relation to transport projects?</td>
<td>Chapter 6 and Chapter 7</td>
<td>Survey Users, Descriptive statistics, Multinomial logistic model</td>
</tr>
<tr>
<td><strong>Q3</strong> Who are the most vulnerable groups affected by transport and how do they perceive these inequalities?</td>
<td>Chapter 6 and Chapter 7</td>
<td>Survey Users, Analysis of correspondence, Multinomial logistic model</td>
</tr>
<tr>
<td><strong>Q4</strong> How reached social equity factors might be incorporated into the decision-making process for transport projects?</td>
<td>Chapter 8</td>
<td>Workshop experts, Multi-actor multi-criteria analysis</td>
</tr>
</tbody>
</table>

Table 3.1. Summary of secondary research questions, empirical chapters throughout the research, and primary methods used in each chapter.

The definition of the problem and the motivation of the research guided the reach of theoretical approaches from the literature. This was a fundamental step ahead from the previous knowledge of the case study, towards the recognition of commonalities with other contexts (in both the global north and the global south), the development of theoretical approaches from authors of different backgrounds, and the recognition of new concepts previously unknown.

The literature review in Chapter 2 was organised in two main topics: social equity and justice, followed by the study of the capability approach. However, every empirical chapter has a brief literature review at the beginning of the chapter. This review contributes to understanding the specific problems and concept presented in each chapter, and helps
framing the specific analysis used for solving the research questions. The main body of the literature considers key concepts of social equity and justice, through the Aristotelian perspective, followed by Rawls, Harvey and Hay. Then the literature centres on the potentialities of the Capability Approach developed by Sen, suggesting links with the transport field, as well as concepts on equity and justice. The Capability Approach is explored in its components of personal freedoms, opportunities and resources, including discussion of applicability and policymaking. Some of these concepts have been further developed in empirical Chapter 6. Then some deeper understanding on subjective well-being and its relationship with the emotive components – drawing on the Aristotelian notions of fairness – will be explored in Chapter 7. Chapter 5 and 8 examine issues on policymaking and approaches that help conceive the applicability of some of the factors explored in the analysis in practice.

The understanding of the literature helped on the research reformulation, considering the aim of the research and the secondary questions. It was also useful for defining the methodological approach carried out during the PhD process. It allowed building a conceptual framework for adequately understanding concepts as social equity and justice within the context of transport planning. The literature review examines different perspectives of authors that have highlighted the need to properly consider the issues of equity and fairness, mainly from urban planning and transport fields.

3.3. Chronology of the research

Figure 3.1 explains the research, highlighting the non-linearity of the process and actions taken. The first component of the graph below is temporal (shown on the X-axis), considering the 4 years the PhD took for completion. On the other hand, the Y-axis, the figure shows the definition of the skills involved in the tasks, divided in: written and oral communication; research and information management; analysis and
problem solving. The circles show the main tasks developed, and the amount of inner circles show approximately the time (approximate number of months) for completing the task. Some of the tasks have led into other subsequent activities. The conferences and training attended have nourished and fed the analysis, so they have been incorporated as crucial elements of the process of the PhD. Two data collection processes were carried out, both linked to the definition of the empirical chapters. They were also part of a process of understanding how to conduct qualitative and quantitative research data. A second review of the Literature Review was developed in between empirical chapters. This helped to a more exhaustive analysis into the concepts that required more attention and represented new challenges for interpreting the data collected.
Figure 3.1. Research Process. Source: own production.
3.4. Quantitative Research

The first two secondary questions of the research have nurtured the focus of the quantitative exploration of the research; the first one relating to the ways for measuring equity in transport projects and the second one pointing out to the most vulnerable groups affected by transport. Therefore, the research considered the use of quantitative methods for the development of Chapter 6 and Chapter 7, based on the use of a capability-based survey.

The assumption is that public transport users (mainly bus users) and lower income segments would show a disadvantage with respect to other transport users and people with better economic situation. However, the findings resulted in a much more precise distinction of the most vulnerable people in transport. The results will also show that disadvantaged people have less options of choosing their preferred transport modes and they tend to associate positive affective and instrumental factors to modes that they are not able to use. These perceptions evidence equity gaps between groups – where the most vulnerable groups are much more affected.

3.4.1. Survey design

The quantitative exploration is based on a database resulting from a survey that collected information on a wide range of travel and related issues. A 7-pages questionnaire was carried out in Santiago de Chile during November and December 2016 through a quota-sampling method for gathering the information, considering the spatial segmentation of the city into six macro areas. The comparison of the socio-demographic information from Pre-Census of 2012, allowed an equal representation of both genders and a representation of the proportion of inhabitants per area have been chosen as relevant characteristics of the sample. In total, 451 persons validly completed the survey (out of a sample of 500 questionnaires). All the face-to-face questionnaires were carried out by
the researcher. Some questionnaires were run collectively (no more than 6 people for allowing questions from respondents) but most of the questionnaires were collected individually.

The CA framed the survey design, for operationalized through a dedicated survey design (see Annex 1). The core of the survey consisted of the identification of different user profiles, based amongst others on their primary transport mode. This approach has been used in various contexts, especially in health and education. Chapter 6 investigates specific existing literature in the field of health, which has helped to strengthen the use of the capabilities approach in the context of this research. However, the use of the Central Human Capability (CHC), developed by Martha Nussbaum, has encountered extensive academic discussion. Economists, philosophers and other humanists have openly criticized the generation of this list (Feldman & Gellert, 2006), and the differences between Nussbaum and Sen have been commented on the basis of the different disciplines they represent (Robeyns, 2003).

In the context of other disciplines, for example, education has used capabilities as a measure of progress in the curricular and pedagogical development of children with some degree of disability (Price, 2015). Price suggests that since the CHC proposed by Nussbaum are central to individuals, incorporating that list into the teaching evaluation will allow general better educational curricula for students. The fields of health and bioethics have pointed out that having a list of capabilities allows societies to determine the threshold levels of each aspect of that list, depending on the contexts and resources (Venkatapuram, 2013). However, beyond reviewing the different sectors and disciplines, capabilities have been associated with the construction of social wellbeing. Anand et al. (2005), use secondary data that, together with the CHC, deliver interesting results about the operationalization of this approach. On the other hand, and despite the differences in the interpretation of the capabilities or the CHC list, the development of
research associated with the use of the capabilities has been beneficial to cover measurement and implementation issues, with a focus on poverty reduction (Qizilbash, 1997; Gasper, 2000, Alkire, 2002).

The categories firstly proposed by Nussbaum in her Central Human Capabilities list (2011) were understood through the lenses of transport, for considering possible indicators based on these concepts (shown in Table 3.2). For example, when considering the categories of Life, Health and Integrity proposed by Nussbaum, the possible application in transport planning could correspond with concepts as stress, physical activity, perception of air pollution while travelling, physical and psychological security levels (safety and security), accidents, noise and crashes. Some of these elements have been previously addressed in transport research. However, the novelty of incorporating these factors relies on the assessment of the users’ perceptions on how these factors affect the way they perceive their opportunities. Table 3.2 shows the categories of the survey considering transferability of concepts from the central human capabilities list (Nussbaum, 2009) into transport.
<table>
<thead>
<tr>
<th>Nussbaum’s Central Human Capabilities List</th>
<th>Categories for the application into transport</th>
<th>Indicators for measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Life</td>
<td>1. Factors of self-assessed physical and mental integrity.</td>
<td>- Stress</td>
</tr>
<tr>
<td>2. Bodily health</td>
<td></td>
<td>- Physical activity</td>
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<tr>
<td>3. Bodily integrity / comfort and built environment</td>
<td></td>
<td>- Air pollution</td>
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<td></td>
<td></td>
<td>- Safety</td>
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<tr>
<td></td>
<td></td>
<td>- Comfort</td>
</tr>
<tr>
<td>4. Senses, imagination and thought</td>
<td>2. Associations between primary transport mode and emotive/instrumental concepts while commuting (or performing main activity)</td>
<td>- freedom</td>
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<tr>
<td>5. Emotions</td>
<td></td>
<td>- insecurity</td>
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<tr>
<td></td>
<td></td>
<td>- functionality</td>
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<td></td>
<td></td>
<td>- enjoyment</td>
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<td></td>
<td></td>
<td>- affordability</td>
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<tr>
<td></td>
<td></td>
<td>- poverty</td>
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<tr>
<td></td>
<td></td>
<td>- safety</td>
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<td></td>
<td></td>
<td>- value of time</td>
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<td>- unpunctuality</td>
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<td>- congestion</td>
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<td>- efficiency</td>
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<td>- luxury</td>
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<td>- environmental care</td>
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<td>- health</td>
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<td>- social interaction</td>
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<td></td>
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<td>- comfort</td>
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<td></td>
<td></td>
<td>- happiness</td>
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<td></td>
<td>- status</td>
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<td></td>
<td></td>
<td>- enjoyment</td>
</tr>
<tr>
<td>6. Practical reason / planning one’s life</td>
<td>3. Reasoning and planning for commuting and/or regular trips</td>
<td>- assessment of access to job opportunities</td>
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<tr>
<td></td>
<td></td>
<td>- reliance on public transport for commuting</td>
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<tr>
<td></td>
<td></td>
<td>- frequency of activities</td>
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<td></td>
<td></td>
<td>- difficulty for performing activities</td>
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<td></td>
<td></td>
<td>- relevance of having choices in transport</td>
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<td></td>
<td></td>
<td>- access to transportation and life quality</td>
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<td></td>
<td></td>
<td>- affordability</td>
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<td></td>
<td></td>
<td>- access to jobs</td>
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<tr>
<td></td>
<td></td>
<td>- availability of transport modes</td>
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<td></td>
<td></td>
<td>- public transport quality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- other modes in the integrated fare</td>
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<tr>
<td>7. Affiliation: respecting, valuing, appreciating people / social interaction / discrimination</td>
<td>4. Social interaction with other people while commuting or doing regular trips</td>
<td>- assessment of the level of interaction</td>
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<tr>
<td></td>
<td></td>
<td>- importance of other people while travelling</td>
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<tr>
<td></td>
<td></td>
<td>- feelings of discrimination</td>
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<tr>
<td>Nussbaum's Central Human Capabilities List</td>
<td>Categories for the application into transport</td>
<td>Indicators for measurement</td>
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<tr>
<td>8. Species and nature</td>
<td>5. Nature and sustainability</td>
<td>- variability depending on weather</td>
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<td></td>
<td></td>
<td>- access to sustainable transport modes</td>
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<td></td>
<td></td>
<td>- willingness to pay for more access to sustainable modes</td>
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<tr>
<td>9. Play and recreational activities</td>
<td></td>
<td>- access to sustainable transport modes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- importance of sustainable transport</td>
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<tr>
<td></td>
<td></td>
<td>- trees, greenery and parks</td>
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<tr>
<td></td>
<td></td>
<td>- access to transport modes</td>
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<tr>
<td></td>
<td></td>
<td>- widening sustainable modes supply</td>
</tr>
<tr>
<td>10. Control over environment / able to influence decisions in the local area</td>
<td>6. Information</td>
<td>- access to information and modal interchanges</td>
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<tr>
<td></td>
<td></td>
<td>- waiting, transfers and travel times</td>
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<tr>
<td></td>
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<td>- difficulties when transferring</td>
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<td></td>
<td>- access to technological online tools</td>
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<td></td>
<td></td>
<td>- evaluation of technological tools</td>
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<tr>
<td></td>
<td></td>
<td>- technology importance in transport</td>
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<tr>
<td>7. Built environment</td>
<td></td>
<td>- considering transport infrastructure for private vehicles</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- parking</td>
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<td>- quality of highways</td>
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<td>- space for pedestrians</td>
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<td></td>
<td>- quality of sidewalks</td>
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<td></td>
<td>- clean bus stops</td>
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<td></td>
<td>- sits in bus stops</td>
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<td></td>
<td></td>
<td>- weather protection bus stops</td>
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<tr>
<td></td>
<td></td>
<td>- amount of cycle lanes</td>
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<tr>
<td></td>
<td></td>
<td>- quality of cycle lanes</td>
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<tr>
<td></td>
<td></td>
<td>- bike sharing system</td>
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<tr>
<td>8. Productive activities and commuting</td>
<td></td>
<td>- access to the public transport network</td>
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<tr>
<td></td>
<td></td>
<td>- commuting productive trips</td>
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<td></td>
<td></td>
<td>- possibilities of getting a good employment</td>
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<tr>
<td></td>
<td></td>
<td>- assessment of current available opportunities</td>
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<td>- satisfaction with job</td>
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<td></td>
<td></td>
<td>- daily travel times</td>
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<tr>
<td></td>
<td></td>
<td>- transport expenditure.</td>
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</tbody>
</table>

Table 3.2: Categories of the survey considering transferability of concepts from the central human capabilities list (Nussbaum, 2009) into transport.
3.4.2. Survey Pilot

The first step was to conduct a pilot survey to test the questions and analysis of the results before the definitive survey application. The definition of the areas was based according to information of the Census data (2002). The pilot was also helpful to understand the extent of information that could be collected a survey tool and the problems on each specific area of study. Previous empirical research on measuring qualitative indicators was used for the pilot design. The result was a pilot questionnaire of 40 questions, applied Santiago in January 2016, with a result of 75 surveys (out of a sample of 100 surveys) validly submitted in the period of one month.

The pilot survey was important to test the questions and define the spatial component of the sampling for representing a wider diversity of people. As Santiago has a strong territorial component of urban segregation, the sampling places were defined with the attempt of getting the most variety of income segments. The pilot survey considered the longitudinal section of the city from the central area to the southern east part. The selection of places for sampling went along five communes with different income, population and density constitution according to Census data (2002), as shown on Figure 3.2. The built environment and social context are diverse enough to take different samples of realities and experiences of each transport mode. Sampling considered individual face-to-face questionnaires in: (a) public areas of shopping mall centres, (b) workplaces and (c) households in residential sectors. The results of the pilot surveys were analysed with statistical and factor analysis, and the questions revised, in order to reduce and improve the questionnaire to have better outcomes. The analysis that informed the first revision of the survey, allowed amending and improving the tool.
Figure 3.2. Interviewee’s residence location for pilot survey. Source: own elaboration.

3.4.3. Data collection

The final questionnaire consisted of 65 questions, which was conducted in Santiago during the months of November and December 2016. A quota sampling method was used for gathering the information at the city level, considering representativeness with the data obtained from the Santiago Pre-Census of 2012.

Five hundred questionnaires were printed, 483 were partially or entirely filled out, 17 questionnaires were blank. Of the sample, 451 questionnaires were considered having at least five complete pages answered - questionnaires with more than two or more pages unanswered were invalidated. The rate of valid responses is high as it involves questionnaires completed face to face. Invalid questionnaires are due to lack of time or because the interviewee dropped the interview due to various circumstances.
Figure 3.3 shows the distribution of the surveys that expected to reach out different sectors of the city and socio-economic profiles. An equal gender representation and proportion of inhabitants per area were chosen as relevant characteristics of the sample. The survey was carried out in centres of activity with dense provision of offices, services and educational centres. These sub-centralities have different characteristics in regard to the built environment – it is assumed that these factors have an impact on the results. Examples of street sections and differences in the built environment (housing, roads, pedestrian space, among others) can be seen in Figure 3.4.

In the first part of the survey, participants were asked about basic socio-demographic data, such as the commune of residence, gender, age, disabilities, level of education, current occupation, income, and main and secondary transport mode for commuting. In the second part, the questionnaire asked about the modes that people associate with emotive and instrumental positive concepts of commuting, as well as the levels of overall satisfaction with the trips. The third part related to aspects of reasoning and planning of the commuting or regular trips, assessment of the access to job opportunities; the reliance on public transport for
commuting and frequently performed activities; level of transport options and quality of life affected from access to transportation. The fourth part considered aspects of social interaction with other people while performing trips; assessed the presence of other people and raised questions about feelings of being discriminated while travelling. The fifth part considered concepts related to nature and sustainability, asking about the consideration of switching modes according to the weather; access to sustainable transport modes and willingness to pay for more access to sustainable modes. The sixth part raised questions about access to information and modal interchanges when performing regular trips; waiting, transfers and travel times; aspects that make transfers more difficult; and access to technological tools facilitating making decisions over daily trips. The seventh part assessed the built environment, considering transport infrastructure for private vehicles, public transport and cycling infrastructure. The eighth and final part considered questions related to commuting and productive trips; level of access and possibilities of employment; travel times and expenditure. All concepts were transferred from the Central Human Capabilities list (Nussbaum, 2011) and reinterpreted for a transport discussion.
Figure 3.4. Streets sections and differences in the built environment of the municipalities in which the survey was carried out. 1) Providencia, 2) Nunoa, 3) Macul, 4) La Florida, 5) Puente Alto. Source: own production based on Google Maps.
Perception questions use a Likert scale with five points from Bad to Good (1 to 5). Categorical variables were analysed through absolute and relative frequencies for the descriptive socio-demographic analysis. From the total of valid surveys (451), where 31% of the respondents are car users, 60% are public transport users, and 9% are active travel users. Figure 3.5 shows the distribution of the primary transport mode over the sample. In Figure 3.5, active travel is represented in blue – mostly located in central areas; public transport is represented in cyan – spread all over the city; and private transport users are represented in red – mostly located in the wealthiest area which corresponds with the information reflected in Figure 1.2. Figure 3.6 shows the distribution of income – which corresponds widely with Error! Reference source not found. in terms of the distribution of wealth which is concentrated in the eastern area of the city. In the figure, dark blue corresponds to high income profile; light blue represents people on middle income; and cyan represents low income sector. The distribution quite coincides with the information presented in Figure 1.2, however is less distinct in the extrapolation of high and low income sectors.
3.4.4. Analysis of quantitative data

Chapter 6 uses statistical analysis for demonstrating and highlighting the main socio-demographic differences between groups. As participants were asked about basic socio-demographic data, such as the commune of residence, gender, age, disabilities, level of education, current occupation, income, and main and secondary transport mode for commuting, the statistical analysis allowed contrasting and recognising the main disadvantaged groups.

Chapter 6 uses just the first part of the survey, which related to the measurement for health-related factors. It uses a Likert scale with five points from Bad to Good (1 to 5). Categorical variables were analysed through absolute and relative frequencies for the descriptive socio-demographic analysis. Comparisons were made according to gender and primary mode of commuting, considering Fisher test – statistical significance test used in the analysis of contingency tables, especially for small samples. P value is the probability of how likely it is that the observed differences between groups are due to chance. Most authors
refer to statistically significant as \( P < 0.05 \) and statistically highly significant as \( P < 0.001 \) (less than one in a thousand chance of being wrong).

<table>
<thead>
<tr>
<th>Health-related factors</th>
<th>Functioning measurement</th>
<th>Weighted functioning measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Likert 1 to 5, (1) Bad - (5) Good</td>
<td>Likert 1 to 5, (1) Not important - (5) Very important</td>
</tr>
<tr>
<td>Levels of stress</td>
<td>How do you assess the level of stress you experience on your usual trips?</td>
<td>What is the importance you assign to the levels of stress?</td>
</tr>
<tr>
<td>Levels of physical activity</td>
<td>How do you assess the level of physical effort you experience on your usual trips?</td>
<td>What is the importance you assign to the levels of physical activity?</td>
</tr>
<tr>
<td>Levels of proximity to other transport users</td>
<td>How do you assess the level of proximity to other transport users that you experience on your usual trips?</td>
<td>What is the importance you assign to level of proximity to other transport users?</td>
</tr>
<tr>
<td>Levels of exposure to air pollution</td>
<td>How do you assess the levels of exposure to air pollution on your usual trips?</td>
<td>What is the importance you assign to the levels of exposure to air pollution?</td>
</tr>
</tbody>
</table>

*Table 3.3. Questions used in the survey for the measurement of health-related factors in transport considering functionings and the weighting functioning measurement.*

Chapter 7 used an analysis of correspondence, which is an analysis based on the primary mode of travel and the questions about affective and utilitarian values. There is a correspondence when a person’s primary mode is the same as the one they selected for those values. For example, if a respondent’s primary mode is Car and he/she indicated that mode in relation to Freedom, then there is a correspondence. This analysis uses the second part of the survey, related to the affective perceptions over different transport modes. As the survey allowed the respondents to make associations between the primary transport mode and 18 positive and negative feelings, the respondents could indicate all the modes they associated to the feelings on the list. Some of these feelings were positive (e.g. happiness or enjoyment), while others were negative (e.g. discomfort or poverty). For the analysis, three affective and
three instrumental factors were considered: freedom, enjoyment, happiness, security, time savings and efficiency, respectively. The questionnaire provides a binary indicator that describes the presence or absence of modal correspondence for each one the selected six factors. The analysis has considered socioeconomic variables (gender, age, education, occupation, income, disabilities), as well as other variables as driving licence, journey times, monthly expenditure on transport and satisfaction with the overall trip.

The methodologies used are analysis of correspondence and multinomial regression, both around the associations of transport modes and affective/emotional and instrumental factors, derived from the SWB framework. The particular statistical technique was selected for reasons of the data type. For this research, the optimal case would have been to have variables of a numerical nature in order to explore through *tobit* or factor analysis models. The method for applying factor analysis uses Pearson correlations, which is the most commonly used in statistical analysis programs. Under this method, the variables tend to be distributed as normal, so the nature of the data is different, and when working with ordinal or categorical variables, the analysis tends to be more complex.

### 3.4.5. Reflections about the use of quantitative data

One of the most complex issues of measuring subjective factors of public and private transport users has to do with the objectivation of the individual perceptions for purposes of quantitative research and statistical data analysis. For example, one of the survey questions was looking for an assessment of the physical characteristics and available facilities close to the respondents’ home location. This question that seemingly could be easily answered, was more difficult to assess for users living in low-income areas, as they simply did not have the physical infrastructure to be assessed. For instance, bus shelters, cycle lanes or bike sharing system, green public spaces, recreational, cultural and
sporty facilities, were some of the examples difficult to assess by people living in low-income or deprived areas.

Another reflection after sampling is how research can provide an objective source of information despite evaluating subjectivities from different individuals. Opposite to what happened in the first case, some interviewees living in the same area assessed the same existent infrastructure in a completely (even contradictory) way. Statistical analysis can help here, by aggregating the values obtained in order to reduce the impact of outliers. However, when doing so, the perceptions of the majority are often taken to represent those of the whole sample, and so mask the perceptions of the underlying minority responses. Overlooking these minority perceptions could directly affect particular disadvantaged groups. Subjectivity (in the form of qualitative data) is here usually more interesting than quantitative data, particularly when considering human behaviour. People often think that large quantitative datasets are more rigorous and objective, but they can end up being superficial. For example, when assessing the state of the public realm, the aggregative analysis could disregard places in which the public realm could be critical for the development of a certain community or group. In that case, most useful insights come from qualitative analysis.

The measurement and differentiation of the capabilities and functionings is a big challenge of using the capabilities approach. In the first part of the chapter, the importance of functionings to understand the capabilities of a person was pointed out. This led towards a reflection on the way of assessing the functionings-capabilities gap, with an alternative possibility of measuring ‘weighted functionings’. This means considering the assessment of certain factors (as the ones suggested from the transferability of the human capabilities list), based on the levels of functionings, but weighted according to the levels of importance that the person attributes to that factor. The quantification of weighted functionings also allows looking at the level of inequalities that must be
addressed by transport policy and practice. This is especially relevant in cases, for instance, in which the level of expectations of performing certain activity goes beyond the realised functionings. When having expectations on using a sport or leisure facility, without being able to access them, the value of functionings will be lower than the capabilities (as they represent doings and beings that a person can feasibly achieve). This is even more critical in sectors of the city or segments of society in which the capabilities of people are reduced as a consequence of the lack of facilities, reducing the opportunities of participating in these activities. When having the facilities, the reduction in capabilities could be explained, for example, with a person with a high workload and long travel distances not having enough time to perform sport or leisure activities. These conditions, exacerbated by the (poor) quality of the transport system and related journey times, might have the effect of decreasing this person’s opportunities and therefore her capabilities.

The various ways of interpreting the differences between functionings and capabilities led into a specific way of discussing the gap. For this purpose, two ways for assessing the distance between functionings and capabilities have been defined in the survey.

The first way of measurement considers the assessment of the current status of a particular aspect (functionings) but assuming that people in these areas expect to have the greatest possible welfare. For example, in the case of evaluation of facilities close to home, people can assess the status and adequacy of educational facilities on a scale of 1 to 5 ("very bad" to "very good"), but as researcher we assume that the maximum expected (capabilities) is obtained for people who answer "very good". An example of this type of question could be: “How would you assess the space for pedestrian on the sidewalks, close to your home location?” (1=very bad; 5=very good). This question assumes that reaching the maximum level of assessment would be preferable for people, so the question allows distinguishing between groups just based on this
evaluation. The higher the score persons give to their status, the closer they are to reaching their personal capabilities.

The question does not directly ask respondents to report on their (perceived) capabilities, but only asks them to make a statement regarding the realised assessment of their functionings. This first type of questions was combined with a second type, asking about the level of importance of a particular facility. In this case, the definition of the levels of importance for that criteria helps when defining the main relevant attributes for a particular group or segment. An example of such a question is: “How important is for you to improve sidewalks?” (1=less important; very important). The answer to this question allows weighting of the factors assessed. This measurement has been defined as ‘weighted functionings’, as it combines the assessment of actual activities or facilities weighted according to the priority given to them.

A second way of measuring the functioning-capability gap is by the relative difference in people’s perceptions regarding a particular variable. This alternative does not assume that the maximum would be desirable for the person, and yet asking the level of importance provides a more accurate way of discussing the weighting of that variable. This could be used especially for questions related to subjective perceptions of people about their trips, feelings, emotions, and experiences. For example: “How do you assess the level of proximity to other transport users that you experience on your usual trips?” (1=bad; 5=very good). Compared to the first question above, this one does not necessarily assume that the maximum level would be preferable or important for people, so the analysis relies on the second question: “How important is for you the factor of being close to other transport users while travelling?” (1=not important; 5=very important). The definition of the level of importance that that person attributes to this aspect helps for defining the maximum in which the gap between functionings and capabilities will be measured.
Unlike the first measurement method, the second compares the variables in relation to an estimated maximum. This is different from the first type of question as we cannot assume a maximum or minimum level of assessment of this factor, as the users’ perceptions will vary according to their preferences. We can assume people will want a ‘very good’ bus stop shelter, but we cannot assume they will want a low or high level of closeness to people. The difference indicates how distant are the expectations of the person versus what they can actually achieve the realization of that activity.

These two approaches have also been applied to assessing the levels of importance of performing productive or leisure activities; questions regarding willingness or preferences about transport modes; perceptions regarding transport expenditure; or aspects related regular travel experience. The difference in the use of a capability-based approach compared to more mainstream surveys into these issues is the nature of the questions, exploring the things people value doing or being that help them achieve higher levels of freedom in their lives.

3.5. Qualitative Research Data Collection

Qualitative data collection has been used in the research for developing further aspects and complementing the existing information provided by quantitative analysis. The exploration of quantitative tools in this research, especially statistical analysis and regression models (Chapters 4 and 5), has allowed understanding some of the factors affecting disadvantaged groups. Public transport users, women and low-income segments have been more profoundly affected over time by constraints produced by transport. However, these tools have not been enough for covering a wider set of issues arising in the context of inequalities, especially those that often depend on institutions and policymakers, as well as the nuances of individual behaviours – which often can only be understood through face-to-face discussion. A significant challenge and innovation of this research has been the utilisation of a broader spectrum
of methods, combining qualitative and quantitative research for recognising both strengths and weaknesses.

The use of qualitative methods mainly focused on the resolution of questions 3 and 4, about the perceptions and importance that institutional actors attribute to the attainment of social equity, and how that discussion can be incorporated into decision-making processes.

3.5.1. Semi structured interviews

The first qualitative method explored was the use of semi-structured interviews. Interpreting the results from the first quantitative analysis with a set of qualitative in-depth interviews with policymakers was important for cross-checking the information collected. A total of 19 interviews were held with planners, experts, private consultants and academics in the field of urban planning and transport (see Table 3.4). The interviews were conducted to local, regional and national level. Communitarian organizations pro-mobility and NGOs were also considered in the pool of interviewees.

<table>
<thead>
<tr>
<th>Type of institution</th>
<th>Transport</th>
<th>Planning / Architecture</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Private</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Academia</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>NGOs</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

*Table 3.4. Classification of interviewees, considering the type of institution and their background.*

Interviewees have been selected on the basis of the impact their works have produced on programs, policies and practices. Diversity in terms of the background was an essential criterion for defining the interviewees. In the context of Chile, and indeed in other contexts, transportation planning has been strongly linked to an engineering background - specifically in transportation engineering. This has limited the ability to solve the problems derived from transport impacts in a more transdisciplinary and integrated way. The diversity of background of the interviewees allows both for contrasting and generating a consensus of
ideas, through an exchange of perceptions and knowledge richer in content. **Error! Reference source not found.** shows the total of 19 interviewees have been approached for these purposes, being named throughout the chapter according to the table below (E1, E2, E3… etc.).

<table>
<thead>
<tr>
<th>Type institution</th>
<th>Position</th>
<th>Background</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1 University</td>
<td>Academic</td>
<td>Engineer</td>
<td>Female</td>
</tr>
<tr>
<td>E2 NGO</td>
<td>Director</td>
<td>Activist</td>
<td>Female</td>
</tr>
<tr>
<td>E3 Regional Gov.</td>
<td>Project Manager</td>
<td>Architect</td>
<td>Female</td>
</tr>
<tr>
<td>E4 NGO</td>
<td>Director Studies</td>
<td>Sociologist</td>
<td>Female</td>
</tr>
<tr>
<td>E5 Public/Private</td>
<td>Director Studies</td>
<td>Engineer</td>
<td>Male</td>
</tr>
<tr>
<td>E6 Municipality</td>
<td>Planning Director</td>
<td>Architect/</td>
<td>Female</td>
</tr>
<tr>
<td>E7 University</td>
<td>Academic</td>
<td>Engineer</td>
<td>Male</td>
</tr>
<tr>
<td>E8 National Gov.</td>
<td>Sub Secretary</td>
<td>Engineer</td>
<td>Male</td>
</tr>
<tr>
<td>E9 National Gov.</td>
<td>Director Studies</td>
<td>Engineer</td>
<td>Male</td>
</tr>
<tr>
<td>E10 National Gov.</td>
<td>Sub Secretary</td>
<td>Economist</td>
<td>Female</td>
</tr>
<tr>
<td>E11 University</td>
<td>Academic</td>
<td>Engineer</td>
<td>Male</td>
</tr>
<tr>
<td>E12 Private</td>
<td>Director</td>
<td>Lawyer</td>
<td>Male</td>
</tr>
<tr>
<td>E13 Private</td>
<td>Director</td>
<td>Architect</td>
<td>Male</td>
</tr>
<tr>
<td>E14 National Gov.</td>
<td>Coordinator Studies</td>
<td>Engineer</td>
<td>Male</td>
</tr>
<tr>
<td>E15 Private</td>
<td>Engineer</td>
<td>Engineer</td>
<td>Male</td>
</tr>
<tr>
<td>E16 NGO</td>
<td>Coordinator Studies</td>
<td>Geographer</td>
<td>Male</td>
</tr>
<tr>
<td>E17 Private</td>
<td>Director</td>
<td>Architect/ Planner</td>
<td>Male</td>
</tr>
<tr>
<td>E18 Private</td>
<td>Engineer</td>
<td>Engineer</td>
<td>Male</td>
</tr>
<tr>
<td>E19 Academic</td>
<td>Researcher</td>
<td>Engineer</td>
<td>Male</td>
</tr>
</tbody>
</table>

Table 3.5. Interviewees, by institution, type of institution, position, background and gender

A series of interviews have been conducted with these experts, of around 45-60 minutes duration. The purpose of comparing these interviews has been focused on unravelling their underlying motivations, contradictions, inconsistencies and commonalities in the use of language on the issues that have arisen from this research. The interviews were conducted alongside the analysis of similar factors explored in the capabilities survey with transport uses.
3.5.2. Questionnaire design

The previous knowledge of the case study and the definition of the main theoretical guidelines of the research were the main components helping to frame the questions. As seen in previous chapters, the first research questions explored the measurement and perceptions across unconventional factors, leading to a questioning on how these can improve the access to better levels of equity through transport projects. The second set of questions relate mostly to the incorporation of these factors into current project appraisal processes, both considering the technical aspects and the particular intentions of institutional actors in order to incorporate these factors. The aspect of improving social equity as an underlying motivation is not evident in all cases, so the interviews have helped understanding this for the purpose of the main question of this research.

Similar questionnaires were used with the interviewees, considering different nuances depending on their positions and type of institutions. The main topics guiding the interviews were:

1. How social impacts are considered, social indicators used, status of transport project appraisal, current methodology used and possible improvements.
2. How the current National Investment System helps incorporating social equity criteria on project assessment. Weaknesses and strengths of the process.
3. Factors and criteria that should be incorporated in transport project assessment for better integration of socially equity issues. Obstacles that the institution faces in order to incorporate these criteria.
4. Relationship between different government levels, intervention scales and between institutions. Challenges of integration and participatory tools.
5. Transport projects that should be promoted in Santiago to better reflect social equity issues.
3.5.3. Analysis using thematic analysis

Content analysis has been defined as ‘a research technique for the objective, systematic and quantitative description of the manifest content of communication’ (Berelson, 1952). The nature of the definition involves the quantitative description of the content that has been communicated. However, the contradiction with the use of this approach is that it has been proposed as qualitative analysis technique for this research. Another well-known definition by Holsti (1969) suggests that the content analysis would allow make objective inferences by the systematization of the information received on the messages. The systematization process could be presented in the manner of codes and themes emerging from the aggregation of the main topics named and discussed by the participants communicating information for the process of research.

Although both definitions help framing the analysis that has been carried out in this research, the more accurate approach comes from the slope of qualitative content analysis, that puts the emphasis on the significance and meaning of the data and categories appearing in the analysis.

The object of the content analysis carried out was based on the transcripts of interviews. The transcripts were coded, which made possible digging on the main concepts that interviewees suggested during the conversations. The most relevant concepts exposed during the interviews were recorded as codes, though an inductive procedure of looking for the main topics developed during the research. The result was a list of 18 codes, dividing into five overarching themes. Chapter 5 developed in detail two of these themes, that were particularly important for defining policymaker’s perceptions on current project appraisal and its consequences on equity.
3.5.4. Multi-actor multi-criteria analysis (MAMCA)

The extensive and permanent use of cost-benefit analysis methodologies is one of the criticisms that research discusses, for which it intends to analyse possibilities both in the theoretical and practical content for appraisal practices in the transport context. In this regard, changes and refinements to participatory multi-criteria analysis (MCA) methodologies, which have the capacity to incorporate a wide range of stakeholders with the purpose of being an alternative to the traditional cost-benefit, have been developed during the last years (Macharis and Bernardini, 2015, Dean, Hickman, Chen, 2019).

Incorporating participatory approaches has been considered as a relevant qualitative method of analysis for this research. A participatory workshop with policymakers and relevant actors was organised for the purposes of this research, helping to recognise and incorporate their views in the final process of the research. Because of its innovative nature, it has been presented as a separate mechanism to evaluate the possibility of incorporating social equity factors in the current evaluation processes of transport projects. The possibility of incorporating these processes helps understanding the applicability of both the discussion and the definition of factors affecting the social dimension of projects. This has been also a provocative alternative to discuss preliminary results of this research with some key actors working in the transport and urban planning industry and public sectors in the context of Santiago.

The idea of choosing a particular project to be assessed in the context of Santiago, was considered beneficial for testing factors affecting the equity dimension after the empirical analysis of chapters 4 and 5. The factors founded to be relevant could be then tested in one particular project of interest. For the selection of the transport project, the research takes advantage of the contingency of a transportation project that has been designed in recent years in Santiago. The project has been called Nueva Alameda Providencia (NAP) as it is a reconversion of one of the
most critical transport corridors of the city. The project brings together the renovation of one of the structuring BRT corridors of Santiago together with urban development and urban ecology considerations. The scale considers the regional level, for the impacts that a regeneration project of this size could produce in the city. The actors involved in the design and configuration also acknowledged those different scales, which became part of the critical challenges of the project implementation. The complexity of the project is a useful attribute for discussing it under the lens of social equity, considering the impacts potentially produced after its implementation. The project NAP will be extensively described and analysed later in Chapter 8.

The need to complement existing analysis tools and assessment of transportation projects was one of the problems exposed in the motivations of this research. In this context, a multi-actor multi-criteria analysis (MAMCA) exercise is a good opportunity for testing experts’ views on urban planning, transport, public policy and project management, in the local context. The analysis of the first two empirical chapters of the research led to think about the need of redefining the way transport appraisal has been conducted over the last years. Current appraisal approaches are all expert led (developed by the project promoter or consultants) and fail to represent the range of population groups – particularly disadvantaged groups – in the process. MAMCA allows a much stronger participatory process to be followed, depending on which actors are included in the process.

The use of MAMCA in the context of this research aims to identify, highlight and assess the particular opinions of a group of experts participating in the activity of evaluating current and possible approaches on project appraisal. The MAMCA allows evaluating different alternatives on the objectives of the different stakeholders involved (Macharis et al. 2012) and has been increasingly used for decision-making in environmental policy evaluation due to the complexity of issues and the
inadequacies of conventional tools such as Cost Benefit Analysis (CBA) or Cost-Effectiveness Analysis (CEA) (Macharis and Bernadini, 2015). Besides these characteristics, MCA allows weighting different criteria, depending on the assessment of decision-makers, so it might be estimated in the analysis of authorities and administrative organizations for research proposes.

Seven steps conform the methodology (Macharis et al. 2012):

1. Definition of the problem and identification of alternatives
2. Identification of stakeholders
3. Definition and weighting of the stakeholder’s objectives
4. Indicators for measuring the objectives
5. Construction of evaluation matrix
6. Ranking of alternatives with strengths and weaknesses
7. Implementation

The MAMCA methodology used in the process of analysing the NAP project will be explained in detail in chapter 8. Although the use of multicriteria analysis in Chile has been discussed for 20 years, the consideration of integrated and comprehensive criteria is still a challenge for transport infrastructure investment. Moreover, the use of innovative tools challenges the incorporation of comprehensive criteria assessment. In this context, testing the NAP project against MAMCA methodology would be a contribution for the discussion.

The MAMCA activity was conducted during May of 2018, through a collaborative workshop that was held and co-organized at the Diego Portales University together with the Observatory of Sustainable Mobility (SUMO). In total, the workshop had 15 participants: academics (6), practitioners (6) and government actors (3). The workshop had three parts: 1) introduction to the project and the problem, 2) appraisal of the project considering new equity indicators and 3) comments and conclusions about the use of the appraisal tool.
Most of the attendants knew already about the project and many of them were involved in some degree. Some of them worked in the definition of the project, while others were involved from an academic side, as consultants or advisors of some agency related to the project. Introducing the project to the attendants worked then for building on the same ground and to present the latest progress on the project so far. The second part of the workshop considered appraising the project with new indicators focused in social dimensions. Some of these factors were already considered in the existent method of project appraisal. The work of assessing these factors was an individual one, which let all the attendants working individually with assessment sheets prepared specially for the workshop. All the factors proposed, and the scenarios of appraisal used in the activity are detailed in Chapter 7. The third part of the workshop considered an open discussion with the attendants about the factors used for appraisal, as well as the (realistic) opportunities of using these participatory methods in the current context of project appraisal in Chile. The discussion ended up discussing the possibilities of using this tool in future plans, within different scales in the territory. The whole activity was recorded with the attendants’ consent, and the assessment sheets were relevant for understanding the differences and nuances of appraisal among the attendants of the workshop.

3.6. Reflections on the use of multi methods approach for research

The process of trial and error in the definition of the survey questions was interesting. The consideration of a theoretical framework, based on the capability approach, was a challenge concerning the application of theoretical concepts in a survey. The prototyping and piloting phase of the survey was fundamental to understand the applicability of the questions and the type of information that the survey allowed.

The process of surveying people was carried out face to face. For
example, in the piloting phase, when designing the instrument, the process of surveying was valuable because it allowed to verify which were the most conflicting questions to understand for people. Once the weaknesses were detected, it was possible to amend some of the questions for the final survey phase. On the other hand, this was one of the most challenging aspects of the research, since the time of fieldwork was limited, same as the available resources. Techniques such as snowball and the use of an extensive network of contacts were fundamental - as well as the selfless help of people that facilitated and allowed links with several respondents.

Currently surveys in the Chilean context, mostly consider user satisfaction, focused on the consideration of travel times and the efficiency of the operation. Using the survey prepared for this research also opened the opportunity to test the possibility of incorporating new questions to current project assessment - suggesting new factors for improving the quality of travel.

The application of the face-to-face survey also allowed an essential interaction with people who have different socioeconomic realities, different travel patterns, different daily activities and different needs regarding transport. All this was very valuable when it came to raising awareness of what was expected to be fundamental factors in defining opportunities for people when they referred to transportation. Although the analysis of the survey has been done through quantitative methods of analysis, the application of the survey allowed relevant conversations with the respondents, beyond the questions of the survey. This did not happen in all cases, but it helped to sensitise around the relevance of factors that do not necessarily benefit savings in travel times, efficiency or speed.

The use of interviews with relevant actors in the political scenario allowed making visible the efforts of this research. Presenting the research topic, as well as the conceptual and methodological particularities was
beneficial for making visible issues that, for now, are not necessarily relevant in the context of Chilean transportation planning. Currently, most professionals working in this field have a transport engineering background, so the approach from planning was, in itself, a plus when interacting with specific actors. The search for a broader range of professionals related to issues of equity and vulnerability resolution was a strategy to broaden the understanding of this issue by professionals in more diverse areas. This is why some architects, planners or sociologists were interviewed as experts. On the other hand, the use of semi-structured interviews also opened the opportunity to understand their current perception of the problem, as well as their personal and institutional motivations for incorporating variables of equity in transport projects.

The use of the participatory methodology in the case of the workshop (in the specific project of Nueva Alameda Providencia) was possible after the quantitative and qualitative exploration of the research. It was an invaluable methodological closure in this sense. On the other hand, it allowed again to make visible the contents and problems of the research with the participants of the workshop. The level of the participants and their interest in this type of methodologies shows that it is possible to achieve a good level of impact throughout this type of research.

3.7. Ethical issues of the research

From personal experience, I believe that being aware of the importance of public transport in the operation of the city started when the Transantiago system was implemented. I had recently entered the University and, despite living relatively close to the place where I studied, arriving there was chaotic and complicated. If I was going through that feeling of chaos, I could barely imagine how it was for people who had more disadvantages.
The problems experienced by someone living much further away, having to get to work early, and paying the full fare were much more difficult. This all showed a profound inequality and urgent social challenges to be addressed. Moreover, the access for elderly people in this context was a very harmful or at least unpleasant experience for sure. The flat fare and modal integration were not enough to cover the social injustices experienced by people that had no more alternative than public transportation and daily commuting travels of more than one hour. What would happen to a person in a wheelchair using the Metro? Or someone with children? What caught my attention in the practice of Architecture, is that it seemed that these issues were unknown to curricular matters, and even more unusual for some studying and working at the University. All the experience of having witnessed and examined from experience the implementation of a deficient system of public transport was the seed to develop this research.

Having the early awareness (before postgraduate studies) that the public transport system means much more than the transfer of people and goods from point A to point B, was the motivation that led me to develop an MSc program in Urban Development. In the course of the programme, I got to share with other disciplines. The development of mobility and urban development issues do not exist in reality without the consideration of the other disciplines that contribute to the generation of that city. Sharing with psychologists, anthropologists, biologists, economists, engineers, sociologists, among others, was an enriching experience. The city must be thought and conceived through the generation of a collective, informed and mutual understanding. The various disciplines and the academy play an essential role in this development.

The Master’s Thesis was focused on the potential of adding functional programs and activities to metro stations, for enhancing a positive synergy within the urban environments in which they were located. In this
way, both users and residents of these areas could gain the benefits of connectivity through the consideration not only of mobility infrastructures, but also the sum of activities that produce value to travel should continue at the future. While research allowed the understanding of variables to be incorporated in the projects of urban design and transport infrastructure, it was possible to both understand management processes of these projects that made more difficult the promotion of these spaces. Thus, the social component began to become increasingly important, as the focus of the discussion was generally and heavily focused according to economic and operational considerations. However, the search for more functional and efficient projects in terms of transport engineering and systems would not necessarily be the solely answer to promoting better use of public transport. Also, reliability for qualifying the performance of the system would not be the only important factor that could solve the standard or the use improvement issue. Important and well-known theories of distribution of goods would also not necessarily be the solution to produce greater social benefits. The results of the first research of the master drew the motivation and the need to continue advancing in the techniques, processes and actors involved. The results reflected the interest in both research and practice of building a city through accessible and equitable mobility.

This present research aims to understand the factors that impact on equity, the perception of these issues by actors that influence processes that can resolve these conflicts, and the recognition of the most disadvantaged groups in society. The research recognises the relevance of answering the questions of how transport affects social equity, from an ethical and practical perspective. The reason for using a variety of qualitative and quantitative methods in this research is that they allow reaching results that complement each other. The nature of the problem is so complex and diverse that the response needs to consider the equilibrated complement between statistical models, the discussions
reflecting the results of a participatory evaluation process, and the rigorous interpretation of a series of interviews. The choice of methods was also an excuse to push and examine new methodologies in order to gain experience and resources for future research.

The development of research has considered the ethical discussion of the personal interpretations – based on experience and the personal political tendency. However, the research design, data collection, analysis and interpretation of results have forced to prevail a "neutrality" free of political colour and social position. This “neutrality” allowed greater consistency when interacting with actors who had different political and ideological positions, becoming an advantage to receive more humbly and maturely the comments of the various transport users (private, public and active) who very kindly responded to my survey. Another ethical challenge of the research was about the interaction with different transport users, who were surveyed face-to-face, with a paper-based survey. The research recognises the relevance of ethical aspects such as those detailed below:

- Respondents and interviewees were informed of the purpose and focus of the interview/survey, and they were informed that they could withdraw the interview when they consider it necessary. People were informed that they could request extra information about the research, channelled through an email.
- In the case of the surveys, interviews and participatory exercises, anonymity in the treatment of the resulting information was ensured.
- The survey used a language that does not violate the susceptibilities of the respondents. On the other hand, the survey recognises that the interviewees have different educational levels, so was written in a direct, formal and straightforward language. For interviews, the questions were formulated in the most a-
political way, in order to avoid conflict with the political ideology of the interviewees.

- The interviewees and respondents are explained that, if they do not understand the content of a question, they can ask for clarification of what it means.

- All surveys were printed in advance, and the places where the survey was conducted were safe and quiet. This allowed the survey to be conducted quietly for the participants.

Regarding the storage and use of information, all surveys were coded and then transferred to a digital response format. The printed surveys were kept in a safe place during the PhD – as a backup in case of losing digital information. The interviews were recorded in digital format, and kept securely, ensuring the confidentiality and anonymity of the interviewees. The digital storage of information, both in the case of surveys, interviews and material resulting from the participatory workshop, was stored for the entire duration of the doctorate.
4. Mobility and transport in the context of Urban Development in Santiago

Santiago is the capital city of one of the countries with the highest levels worldwide of inequality in terms of socioeconomic distribution. Recent social demands, exacerbated in the final months of writing of this thesis, have highlighted the relevance and impacts of the neoliberal economic model in the development of the city – which correlates with the construction of the society and therefore shapes the development of transport infrastructure (see for recent protests and social crisis: Davies, 2019; Guardiola-Rivera, 2019; Sehnbruch, 2019). The transport planning approach has mainly followed the model of highways and the dependence of private car, following the North American model over the 1970s-1990s – which in turn, correlates with the current social demands.

As an example of the territorial inequalities, the following Figure 4.1 shows the income distribution based on the data of the Pre-Census of 2012. In the map, colour blue represents the higher income segment, followed by the green colour (located closely to the blue and also distributed along the main transport corridors of the city). This is the wealthiest area of the city that happens to have an important amount of the main facilities and offices. Therefore, this is the place where most of the trips come together on peak hour – which has been the perfect excuse for keeping the vicious circle of the creation of new infrastructure in these areas. The lowest income segments are represented in red and orange, which are mainly located in the periphery – and recently attached urban conurbations. Another important density of red spots is located in sectors of the southern and northwest area – many of them corresponding to relocation of former informal settlements.
Current barriers of segregation and social inequality seem to be accentuated with long distances to main activities. The inconvenience – and sometimes the inaccessibility – of public transport affects to a large portion of the users of the entire system. This situation results in an unfair transport system for the most vulnerable sector of population. Going back to the concepts of fairness and justice in transport, developed in Chapter 2, it is socially inequitable if different populations have different travel experiences; it is socially unjust when the situation locates the vulnerable groups in position of disadvantage that increases their vulnerability.

This situation of wealth distribution and transport modal choice has resulted in an unjust transport system that is particularly affecting the most vulnerable sector of population. According to the Origin Destination Survey of 2012 (Observatorio Social, 2014), the highest percentages of low-income families per household are located in the south-west
extension area (38%), south (27.7%) and western (26%) area of the metropolitan region, as seen in Error! Reference source not found.. These areas have a high daily usage of public transport (close to 60%) and very low percentage of car ownership and usage, compared to wealthiest areas in the East, where 57% of households have a high household income. The longest trips reported in Santiago are made by public transport. On the other hand, the households that spend more time on trips are located in municipalities of the south, south-west and northern areas – they coincide with municipalities located at the city edges, which have poor road infrastructure and poor public transport services.

In recent years, the results from academic research has accentuated the social inequities as result of transport in the case of Santiago. The reference to everyday mobility in Santiago has also been contextualized in relation to other Latin American cities (Avellaneda, & Lazo, 2011; Rodriguez Vignoli, 2008), but there is much more to be explored in other regions in the Chilean context. Measuring instruments and new methodologies have allowed a more accurate and precise understanding of the social issues arising as consequence of transport infrastructure and housing provision (Cox & Hurtubia, 2016), and the minimum provision of basic services (Tiznado-Aitken et al., 2016). However, the focus on accessibility as a measure of inequities remains predominant (Tiznado-Aitken et al., 2018; Figueroa Martínez, et al., 2018; Niehaus et al., 2016; Rojas et al., 2016). Therefore, an analysis from everyday mobilities (Imilan, et al., 2018; Jirón, 2007, 2010; Jouffe & Lazo Corvalán, 2010) people's capabilities, opportunities and activities are relevant to broaden the discussion on this transport and social equity.

4.1. Socioeconomic distribution

The socio-economic distribution in Santiago is one of the dimensions of the problem. Although the previous Figure 4.1 presents the reality of the
spatial distribution of the socio-economic groups, there are rough realities rooted in deep-seated social problems. The roots and policies focused on the eradication of campamentos and their consecutive location in villas of homeowners have, for instance, perpetuated a situation of complex social stigma. On the other hand, the barriers of segregation not only correspond to the distribution of housing rights, but they are accentuated and perpetuated through the construction of public infrastructure, public realm and public spaces.

The following Figure 4.2, produced by Fundacion Vivienda, shows the location of informal settlements called “campamentos”, and the eradicated populations in 1985. This relocation of the most vulnerable families has its origin in the dictatorship, where a municipal reform took form defining the policies of urban development. The campamentos in Greater Santiago were spatially relocated between the years 1979 and 1985 (Morales & Rojas, 1986). The neoliberal economic thinking guided the decision of modifying the location of the marginal and economically most vulnerable sectors, moving these segments to the periphery. This resulted in a relocation distinguished by socioeconomic polarization between rich and poor groups (Morales & Rojas, 1986), which produced profound disadvantages for people with lower resources. The negative effects of land markets deregulation processes have already been commented not only for the case of Santiago in recent decades but also for other cities in Latin America (Sabatini, Cáceres & Cerda, 2001). Among the commonalities in these cities are the construction of transport infrastructure having a high impact on the capture of capital gains.
The relocation of a massive amount of families caused problems of mobilization and congestion, affecting all the users of a system flowing daily for activities located in central areas of the city. This happened mainly in the communes that tended to higher growth, such as La Florida and La Granja (Labbe & Llevenes, 1986). However, a significant example is the commune of La Pintana (Gurovich, 1999), where the most significant volume of eradications of campamentos, both in quantity and in the total number of displaced people was concentrated in one sector.

Even though the reality of campamentos has improved over the years,
numbers are still alarming. At the national level, by the year 2016, there were a total of 38,770 families living in campamentos, where the most critical conditions were in the regions of Antofagasta, Atacama and Valparaíso. In the Metropolitan Region (Gran Santiago), the number of families living in campamentos by 2016 was 4,337, which represents 11.2% of the national total. More than 60% of these homes earn less than the minimum wage, and 60% have not finished school. There is a 12% illiteracy rate. Very few have access to health. 58% have a precarious job. Community-wide there is a profound problem of broken social foundations.

Transfer families from a campamento to social housing is an essential change from the social and economic point of view. The change in housing causes short-term changes that may be observable, changes that according to (Alvarez Marin & Wurgaft (1988) will undoubtedly have other impacts on the society in the future. Getting a family the option for accessing to their own properties has generated the advantages of having a place. However, this policy has been also greatly criticised and questioned, because the challenge has moved now to the segment that has a place to live but lacks other social components. Rodriguez and Sugranyes (2005) have delved into the problems of “los con techo” (those with roofs). In sectors where the population is homogeneous and turns out to be a disadvantaged population, is difficult to create interaction with other types of opportunities. Therefore, people who lived in campamentos and now live in social housing might remain isolated, perpetuating the circle of poverty.

The relocation of campamentos has been part of the housing solutions given by the Housing Ministry over time. As most of the state resources are used for land purchasing, new social housing is located in already impoverished neighbourhoods far from the city centre. Relocated families turn out to be more distant from their labour source. Transport opportunities in these locations are also scarce, especially when
connected to business and working areas. As consequence, they can either travel long distances or remain in precarious occupations, with no choice but isolation. The relocation to social housing has also as consequence the modification of the jobs to which families can opt. In Alvarez Marin & Wurgaft (1988), even though after the eradication, the heads of household did not lose their job, they were affected by greater mobility.

The case of villas could be even more problematic in terms of physical accessibility. This is the case for families who have moved to the periphery but work in central areas, sometimes taking more than two hours to get to their jobs. Both for campamentos and villas, the relocated families are left with two options: travelling long distances from their new home to their old source of work, or working closer to their neighbourhoods, so they do not have to make such long trips. The second is often the most complicated option because the new residential places are located in areas with lower opportunities. Localisation decisions originate deep problems of physical accessibility to job opportunities, access to health centres and other fundamental social facilities.

Life in the periphery for displaced families means the creation of situations of poverty perhaps much deeper than those lived in campamentos. The extent of the barriers to access is hence important. When relating to the concepts of capabilities and functionings explored in Chapter 2, this is an example in there is a very large gap between the capability and actual functioning, and hence in participation in travel and activities. Part of the public policy agenda has focused in the decrease of poverty over the years. This has appeared in diverse communication channels, so there is a public sense of improvement in this area. However, this perception has been created by the expansion of the margins of what is considered middle class.

The provision of transportation infrastructure and solutions allowing a
minimum transport fare is an urgent requirement to connect these sectors. Santiago has currently not had minimum access conditions that these families need. Both poverty and lack of opportunities are a vicious circle, since areas with homogenous and disadvantaged population are separated from the opportunities and the possibility of building larger social capital. Free public transport is being considered in some European cities such as Luxembourg (Dutra, 2019), and this, or at least minimal cost public transport, would be a great step forward for a city such as Santiago.

4.2. Built environment and modal split

Inequalities related to the built environment are evidenced not only in the use of urban space but in the standard of infrastructure. Today, Santiago has about 16,000 kilometres of streets, but only 240 km for buses. This is disproportionate considering the modal split. According to the latest Origin Destination Survey (Sectra, 2018) 5.378.479 people use Public Transport, and 5.859.965 use Private Transport. The same survey evidences that, for a total of 18.461.134 daily trips, 6.363.320 of them are made by walking (34% of total trips).

There is also a vast inequality of standards in mobility infrastructure, reflected for example in Metro Line 5 (in the pictures Error! Reference source not found.), which exists in peripheral areas away from the centre. The same happens with Line 4, which also results to be a high viaduct in municipalities that do not have the same income level as those with covered infrastructure.
The provision and maintenance of infrastructure standards are different depending on the area. This is expressed in bus stops, pedestrian infrastructure and various other examples in Santiago. Visual differences but also a systemic difficulty for the user are perpetuated as a consequence infrastructure differences. Although Metro has worked on designing standard stations for the entire network, the bus stops have not yet reached a standard that is equal in all cases.

The assessment of physical infrastructure has been tested in the survey tool developed for this research. One of the sections asked about the assessment of different types of mobility infrastructure.
Figure 4.4. Assessment of public realm by macro areas of Santiago.

The graph Error! Reference source not found. shows the assessment made by 98% of the participants of the survey. Highest assessment corresponds to the East – the wealthiest area. Lower assessment corresponds to areas North and South: the first one with an important dependence on car; the second one is where a high proportion of low-income households are located. The questions were asked about the conditions of the built environment concerning mobility infrastructures, near their place of residence. The following criteria were evaluated: state of the highways, space for cars, space for pedestrians, pedestrian sidewalks, bus stops, seating areas, bike lanes and parking lots. As shown in the methodological Chapter 3, the division by macro areas responds to the strong component of territorial segregation that exists in Santiago. East and South East areas have better economic situation, while southern and part of the northern area have a high concentration of low income and disadvantaged people. The graph reveals that there is, in fact, spatial segregation that corresponds to mobility infrastructure assessment. In some places the highways go underneath, and in others, they go up in the surface, regardless of the housing that is next to the highway, and anyone have any way to protest for that.
On the other hand, the raising use of motorised private transport in Santiago is particularly worrying. The Figure 4.5 Error! Reference source not found. shows the distribution of car ownership in Santiago. The darkest areas reflect a percentage higher than 60% of car ownership, located mainly in the area of the city with the most upper socioeconomic income - where the main centres of work and commercial activity are also located.

![Figure 4.5. Distribution of car ownership on Santiago. Source: Juan Correa, based on National Institute of Statistics (2012) and Ministry of Public Works (2016).](image)

Regarding public transport, although the recent focus on public transport was intended to result in more inclusive transport systems, the process of implementation has led to some difficulties. Segregation deficiencies in Santiago have got worse as a result of transport policies, which began operating in early 2000 (Ureta, 2015). However, the more recent crisis of public transport (which still continues by the time this research was
finished) started in 2007 with the introduction of Transantiago system. Although BRT systems in Latin America are examples of the attempt to improve transport in vulnerable contexts, the mismanagement of bus system through the implementation of Transantiago and the saturation in Metro system during peak-hours has led to a discrediting of public transport and an increase in the search for alternative private transport by users. Vasconcellos (2001) explains that all the most major cities in Latin America were dependant of private bus operators, which provoked inequalities between people with and without access to private transport. The deregulation of the system started in Santiago in 1979 with the operators, followed by completely deregulated fares in 1983. This meant for Santiago a series of consequences suggested by Figueroa (1990, in Vasconcellos, 2001, p. 128):

... the number of lines increased by 36 per cent; (...) fares increased by 169 per cent for buses and 103 per cent for shared taxis; the annual number of passengers per vehicle decreased by 56 per cent for buses; the share of pedestrian trips in the city increased from 17 per cent in 1977 to 31 per cent in 1990.

By 1991, Metro de Santiago had a 4% of the share of the market, while minibuses had 48% (Ortuzar et al, 1993). During the first and second presidential periods after the return to democracy in 1990 (1990-1994, and 1994-2000), the main priorities on transport were implementing major regulations in public transport, followed by the creation of a “more ambitious reform program that would not only tame micreros [bus drivers] but fully abolish them” (Ureta, 2015).

The Plan “Transporte Urbano de Santiago 2000-2010” (PTUS) (SECTRA, 2000) was a document produced for synthesising plans for transforming the mobility system in Santiago, facing the new challenges of a growing city for the following 10 years. The strategies of the plan aimed mainly to modernise and maintain the participation of public transport; decrease the use of car; encourage the use of non-motorised
modes; improve transport safety; preserve the environment; and rationalise the trends of residence location and activities. The structuring role of Metro was fundamental on the plan, as well as the creation of exclusive lanes for public transport. So far so good, until the urge for having a product for the bicentennial celebrations of 2010 pushed the first socialist president after the dictatorship to schedule a massive infrastructure transformation. Therefore, the ideas from the PTUS were translated into a transport infrastructure plan looking at the bicentennial. The promise of a society’s world-class public transport system was born under the name on Transantiago in 2003, with the novelties of being a single fare system, integrated with the Metro network and based on feeder and trunk bus lines – run by private bus operators.

The implementation of Bus Rapid Transit (BRT) systems have improved efficiency and accessibility in some cities in Latin America (Hidalgo et al., 2010; Hidalgo & Huizenga, 2013; Rodriguez Vignoli, 2008), as is the case of Transmilenio in Bogotá (Guzman & Bocarejo, 2017; Bocarejo et al., 2016a; Guzman et al., 2018; Rodriguez & Targa, 2004), the metrocable in Medellin (Bocarejo et al., 2014), and Lima (Oviedo et al., 2019; Scholl et al., 2018). However, BRTs in Latinamerica have not either been exempt of criticisms (Guzman & Oviedo, 2018; Bocarejo et al., 2016b). The tools of analysis and evaluation of such projects are complex and depend on the political, institutional, cultural and economic context. Transantiago demonstrated that the implementations of these systems are not a formula, but an enterprise that requires many important factors, but especially a perspective for the city in the medium and the long term.

Transantiago is not the object of this research, but one of the causes of the crowdedness, inefficiencies and social inequalities produced by the public transport system in Santiago. Ureta (2015) analyses in detail the processes and causes of the failure of the system, the disruption and discomfort for the citizens, as well as the long normalisation process that subsists until today.
As the bus finally approached, usually after they had been waiting several minutes, they had to fight with the other people at the bus stop to reach its doors and enter. If they were lucky enough to get inside the bus, they needed to hope that the device validating the availability of funds on the Bip! card was functioning (…) Then at some point they would have to get off and transfer to another of the new bus lines and/or the Metro, starting the whole process all over again (Ureta, 2015, p. 96).

One of the social impacts resulting from Transantiago was the immediate effect to the quality of life of citizens as a result of the poor operation and infrastructure of the entire system. But probably most important, the citizens themselves realised the tremendous effect of a bad quality public policy in their own lives. To the chaos of the early days of the new system, was added a big shortage in terms of infrastructure in bus stops and minimum physical elements of mobility needed for proper operation – that only began to be supplied one year after the operating system started. Both the authorities and citizens were strongly affected – in political and practical ways respectively. A robust and vicious circle of discontent was produced as a result of the failures in the system: car ownership grew up increasingly and therefore the traffic congestion also highly boosted affecting in return to the operation of the public transport system.

In relation to cycling in Santiago, the spatial distribution of trips and the profile of cyclists has changed. The idea of the bicycle as a transport mode associated with low-income segments and young men is not the same as 30 years ago. The presence of women has also risen – cycling modal share for women has increased from 10% to about 30% in recent years (Sagaris & Tiznado-Aitken, 2017). Furthermore, in the commune of Santiago (centre), women represent 67% of the trips destined for other communes (Waintrub et al., 2018). However, it seems a central issue to review the quantity, quality and type of cycling infrastructure that meets...
the requirements of women since they tend to better recognize the safety conditions of the streets (Waintrub et al., 2016). Today the city tends to an increase in the number of cyclists, although women are only a quarter of that total.

The strong inclusion of women in the field of cycling reflects another series of inequities. This time not spatial, but social. Issues of safety and street harassment are a huge social barrier that demonstrates gender inequities. Women we are more exposed to street harassment and more unprotected – which makes the trip different to men. This not only has consequences at the level of the modal choice but also in the use of public space. The street harassment has recently been included as part of a political bill and incorporated as a municipal ordinance in a couple of municipalities in Santiago. While there is not yet a legal figure at the national level, the harassed person can report the aggressor, who receives an economic fine paid to the local police court.

As a matter of context, it is important to note that Latin America has a serious problem, not yet massively unveiled, of street sexual harassment that is well evidenced in public transportation. Street sexual harassment has been defined as a practice of sexual connotation exercised by an unknown person in public spaces, public transport or on the street (Garrido et al., 2017). The action affects the victim unilaterally, while the harasser has no interest in establishing a real communication with the person who is being attacked. This has a negative mental impact, that influences the way the person mobilises, evidenced in changes on the mobility patterns, modes and even implies a dependence to move accompanied by other people. This violent practice, both in public spaces and in transport, has been well documented in many publications. In the context of Chile and other Latin-American countries, see for example about the definition of street as gender violence (Garrido et al., 2017); sexual harassment gender differences on safety measures in public
transport in the context of US (Yavuz et al., 2010); women’s fears using public transport (Schulz & Gilbert, 1996); the influence of harassment over apprehensions and changes in travel patterns on women (Lynch & Atkins, 1988); and Rainero (2009) from a feminist position on the conflict insecurity for women in Latin America.

4.3. Differentiated fare

In the Metropolitan Region, the public transport fare is flat. Travelling from the periphery to the city centre can cost the same as a 10 minutes trip inside the city centre. However, and contrary to what could be imagined, the flat fares do not necessarily favour the reduction of inequities – at least for certain social groups. The figure below shows the total income for the socioeconomic groups, versus the percentage of transport expenses for each group. The information of the figure has been taken from the Survey of Family Budget (INE, 2018), which provides information about the monthly expenses of families. In the figure, AB is the higher income group (more than $6 millions pesos per month), spending less than 2% of their monthly income in transport. In the opposite extreme of the figure below, the socioeconomic segment E has a monthly income that averages $400 thousand pesos and spends almost 30% of their income in transport.
The flat rate has meant a profound advantage for families who, having less income, must travel more considerable distances to the areas that have focused the jobs supply. A pricing policy by zone – such as the London Underground – would be regressive for lower-income groups. The possibility of adding fare zones in the Metro has been considered, despite being politically unpopular. The above is due to the high operational cost of Metro, which is self-financing 75% from user travel. Nevertheless, even considering the flat fares, daily trips can be prohibitive for specific segments – as seen in the graph above. While there is a differential between the use of bus and metro – when combining both in one trip – there are people whom, still having available the option of metro, are not able to pay the difference of $30 or $50 pesos in a daily basis. That is a source of inequality because the bus also implies a longer travel time.

Difficulties in accessing a public transport fare do not equally affect men and women. This occurs especially in households that have limited spending budgets. Paying the price of daily mobilisation for two people presents not only a logistic challenge, but it also reflects the decision of which family member can “go out” to work. Currently women do not have equal remuneration than men, so the scale of salaries and positions is lower in the case of women. By having access to lower-paid or precarious jobs, it is even less economically convenient to go to work. Women could spend as much as 60% of their income in travel to their jobs. This means that the cost-benefit of going out to work is relative regarding the household income. The cost of travel is a powerful element of the decision within the household, and the reason why many women end up choosing to stay at home. Furthermore, literature and practice show that the care role continues to be fulfilled to a greater extent by women – although there are increasing cases in which man shares more
responsibility. The permanence and dependence on the house for women have not only financial consequences but also social, personal and emotional. This is just an example of how transport fares can affect directly and indirectly to the gender gap.

4.4. Transport Appraisal

One of the relevant actors in the process of transport appraisal is the DTPM (Metropolitan Public Transport Board), who has the role of analysing the capital's public transport system comprehensively and ensuring the proper coordination of the different modes involved in public transportation in Santiago. This body was formed through a Presidential Instruction in 2013, as a replacement for the Committee of Ministers of Urban Transport, with the purpose of more actively taking on the responsibilities that arose after the start of the Transantiago System, given the need for greater regulation, control and supervision of the system. The main task of the Committee was to coordinate and monitor the actions, programs, measures and other elements of the Urban Transport Plan for the city of Santiago, which is linked to the Ministry of Transportation and Telecommunications through an Executive Secretary who acts as Coordinator Transport General of Santiago. The DTPM works very interrelated with the SERVIU (Housing and Urbanization Services), an organization that was born in 1976 as autonomous institutions of the State, related to the Government through the Ministry of Housing and Urbanism and that is present in each of the regions of the country. This organism does not have the planning faculties, but rather the execution of works of housing services and urban improvement, housing and urban works.

The economic orientation of Chilean project evaluations has defended a profitable model of supply and demand that has meant transport has become a commodity while the user has become a client of these services. Efficiency has taken a primary role in the assessment of transport projects, over the quality of service for users, failing in the
fulfilment of the expectations on user’s parameters.

In the Chilean context, the National Investment System (SNI) determines the social impact assessment, which set up the methodologies and procedures necessary for the evaluation of initiatives that require an evaluation of public funds.

The SNI acts on all projects that must be evaluated and require public investment in Chile. This gathers the "methodologies, norms and procedures that guide the formulation, execution and evaluation of the investment initiatives that postulate public funds" (MDS, 2018). The executive power as a whole (presidency, ministries, mayors, governors and mayors) is the formulator of the decisions and prioritisation of the projects that must be accomplished. Ministries, public services, companies and municipalities are responsible for the direct execution of projects, which is distinguished within the scope of administration. Investment decisions go through a level of advice, which reviews from a technical point of view the studies and projects presented by public bodies. This action corresponds mainly to the Ministry of Planning together with its different dependencies (Arancibia et al., n/y). The analysis of project appraisal involves comparing impacts through different metrics, which result in a final economic benefit. Social prices (or social value) reflect how the units of resources used in the investment, execution and operation of a project can impact society as a cost. The need for standardising social prices has resulted in a list of the most commonly used resources: social labour price, social price of the currency, social rate of discount, and social value of time. Transport projects have mainly used the social value of time, determining the willingness to pay of passengers to save 1 hour of their trips.

The cost-benefit analysis (CBA) aims to measure well-being at an aggregate level and "is based on the notion of the rational individual, where a person makes decisions on the basis of known costs and
benefits” (Hickman & Dean, 2018; p.690). However, the use of CBA is controversial due to its limited spectrum of evaluation, especially in more complex projects. Some projects have benefits more difficult to identify, in spite of the value that these projects could provide to society. As these projects might be desirable for society, the benefits are meant to be obtained on the minimum possible cost, so the project can be accomplished.

Today Chile uses two approaches on social project assessment: cost-benefit and cost-efficiency. Both approaches can identify and measure the costs, but the difference lies in the appreciation of the benefits; cost-efficiency uses as main social indicator the CAE (annual equivalent cost), an index that compares the credit alternatives offered by different financial entities under the same conditions – which can be measured by the total amount of beneficiaries of the project. Another index used for the cost-efficiency approach is the VAC (current cost value), looking primarily for the minimum cost between two alternatives (MIDEPLAN, 2007). Social transport assessment involves comparing the impacts of the project through economically acceptable social metrics, seeking for the approaches that better fit the analysis of the variables. This results in an economic benefit, better known as the social VAN (current net social value).

The key for understanding how transport appraisal works today is calculating travel times with and without the project. Depending on the scale of the project this is defined for the city or the municipal level. Time savings is translated into hours per year per person, which turns into economic savings per person. There are other savings that are considered as operative savings (fleet) or fuel savings, but mainly the discussion goes through the savings of people’s time. For example, in the case of Metro, project appraisal focuses on the travel potential for as many trips as possible – in the framework of the non-generation of operational deficiencies. The focus is on the system efficiency, which
makes the overall travel more profitable – in order to produce more trips in the future through operation and construction. Time savings is the one criterion that mainly defines the national investment system.

The inconvenience of having various unsatisfied needs on transport infrastructure had opened the discussion on other ways of financing these complex and long-term projects, through concessions and private investment. The success of the concessioner highways in Chile – success being seen as the number of highways and economic profitability for concessioners – has opened the debate towards the possibility of using this mechanism on other types of mobility infrastructure, such as metro lines, suburban trains or other more innovative transport solutions such as cable cars.

The case of concession new metro lines is particularly interesting to comment on, since Metro has run until now as a state company with public and private capitals. The construction of the metro lines has been entirely paid for and financed by the metro operation. On the one hand, lines 3 and 6 have recently been inaugurated with great success. The construction of these lines sums 140 kilometres, connecting 26 communes and transporting more than 700 million passengers annually (Metro, 2017). The construction and consequent inauguration of lines 3 and 6 transcended the changes of government and political coalitions and fed the network of new users in communes that previously did not have access to the service. This has resulted in signs of economic, political and social sustainability over time. On the other hand, the standard used in the new lines allowed the use of larger and more energy efficient cars, with stations that guarantee universal accessibility (Metro, 2017). It is important to point out that Metro fare is integrated into the Transantiago bus fare – part of the complete bus and metro system. This means that at the regional level, a modification of Transantiago's network for re-structuring bus corridors will impact on Metro's efficiency and
capacity – at one particular station or at the entire line. Considering the importance that Metro has on structuring the system, it currently has the double mission of positively impact not only on the proper functioning of its internal network but also of impacting mobility at the regional level.

The discussion of concessioning new metro lines has arisen in particular due to the high confluence of necessary capitals for the design, implementation and start-up of new metro line projects. This, added to the positive economic advantages and capital gains generated by the definition of new stations, has fuelled the debate of a faster expansion of the network through the incorporation of private capital. While this debate has not had much impact so far, it is important for setting up the basis in which terms of distribution capital will be defined considering the implementation of new metro stations. Positive and negative impacts produced over the distribution of land capital will be questioned and will need a normative framework, in a context in which the concepts of the capture of surplus value of land uses have not been well defined.

Several dilemmas mentioned for the case of Santiago are common in several Latin American cities. However, it has been relevant in this chapter the exploration of the contextual determinants that have deepened social inequalities, beyond the action that transport causes in the city. Transport appraisal, affordability, car use and the built environment are key factors that sustain the "visible" differences between transport users. This recognition of the context allows a better development of the gaps aimed at this research.
5. Unravelling policymakers perceptions of Social Project Appraisal and inequalities

5.1. Introduction

The appraisal of transport projects in decision-making increasingly urges for looking at the best distribution of benefits for reducing transport and urban inequalities. However, the alignment of those positive intentions needs a relevant and coherent strategy for incorporating factors that can actually reduce the inequality gaps between different transport users, and socio-demographic groups of society.

The deficiencies for project appraisal to assess social impacts are well known in Chile (see Chapter 4). In Chile and many other contexts internationally, social project assessment has been developed around the method of Cost-Benefit Analysis, considering mainly an approach based on efficiency for almost 30 years. Although this has allowed comparing costs and benefits to determine the convenience of the schemes, the need of generating better standards of social equity has challenged the pertinence of the evaluation that has been applied so far.

The chapter aims to explore how transport policymakers perceive the strengths and limitations of current project appraisal, and challenges their perceptions on equity. The approach to policymakers recognises that they are more familiarised with the social exclusionary framework rather than more unconventional approaches as the capability approach. The process of interviewing has considered exploring their perceptions about the possibility of incorporating new measures (as users experiences, attitudes, needs, capabilities, among others), and it has challenged their understanding of the social impacts and transport users’ concerns.
This chapter builds upon the secondary research question proposed at the beginning of this research, about the perceptions of policymakers for improving social equity in transport appraisal. The relevance of understanding policymakers’ perceptions relates to one fundamental part of the literature developed in Chapter 2 (see p.68), about the relevance of the context and the conversion factors. Exploring policymakers’ perceptions on the current appraisal and notions of equity helps because:

- Understanding the context in which the institutions act is relevant. This is the space in which the project appraisal, programs and transport policies are developed.
- The understanding of how unequal the society is could have different interpretations – this will affect in the way the problem has been and will be solved.
- It recognises that the equity gaps between individuals in a society does not only depend on these individuals. Inequity is a social problem and a social construct – which requires the understanding and the actions of the people working in institutions.
- People rely on they representatives, so the capability for them to change/transform their life conditions will deeply depend on their representatives, as well as the public functionaries, private sector and third sector.

This chapter develops a qualitative approach through semi-structured interviews with the policymakers. The policymakers are from the public and private sector, academics and ONG leaders, all involved in transport planning processes. People selected for interviews act in different territorial levels – considering national, regional and local actors involved in the discussion.

Some of the findings indicate that they agree not only on the relevance of discussing equity in transport but also on the need of solving institutional barriers, processes, interactions and data collection. All
these together would help to address new ways of incorporating novel factors into the evaluation and bringing new approaches into the discussion.

The first part of the chapter explores the impressions of policymakers on social project appraisal, multi-sectorial and multi-actor participation. Most of discussions were widely built on the criticisms to the current methodologies of the national system of investment, questioning the focus on time savings and the cost-benefit analysis. Some explorations in the last years around the figure of concessions also shaped the discussions with policymakers, as public investment is insufficient to cover the needs of public transport that could compete with the trend of car usage. The second part includes impressions of policymakers, around topics that have been relevant in the development of this research – although not necessarily tackled in the quantitative analysis of previous chapters. This exploration of subjects as gender, socioeconomic, material and cultural inequalities become enriched when analysing the diverse points of view of people who have worked directly on the political and technical debate. The third part of the chapter explores the impressions of policymakers about the factors that should be incorporated in social project appraisal, considering the inequalities gap that is still open in the current evaluation system. This aspect has been particularly important for framing the next empirical chapter, which will present an assessment method that builds the evidence of more subjective factors to be included in the process of criteria weighting on project appraisal.

5.2. Using a social exclusion framework with policymakers

Several formal and informal meetings with policymakers in the Chilean context reveal that, even though considering social equity issues, their approach tend to the notions of social exclusion framework, rather than (more innovative and unexplored) concepts as the capability approach.
This has been evidenced as experts will refer to these topics, contrasting their perceptions and interpretations of the factors that should improve transport appraisal. Some of these categories and measures are explicitly mentioned later in the interviews. They have mentioned that physical barriers may impose serious difficulties for transport users, as described in the work of Church et al. (2000). They have suggested that physical exclusion of certain groups might be a synonym for social exclusion – which has also been described in Lucas (2004). As suggested by Preston & Rajé (2007), the policymakers have mentioned that social exclusion in Santiago is not only a synonym for income-based deprivation but it is strongly affected by transport in determining the exclusion of a person, especially by public transport users.

But policymaking has also had the dilemma of increasing mobility for solving needs, versus increasing the need of mobility with the rise of activities and opportunities. In the case of socially excluded people, the increase of opportunities will rely on the production of better means for mobility – situation that has been criticised in the context of Santiago by many of the interviewees as the means for mobility act against bringing the opportunities to people. Another interesting perspective raising from the interviews with experts, relates to how people can actually participate in different social activities, taking advantage of the context in which they are involved. Some of the interviewees refer to the use of some modes as the bicycle, or the improvement of walkability, as promoters of social engagement and social activities.

This chapter explores how transport policymakers perceive the strengths and limitations of current project assessment tools for improving equity, as well as the idea of social equity underlying current transport policies. They have been asked about their perception on incorporating new measures in the analysis (as users experiences, attitudes, needs, capabilities, among others) and their thoughts on more participatory approaches for tackling inequalities in transport. Some of the findings
show that they do consider there are social inequalities strongly evidenced in transport. They in general agree both on the relevance of discussing equity in transport policies and also on the need for solving institutional barriers along the process.

Some of the concepts that led to the systematic framework for asking the questions were taken from Lucas (2012, p.107) considering the social and transport disadvantages leading towards transport inaccessibility and social exclusion. In the context of this research, the framework takes the three dimensions used by Lucas: social norms and practices, governance and decision frameworks, and economical and political structures. This has been illustrated in Figure 5.1. The idea of social equity in transport is driven by the centre of the diagram, and the dimensions suggested by Lucas have been connected to the main issues detected at the diagnosis and aims of this research. This diagram has been used for structuring the main topics for conducting the interviews, in order to answer the question of how the different stakeholders perceive the relevance of social equity and are able to improve these parameters in transport.

Figure 5.1. Systematic framework for semi-structured interviews. In circles are the dimensions that explain the relationship between transport disadvantage, social disadvantage and social exclusion, from Lucas (2012). In squares, the categories
explored through semi-structured interviews with policymakers, considering the previous categories. Source: Own production based on Lucas (2012).

The first category in Figure 5.1 explores the perception interviewees have about the concept of social equity and the idea of a better integration of disadvantaged groups through transport. This one is grounded into the context through the social norms and practices, as well as the current state of governance and decision-making framework. This category considers questions about the need of improving the transport system in order to have better equity outcomes; about how people is forced into particular modes or particular activities because of transport; barriers and that different population groups face because of the lack of transport; and how this might affect the opportunities of the most vulnerable groups.

The second category explores the institutional assets and barriers as a result of the political and economic structure, as well as the context of governance. It explores the factors and criteria that should be incorporated in transport project assessment for better integration of socially equity issues; obstacles that the institution faces in order to incorporate these criteria; relationship between different government levels, intervention scales and between institutions. This type of questions also challenges the integration of participatory tools.

The third category explores elements of transport appraisal and current assessment policies, which implies an understanding of the current context of social norms and practices, as well as the economic structure that allows normative changes to the appraisal system. The type of questions considered under this category are related to the current status of transport project appraisal, current methodology used and possible improvements; weaknesses and strengths of the National Investment System; dimensions for measuring social equity; how social impacts are considered; what the role of CBA is.
<table>
<thead>
<tr>
<th>Main topics</th>
<th>Type of questions guiding the interviews</th>
</tr>
</thead>
</table>
| 1. Perception of social equity and better integration | - Need of improving the transport system in order to have better equity outcomes  
- About how people are forced into particular modes or particular activities because of transport  
- Barriers and that different population groups face because of the lack of transport  
- How this might affect the opportunities of the most vulnerable groups. |
| 2. Institutional assets and barriers | - Factors and criteria that should be incorporated in transport project assessment for better integration of socially equity issues  
- Obstacles that the institution faces in order to incorporate these criteria  
- Relationship between different government levels  
- Intervention scales and between institutions  
- Integration of participatory tools. |
| 3. Transport appraisal and assessment policies | - Current status of transport project appraisal  
- Current methodology used and possible improvements  
- Weaknesses and strengths of the National Investment System  
- Dimensions for measuring social equity  
- How social impacts are considered  
- What the role of CBA is. |

*Table 5.1. Summary of the main topics and questions guiding the interviews, under the dimensions of the systematic framework.*

The analysis of the interviews has been conducted using content and thematic analysis in order to quantify and develop a description of the main topics described in the interviews, systematically and objectively identifying the specific characteristics of the material (Mars et al. 2016). The interviews collected have transformed the information into categories, helping to structure the main themes that have shaped the differences and similarities between the interviewees (Vaismoradi et al., 2013). Both analyses have helped framed a qualitative and exploratory approach. All interviews were explored in depth with transcription boxes.
for a better assessment of the information. Under the umbrella of the thematic analysis, transcripts were useful for an inductive process of coding the raw data from interviews, recognising the important concepts in the data and encoding them for further interpretation. The inductive characteristic of the process allowed the theory to emerge through the codes, from the data. Coding the interviews has helped for exploring the main concepts that interviewees have suggested and repeated during the conversations. Thematic analysis has mainly helped shaping the most relevant values and concepts exposed during the interviews with experts. The inductive process of coding ended up producing 8 codes – after the grouping and organization of several of the codes that emerged from the analysis. The codes were grouped according to their conceptual relationship. The themes did not follow the same inductive process. Although the codes were emerging from the discussions with policy makers, the themes were determined by the theoretical framework for approaching to the interviews. The determination of codes was followed by the aggregation of them into three pre-defined dimensions of the systematic framework: perception of social equity and better integration; institutional assets and barriers; and transport appraisal and assessment policies.

<table>
<thead>
<tr>
<th>Codes from the interviews</th>
<th>Link to the systematic framework</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender inequalities</td>
<td>1. Perceptions of social equity and integration</td>
</tr>
<tr>
<td>Economic inequalities</td>
<td>1. Perceptions of social equity and integration</td>
</tr>
<tr>
<td>Physical inequalities</td>
<td>1. Perceptions of social equity and integration</td>
</tr>
<tr>
<td>Coordination, competences and integration</td>
<td>2. Institutional assets and barriers</td>
</tr>
<tr>
<td>Civil society and communities</td>
<td>2. Institutional assets and barriers</td>
</tr>
<tr>
<td>Cost-benefit analysis</td>
<td>3. Transport appraisal and assessment policies</td>
</tr>
<tr>
<td>Concessions</td>
<td>3. Transport appraisal and assessment policies</td>
</tr>
<tr>
<td>Time savings</td>
<td>3. Transport appraisal and assessment policies</td>
</tr>
</tbody>
</table>

Table 5.2. Codes and themes emerged from interviews.
The following sections are based on the analysis and results of the interviews, considering three of the five themes emerged from the coding and thematic analysis process. Each section follows one of the selected topics on Error! Reference source not found., with subsections that have developed some of the most relevant codes recognised in the analysis.

5.3. Results

The results from the analysis of the interviews have not consider a quantitative approach. However, the following image created by using word frequency analysis with the all the transcriptions from the interviews allows to visually understand the most repeated words – coinciding with the themes suggested as part of the thematic analysis. The nuances and emphasis between the different interviewees have been suggested in the subsections below.

![Figure 5.2. Word frequency cloud with the most repeated 40 words from the total of the interviews. Source: own production based on interviews with policymakers.](image)

5.3.1. Gender inequalities

Perceptions of experts and policymakers regarding vulnerable groups, specifically about topics as gender, economic and physical inequalities
were some of the topics revealed by the interviewees in this research. Which might be considered as odd, is the interview guideline not considering specific questions related to gender. This occurred because the design of the interview questionnaire derived from the preliminary survey results, which did not produce significant differences in terms of gender. However, when analysing the interviews, gender differences appeared as a key element for pursuing more equitable outcomes. Thus, it has been incorporated and investigated deeply in the analysis.

**a. Care role and chained travel**

Care role and chained travel has emerged as one of the issues around gender inequalities. Mobility patterns between men and women are different, as it is still a country in which male population leads the majority of the labour force. E2 (activist, female) refers to this situation from her involvement with cycling groups of men and women. She says that the "pattern of mobility of women is different than men's because women fulfil more diversified roles, having more responsibilities than their partners. The result is women having to make several chained trips and several activities during the journeys" – which is supported by academic evidence, e.g. Primerano et al. (2008). The trips are much more complex, and often the fact that they are chained is related to their care roles with another family member (in the context of Chile, see Sagaris & Tiznado, 2017). This implies for women spending more time and money than men, when men tend to have, in general, a more linear travel pattern going from home to work and vice versa. It is possible to observe to a greater extent that men tend to own the car that the household have, as men still act as family head. This implies that "in many sectors, even in middle-income sectors, men takes women to work and then women remain alone (...) [woman] is left without means" (E2, activist, female).

How does transport affect the multifunctional role of women? Diverse transport and mobility factors can influence the role of women. Already mentioned is the predominant car ownership by men when compared to
women and the consequence for woman to use other means of transport – mainly public transport in the form of buses and metro (E19, engineer, male). For understanding how transport affects the multifunctional role of women is then relevant to understand the fare system. When Transantiago started its operations trial period in 2003, a single fare system was established integrating the buses with the Metro network and based on feeder and trunk bus lines. This would be run by private bus operators, with contracts that changed over the evolution of the system in the following years. The flat fare means that distances farthest from the centre do not imply a higher cost. On the other hand, the current system allows a transfer bus-bus, bus-metro, or metro-bus, charging the same rate for an hour range - except for an extra delta in case of taking the metro. Nevertheless, the analysis of time and space are not enough to make an exhaustive analysis of the social implications that these trips have for women (Sagaris & Tiznado-Aitken, 2017).

b. Labour inclusion for women

Results from the interviews show a perception of opportunities and barriers for getting employment as another key aspect in the attainment of more equitable transport. E4 (sociologist, female) describes from her position on one of the most relevant Chilean NGOs promoting both emergency and definitive housing in Chile. She differentiates men and women regarding the possibilities of accessing a job. "For a family, a woman going to work is complicated" because in the equation should be considered issues of family time and household money that are not questioned or analysed in the case of man. Women "could spend as much as 60% of their income in travel to their jobs", so the cost-benefit of going out to work is relative regarding the household income. This comparison gets more exacerbated when transport costs are high since "she will spend more money on transporting, compared to the benefits of having a job". The solution in most cases is "to stay in the house, take care of the children and save that expense". Furthermore, women who
are in a more vulnerable situation do not usually have a job but have more than one, which is added to be in charge of family activities - what in turn increase transport costs. In this case, the flat fare mentioned before is not enough for equalising the roles or encouraging women to be included in the labour force. These factors have implications for transport policy if we are to think how access to activities can be made more equal. The capability is in effect in place, yet the barriers to access (cost) mean that the level of functioning for females is lower.

Although the benefits of children being accompanied and cared for during the first years of life have been reported in various studies, this role continues to be fulfilled to a greater extent by women. E4 (sociologist, female) affirms that the cost of covering the fare of the transport ticket plays a fundamental role in this decision, since "women stay in the house, take care of the children and there are no changes. And even if you say you have to go to work, the budget and salary are not sufficient". The permanence and dependence on the house for women have not only financial consequences but also social, personal and emotional. The "women, being shut in the house, have very low self-esteem because they do not do anything remunerated and economically productive" (E4, sociologist, female).

The cost of travel is a powerful element of the decision within the household, and "that is why many women end up choosing to stay in the house". The cost is also related to how to handle parenting or take care of them while they work "(E4, sociologist, female). Moreover, currently women do not have equal remuneration than men, so the scale of salaries and positions is lower in the case of women. By having access to lower-paid or precarious jobs, it is even less economically convenient to go to work (E2, activist, female). For low-income people, it is very costly, in relative terms, to go out to work, which has been stigmatised by the misinformed, short and judgmental perception of some people that consider this segment as "lazier" than others, a condition that might
explain their socioeconomic status (E18, engineer, male).

c. Local scale and active travel

Local scale is where the support groups, as well as the construction of social capital for communities, play a fundamental role. E4 (sociologist, female) has emphasised that transport accessibility to jobs is not the only key allowing an improvement on social issues. Techo para Chile (TECHO) works as a housing association and NGO that has developed an exhaustive work with communities of the poorest sectors of Chilean cities, with an especial focus on informal settlements. They have not only made possible their access to definitive housing but have worked with the community in the implementation of measures promoting progress in the creation of social capital. When the problems of accessing to transport are not solved in the short, medium or long term, the generation of these networks of opportunities becomes a real possibility to move forward. TECHO have developed manual and productive workshops, on a micro scale and at a walkable distance from the households specially for women – since, compared to men, they stay more at home. Pedestrianisation and on foot accessibility are relevant for enabling trips, which are a declaration of openness of opportunities, especially for women. "When women join the workshops, they realise that they can do things they did not know, and we can give account of this with surveys and evaluations," said E4 (sociologist, female) regarding possibilities at the local scale. Active transport modes that allow reaching medium and low distances, such as the bicycle, are ways that "better channel women needs" (E2, activist, female). When women use this vehicle is when the bicycle reaches its most significant potential. The promotion of the bicycle is one of the factors that can promote greater inclusion of women in the labour market.

Despite these benefits, the promotion of active transport modes remains controversial from a strategic point of view. One of the interviewees (E17, planner, male), from his position of a male urban planner, refers to the
"disruption" of the bicycle as an elitist phenomenon that, far from improving the life quality of people with fewer resources, hinders their possibilities to access better transportation. For him, the bicycle "has a problem of scope and coverage, as well as a gender and age issue". When referring to gender, he does not only suggest the existence of inequalities for using the bicycle, but it procures a condescending tone about the physical resistance and condition of women, that would be placed below the possibilities of men. However, if that interpretation was not for health and physical resistance conditions, but for cultural norms, it could refer to the social barriers existing today regarding the use of bicycles by women. "The subject of sweat and perspiration in our countries is taboo; a woman cannot walk sweaty, is a bad culture, is being ordinary" (E2, activist, women), as commented by one of the female interviewees.

5.3.2. Economic inequalities

Economic inequalities have been visible in previous chapters since quantitative analyses have highlighted the socioeconomic income variable as a significant aspect. The interviewees have been asked throughout the conversation about various topics, and most of them have spontaneously presented a vision of the problems and difficulties associated with lower income people, mainly when they refer to issues of social equity. As mentioned in Chapter 1, territorial inequities are evident in the context of Santiago. Socioeconomic differences are reflected in the way people are distributed in the city, the way they access work centres, schools, health centres, etc. However, there is also "a high correlation between people who drive in the city with the level of income; it is impressive" (E8, engineer, male).

E17 (planner, male) points out that "today 80% of bus users are people who cannot have a car, who can only to use buses to travel with no other mean". However, he also points out the urgency of having a better public transport system for not adding new car users, so that "people who
currently use public transport do not start using the car, because 7% of those people have left (public transport) in these years”.

Where is the real focus then? Is it about solving the lack of public transport or not contributing to traffic congestion? This represents a dilemma and a challenge for urban planners since the use of car versus public transport becomes a vicious circle, challenging to solve. Planners understand that most public transport users have low incomes, which causes an economic burden for the State having to provide better coverage and service to lower income areas. However, a public policy of providing public transport infrastructure mainly on peripheral and low-income areas perpetuates, even more, the stigmatisation of the use of public transport, since this infrastructure is not prioritized in high-income sectors. Naturally, a greater transit coverage focused just on peripheral areas, will allow a continued automotive growth in wealthier sectors of the city. The decision of reinforcing lower income sectors with more public transport has been directly mentioned by E10 (economist, female) as a State policy. She points out that “the portfolio of projects that has transportation is much more localized in lower income municipalities ... that is a political decision at the end of the day!” This political decision has resulted in a persistent perception of users that public transport is for economically disadvantaged people. There is an issue of adaptive capacity, in that the disadvantaged groups get used to a low quality of transport provision, either with or without public transport – and not even the BRT is of high enough quality and extensive enough to allow easy and comfortable access across the whole city. Hence activity participation remains restricted for a large population cohort.

The actual location of existing public resources for the construction of transport infrastructures is an area in which the opinions interviewees did not converge, as seen below:

If you see where these resources are located, they are on metro lines, which are probably where the most vulnerable people live,
but also where the largest population lives. In other words, the MTT [Ministry of Transport] will not finance a project in Las Condes [one of the wealthiest municipalities] with a national budget. If the municipality wants to fund a project, well they also have to go through a cost-efficiency evaluation (E10, economist, female).

This contrasts to E19’s opinion who considers that state (national) resources are mainly located in high-income communities:

The problem is that if you do not cut the vicious circle, you end up always investing for the same people. Let me put it not only in socioeconomic terms but demographic ones. If you do a social appraisal, then almost all the investment will go to the eastern [wealthiest] area because the number of people benefitted is more significant. (E19, academic, man)

This 'national budget' refers to public funds directed for the construction of transport infrastructures. The outstanding peculiarity of the first statement is that contradicts the facts. One of the most expensive projects in recent years in Santiago, Rotonda Perez-Zucovic (USD 148 million), has just been completed. The interurban highway project links the wealthiest municipalities with the central business district sector of the capital. The project significantly improves traffic in this area. Presumably, this project was approved with a high score in its project appraisal, since it is one of the most congested places in Santiago. These types of projects feed the dilemma and the previously presented challenge for planners. The higher income per capita, means a higher level of development, which end up meaning more people are attracting more trips. Moreover, "groups with greater access per capital make more trips than lower income groups" (E19, academic, male). In the end, we can see that the low income groups are very unevenly distributed, and tend to be located in the more remote southwest neighbourhoods. Providing effective public transport connections to these dispersed parts of Santiago is very difficult due to cos issues. There is a correlation
between income capacity as a way of understanding development through a higher number of trips – a dilemma that perpetuate the vicious circle of producing more time savings in areas where more people are located – and wealthiest people are located as well. Since the wealthiest sectors produce more trips, there are more savings and the infrastructure is deemed to have more value.

5.3.3. Coordination and competences

E3 (architect, female) presents an example to show the lack of coordination between the different sectorial bodies. From her work at the regional level, she mentions the case of the implementation of two initiatives held in parallel: improvement of sidewalks and improvement of the road for buses in a municipality of limited economic resources in Santiago. She explains that the development of the sidewalks, in this case, was problematic and could not be solved only by the lack of coordination of the institutions involved: the DTPM, MINVU through SERVIU and the municipality. As it was a public space of joint domain, the institutions could not resolve the definition of budgets, works and construction of the sidewalks of the sector. The problem of the inadequacy of transport projects has to do with the responsibilities of who is responsible for the results of these projects. In the case of BRT projects, for example, "mobility corridors should be triggers for major developments - taking the logic of Metro" (E3, architect, female).

From the view of a municipal planner, E6 (architect, female) presents a different perspective, since as local planners they need to pass the projects through the standard evaluation of projects, which are focused in providing benefit to as many people as possible. The scale of the intervention is one of the main factors that are assessed for the project to be carried out. The problem is that projects that benefit small sectors, minorities, or even walkability projects, tend no to be a priority. There are also obstacles when it comes to resolving conflicts at the sectoral or regional level. The advantages of the association between different
municipalities allow generating projects with a scope of a bigger scale. For example, the scheme of public bicycles in Santiago has its origin in the communes of Santiago and Providencia. Nine other communes were added to the initial circuit because the Regional Government promoted the project with political and economic resources – which allowed a more significant development of the cycling network as a whole.

The academy can also play a fundamental role as a bridge between government agencies and the knowledge of research. E7 (engineer, male) comments on the little conversation between the different entities. Research centres that have the resources and knowledge for researching about these issues do not frequently have the communication or strategic channel to generate changes in the ministries' thinking structure. These type of problems of coordination and competencies suggest the lack of sensitivity that the transport sector has had with the effects of the construction of this infrastructure with the built environment. This also shows the lack of a correlation between politics and practice, as well as the theory that is very limited in public affairs.

5.3.4. Civil society and communities

Interesting concepts related to social capital of the most vulnerable people and groups came out of the interviews. The role of communities and democracy in decision-making is fundamental to promote social mobility. Moreover, there are certain transport modes - mainly active transport over public, which can favour local dynamics benefiting disadvantaged groups. E2, for example, refers to the use of "the bicycle as a vehicle for social mobility", associating to physical and socio-economic mobility. This vision is, again, challenged by planners with a more statist profile (as E17 and E19), harbouring the idea that the bicycle is an elitist mode, as mainly middle and high-income users can actually get to work by bicycle because of the short distances. Nowadays, however, there is a much prominent general perception that it is relevant
to promote the massive use of the bicycle.

Beyond the notion of being a "social vehicle", the bicycle can also promote the potential of other scales of the territory. E2 has underlined the relevance of this mode as an "instrument of social cohesion and cultural transformation of today's society". She suggests that the bicycle boom in Chile is the product of a social appreciation of the bicycle and the cyclist. At the beginning of the 80s in Chile, the use of car reigned over the definition of cultural patterns. A famous television advertisement showed a man going to his fiancée’s house on a bicycle, while all the people on the street shouted to him to buy a car – anecdote mentioned by one of the interviewees but well remembered in Chilean context.

Today the trend points towards the use of sustainable modes and advertising, a powerful tool these days, has made room for new ways in which the bicycle is a container for advertisement. There has been a process of massive increase of the bicycle use in Chile, starting with the middle income sector, and then spreading to other social segments. It has been a process that, although can be considered fashionable, is worthy since people of middle income tend to set the trends.

E2 explains the reasons behind the slow incidence of bicycle use in Chile and Latin America in general. Cultural, economic and even political patterns in the 70-80s had shaped the current patterns of many grown-up adults that had not had the opportunity of riding a bike when they were younger. So indeed there is a fundamental learning process and very necessary to do for future generations. E2 suggests that, as human beings, we are self-displaced individuals, so it is essential that people can experience walking and cycling in cities that allow this to happen. She suggests we make more prominent efforts on incorporating active travel in children's lives, as well as the feelings of freedom and autonomy while experiencing travelling.

Going back to the idea of social capital, other modes can also promote more opportunities in different territorial scales and range of people.
Metro, for example, can reduce waiting times by shortening distances, integrate the city, and is a democratic element of a good standard (E12, private, man). Metro can also be the articulator of other activities beyond transit so that users can access more facilities, goods or intangible capital while travelling. Chain activities could be an opportunity for users and inhabitants in cities (E5, public/private, man). However, real estate developers, who have made the most of the economic advantages of location and land value, have gained an important part of this capital. Capture of generated capital gains in the urban environments nearby metro stations has more potential than what has been developed so far. Urban transformations of these characteristics imply the participation of public and private stakeholders, as well as community members. Today the challenge of building these new infrastructures must necessarily be associated with the creation of new benefits for cities and communities.

The challenge is in the involvement of the communities. E4 has worked from her role in TECHO, reinforcing community leaders and the social weave. They have taught them to organise themselves so that they bring up their own demands as a collective structure. An organisation such as TECHO do not decide what is better for them but helps to generate links between the communities and the municipalities or the regional government. They cannot solve the problems of the communities directly, so even functioning as facilitators, the idea is for the communities to get up and take their own networks. The emphasis is on empowering the community to have the interest to solve their problems. The approach also considers fostering democratic communities, as having the same leaders perpetuated in change could generate disinterest of the people, turning into something less democratic on time. Afterwards is about looking for ways in which more people can have access and interest to participate, to have a community, to democratically elect a representative who effectively speaks to the needs and interests of the people (E4, NGO, woman).
Unfortunately, generating social capital together with communities is a significant challenge\(^2\). The individualisation that exists between each other reaches critical levels: "nobody trusts anyone, nobody trusts the neighbour" (E4). Amazingly, friends are the people who people trust less, "it's hilarious because friends are what you choose". The interviewee explains that neighbours are located after the friends in this scale of trust. Community leaders are trusted the less.

This self-generated and governed vision from and by the community is opposed to the perspective of other interviewees, who consider the role of NGOs to be paramount, especially in the areas in which the transport component should be channelled. "The more mature organisations in these [transport] issues are those that should lead the processes, since in general, they are the ones that remain throughout the entire process, participate more actively and serve as a bridge between municipalities, regional governments and the communities" (E4, NGO, woman). NGOs also ensure that decision-making processes within the community are more democratic since sometimes community leaders make decisions without directly consulting communities. On the other hand, the role of these organizations has been highlighted, since the central point of their existence is the focus on social equality:

\(^2\) TECHO starts with the families, especially with women and children. When working with children, all is a pursuit of community development, as they have built a program looking to gather children from different areas and in the same place so that they are together. If the children get to know each other, the parents would potentially also meet, so the program seeks to improve the interpersonal relationships of the children and adults. The work with adults relates to other economic and productive activities. If a neighbour knows a craft skill, she teaches it to her neighbours, called "Popular Learning Workshops". Then TECHO injects capital, and the first thing it seeks is for people to get to know each other and the community itself to teach. They have training, and that can sell their work later.
"In a way, the whole nucleus of people in this group [NGO] are social fighters, people who have fought in the field of culture, the arts or directly from working population. All with a search for a fairer, more balanced society, where people are freer, more autonomous and more empowered" (E2, NGO, woman).

5.3.5. A limited transport appraisal

There is a consensus among various interviewees about the benefits of using time savings as main criteria of project assessment. E5 (engineer, male) and E18 (engineer, male) have highlighted the idea of time savings as a personal resource that can be used in other areas of people's lives.

"The greatest benefits of transport infrastructure projects are related to travel time savings. Therefore, it is about saving people’s time that they can use in other activities, with the time they are no longer using in transportation. That is the main reason why these types of projects are built. "(E5, lawyer, male)

But can people actually realise these time savings? Going back to the concepts reviewed in the first literature review chapter of this thesis, this is in the line of generating the (time frame) capabilities space for people, for deciding over their own life. Having more time would allow them to choose wisely the activities they want to perform, from spending more family time or complementing their daily activities with leisure time. While this sounds logical, it is more likely that the perception of the minutes saved in travel time would not be enough for a person to perform another activity - or benefit from these savings to strengthen other aspects of their lives. Often a project is justified in terms of saving very small time savings for thousands of people – hence the actual impact on any individual is marginal.

a. Incorporating standards

It has already been commented that transportation projects in Chile are evaluated through cost-benefit methodology through time savings.
However, some interviewees have commented on the way of establishing the minimum standards that are allowed to save those costs. E10 (economist, female), for example, defines that "the cost-benefit methodology has always been by standards, taking care of the minimum cost to provide a service, but it has to consider certain standard levels". She does not define the minimum quantity or the minimum standard but reveals that these are defined project by project. This discretion, as suggested by E18 (engineer, male), is one of the significant deficiencies of the Chilean system, as it depends on discretionary decisions.

"It would be ideal to generate a parallel methodology to the social evaluation that allows decisions that seem logical but that have no technical support (...). In Chile this has been done with discretionary tools - basically a certain budget per quarter. The arbitrariness and the lack of technical support behind the reason is critical "(E18, engineer, man).

From academia, the incorporation of standards has been studied as a much more efficient element in the inclusion of qualities and benefits in the projects. The definition of standards allows the evaluation not to be project-by-project, but to catalogue the types of projects that have a certain quality standard. E1 (academic, female) says, for example, that adding benefits to the evaluation (or new factors to measure) is an alternative, but the incorporation of standards would work much better and would be more efficient, since there are ranges that cannot be smaller or surpassed (noise, cleanliness, vibration, comfort, quality of urban space, etc.). The difficulty, she points out, lies in defining the list of indicators that should be included and then the minimum and maximum ranges for each indicator, which should be based on studies, previous cases and based on the national context. This is particularly important for this research, as one of the aims reflects upon the factors that can better contribute to improving social equity or reducing gaps of social inequalities between social segments. Lucas (2012), mentioned in the
systemic framework for building the interviews, helps on this by suggesting the use of measurable methodologies and metrics for helping the improvement of public transport standards:

"Metrics are needed to establish the minimum level and standards of public transport which are necessary for social inclusion given certain distances, densities, levels of services, etc. and local targets set to achieve these within given timeframes. To achieve this goal, social inclusion also has to be an explicitly stated outcome within service contracts with public transport operators." (Lucas, 2012, p. 112)

Beyond time savings or distances, adequate progresses on improving project appraisal in Chile has been delayed. According to E18 (private, male) this is consequence of looking just at the current picture of the situation, without foreseeing the long term. The problem with the current picture relies on the concentration of investment in the places that have the highest number of people, where the most significant number of jobs and the most affluent people are located as well. There is a perverse incentive to invest because where there are more people, which means more time is saved. Wealthiest areas are favoured with these measures because this is where numerous trips are produced. Cutting the vicious circle is the challenge, for to stop ending up always investing for the same people.

b. Questioning the nature of project appraisal
A critical issue of project appraisal is how this can help to solve other problems such as social equity or urban space issues. Vulnerability, segregation and extreme poverty, which are presented as categories of evaluation and budget definition from the Ministry of Social Development, should necessarily be coordinated with the budgets and willingness of other ministries.
The discussion with E3 (architect, female) allows inferring that the failure in project assessment has to do with singling out the transport project as the only object to be evaluated, considering only the mobility attributes on the engineering project. In this case, projects that have combined natures between ministries could be managed and executed with an active social objective associated with the resolution of these problems. However, one of the significant difficulties of state projects in general in Chile is the strongly sectorial vision – despite the need of these projects to be solved systemically. According to her, the success of the methodology of project appraisal should be channelled into a more integrated assessment of the project, this being the factor that prevails over the others. In the case of Metro lines, for example, this would correspond to the evaluation of the entire project considering urban environments outside stations, universal access, land use and economy of the place, etc. She formulates that "through a comprehensive evaluation model, it is probably easier to integrate other variables that do not necessarily result in economic profitability, so it depends on the initial formulation of the problem" (E3, architect, female).

Contrary to the previous view, E10 (economist, female), representative of the Ministry of Social Development, has a different view. She suggests that the core of the methodology should allow comparing the profitability that has the lowest social cost:

"Beyond the merit of the objective, what the methodology does is to look for a way of evaluating if the objective is fulfilled or not. In the case of the social evaluation, any money that is invested in society has a social return that justifies it (...) that has the social NPV less than zero" (E10, economist, female).

Is it about lower social costs or maximum social gains? The divergence of opinions does not correspond only to individuals but also reflects
diverse institutional visions. In the previous case, it compares the vision of E3, part of the DTPM, versus the opinion of E10, a senior member of the MDS. Having different versions of the best way of maximising benefits is not necessarily a virtue on diversity, but shows a confusing image to the public opinion, private entities and investors. The wide diversity on the interpretation of ‘how to solve social issues’ has brought serious problems of consensus in governmental institutions and public agencies. Private and academic external entities tend to be quite critical about this. E17 (planner, male), for example, considers that the current project assessment methodology is supported by two types of people (or agencies): the Ministry of Finance through the DIPRES, and the defenders of the current Transantiago model.

"They are the ones who defend the methodology because they want to spend little because they see it as an expense and not as a benefit, and the Ministry of Finance that likes to spend little. That's what the current methodology holds, which was invented 30 years ago. And that will not change until the mentality does not change. It is not a technical discussion in that sense, but it is politics" (E17, planner, male).

The last thought on the paragraph above, about the discussion not being technical but a political decision is an agreement between several of the interviewees from the MDS, MTT, external and private consultants. All do think over the potential changes that the tool may have, but they suggest that the political audacity of the long-term change in the valuation of projects has much more weight than the definition and evaluation of particular factors. It has been pointed out by a couple of interviewees (E8 and E18, both engineers males) and there is a general feeling of convergence in which the methodology of social assessment serves certain levels of the project but there are others in which it does not make sense. There are some projects that are simply required by society, so it
should be just necessary to evaluate based on what is the lowest cost to build – which goes beyond the measurement of benefits.

"That kind of thing you have to look at from the perspective of how to do it from the lowest possible cost" (E8, engineer, male).

Given this context, some interviewees have proposed or mentioned the multi-criteria methodology as it can help changing the criteria and parameters usually used in current project appraisal. Chapter 8 in this document will present an exercise carried out with policymakers, using a multi-actor multi-criteria methodology. Ranking projects among similar criteria is part of the benefits of a multi-criteria methodology. E10 (economist, female) and E18 (engineer, male) have pointed out that only applying this methodology is not enough. There is a perception that the multi-criteria methodology is good when it is possible to compare different projects that have the same problem, but that can be located in different territories. Ranking projects allow prioritizing when not all projects can be served. E18 (engineer, male) suggests that the project evaluation guide has to be updated and modernised in order to incorporate things that were not important before but are important now.

"What I find most criticisable about the methodology is that there are certain things that are not being measured, that I would understand that they were not measured 30 years ago, because obviously, the country was at a different level of development. But it is difficult to explain that they are not measured today" (E18, engineer, male).

In general, the recognised advantages of applying a concessions system relies on the improvements, technological innovations and construction models that private companies tend to present - more than the contributions arising from the State. However, E5 (engineer, male) explains that in the case of Metro de Santiago these improvements and
technological innovations have a high standard. Thus, instead of concession the infrastructure, the option of bond financing has shown up as an alternative. Metro S.A.'s structure of debts is formed by 56% of Bonds and 44% of Bank Loans\(^3\).

E17 (planner, male) coincides with this vision, explaining that concessions are financing mechanisms of administration and management of public works, which according to him sometimes is forgotten. When having an efficient company like Metro it is not necessary to concession the system. In fact, this can turn into a threat to the correct distribution of the location advantages of the metro stations, since the concession responds to projects that are profitable from the private point of view but cannot be financed by the State - which does not necessarily have a high social return. E17 (planner, male) points out that then the discussion of the concessions has been ideologised to discredit the use of these in transport projects, although it is considered as an alternative to the current scenario of no possibility of building new lines with capital from Metro.

“\[\text{A concession may be a possibility to increase capacity and secondly, financing capacity. Metro today does not have the money to build a third metro line and the Ministry of Finance would not approve it}\]” (E8, engineer, male).

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\(^3\) The document refers to Metro's investment attractions. Within these, the quality of Metro is considered a seller of bonds with solid prospects (Classification Issuer Default Rating by Fitch in 'A +'), because of an essential relationship between the company and the State of Chile, in legal, financial terms and strategic. The company that represents a constant growth, which is 100% owned by the State (43% belongs to the Treasury, and 57% belongs to the Production Development Corporation, also a state agency.) On the other hand, within the possibilities of bond issuance by Metro is considered the high degree of stability over time coming from the high operating flows.
An essential hint to consider about concessions is the impact on fare integration. E8 (engineer, male) points out that it is not known if the metro fare would be integrated into a concession system, which can be a problem to maintaining the integrated flat rate at the metropolitan level.

5.4. Conclusion

At the beginning of the chapter, references were made by authors who have explored the problem of social exclusion from several different fronts. Lucas (2012), for example, has generated a conceptual framework to understand this problem holistically, considering the social and transport disadvantages that draught in processes of social exclusion. Groups considering both transport and social disadvantages may result in a circle of transport poverty. Several of these factors have been mentioned and broken down in the interviews with the experts and policymakers grounded in Santiago. Some of these causes can explain the social, economic and governance framework that surrounds the context of the problems of social inequities in the case study.

One of the lessons from this chapter is that public policy concepts of social exclusion and transport should relate in a multidimensional, relational and dynamic way (Lucas, 2004). Intrinsic characteristics of each individual, such as gender, race or (physical) disabilities could become a difficulty for overcoming social exclusion. Contextual factors related to the national context, the market, and economies of scale, cultural influences, policies and legislative frameworks are hugely important to determine the context of social exclusion.

The existence of different measuring methodologies, changing among different contexts, can be helpful to build a bridge for the transmission of empirical and theoretical knowledge helping on the resolution of this type of conflicts. One of the challenges then is the utilisation of academic knowledge, effectively impacting the vision, perception and
determination of decision makers in the concretisation of improvements in social equity standards.

Throughout the chapter, however, it has been shown that there are several agreements on the diagnosis of the problem, corresponding to different scales of administration and influence in the territory. However, they also share a contradictory vision regarding the ways of solution that can anticipate more prosperous and more equitable scenarios for solving social conflicts.

At the beginning of the chapter a dilemma was proposed about policies aiming to solve the lack of transport infrastructure on peripheral areas of the city, mainly with the development of BRT systems. Public transport should be for all, despite the social income or individual determinant factors that might discourage its use. And it should be possible to be used regardless any social or physical condition. In this way, the connections and new accessibilities can effectively have a destination in the areas where the most significant opportunities for development are. Statists agree on connectivity as the best way of investing on equity. This is applicable not only in buses, but in the municipalities and areas in the city where the greatest number of vulnerable people and middle-class people are concentrated. Most of the investment should go to the most vulnerable municipalities.

At the communal and local scale, the bicycle - which has been criticised as an elitist transport mode – can appropriately represent a solution in the medium and long term, as a vehicle for social mobility. The amount of activities that can be pursued in short and medium distances is much more significant than the impact of public transport and even the car. People can easily access to jobs and services in a medium range free of charge. Part of the solution is providing public investment funds in bicycle schemes in vulnerable areas or subsidising the purchase of bicycles for private use. Facilities for intermodality must be provided, so that the bicycle user can travel comfortably, safely and efficiently, being used
together with public transport. Alongside, the public transport system needs to be more extensive, of higher quality in journey experience, and perhaps free.
6. Using ‘weighted functionings’ to reveal health-related inequalities for transport users.

6.1. Introduction

This first empirical chapter reflects on two of the secondary questions expressed in this research, regarding the new factors that should be incorporated in the measurement of social equity, and what are the vulnerable groups mostly affected by these inequalities.

The chapter uses the information from the survey applied in Santiago to 451 people, described in detail in the methodology of this research. The survey considered a vast number of factors that include different dimensions of people's human development. These factors have been initially taken from the Central Human Capabilities list, and then translated to be incorporated in transport project assessment. The process has been explored in detail in Chapter 2 and defined - and methodologically described for the purpose of the survey in Chapter 3. This chapter focuses particularly on a section of the survey, responding to considerations of mental and physical health of people - which in the case of transport projects have been assessed according to different types of users.

The chapter also develops a broader understanding of the capability approach explored in Chapter 2, as it relates to literature that has not necessarily built from a ‘transport’ approach, but from the impacts on health. Although the definitions of capabilities and functionings have been previously manifested, this chapter explores the concept of ‘weighted functionings’, as a way of incorporating the levels of importance that users attribute to these factors.
Regarding the context in which the research has explored these factors, in Chile the levels of poor mental health, sedentary lifestyles and environmental pollution are low relative to other countries in South America and the OECD. The World Health Organization (WHO) (2017) has estimated that 5 per cent of the Chilean population has depression and 6.5 per cent suffer from anxiety. Chile also has 63 per cent proportion of the population being overweight (Organización de las Naciones Unidas para la Alimentación y la Agricultura & Organización Panamericana de la Salud, 2017), which is the highest level in Latin America. There is growing global concern concerning these issues, and international organizations pointed towards risk factors relating to individual lifestyles, i.e. unhealthy diet and insufficient physical activity. According to the WHO, behavioural risk factors are potentially modifiable and, if they were changed, at least 80 per cent of heart disease, stroke and type-2 diabetes, and 40 per cent of cancers could be prevented (MINSAL, 2013). These seem to be great public health gains to be made, hence the requirement to closely examine transport-related health issues.

Regarding the transport discussion in Chilean context, the Ministry of Transport (2013) has recognized in the National Transport Strategy that people's transport choices influence their health and well-being, hence it is necessary to promote active travel such as cycling and walking for short distances and as a way of accessing public transport. However, and in spite of the improvements made during recent years in both infrastructures and in the operation of transport systems, the physical health of individuals remains very inequitable across Chile and in Santiago.

On the other hand, and adding to the problem, evaluative tools for public projects are particularly poor in considering transport and social inequalities. Transport systems and their use are inherently inequitable – different population groups use different modes and are able to access
different activities. Yet, project planning and appraisal rarely considers social impacts of transport investments. Many projects are assessed against economic efficiency goals, through tools such as cost-benefit analysis, and there is little assessment relative to wider social or health objectives – distributional issues are often overlooked (Hickman & Dean, 2017; Lucas, 2012; Martens, 2017). Social impact assessment in transport – if utilised – is usually based on the understanding of potential impacts related to physical accessibility, casualties and security. The ‘performance’ of public transport has been measured through levels of service, such as journey and waiting times and reliability. But these are all fairly mechanistic outputs and often do not reflect the quality of the service, or help us understand the choice to use the systems, potential activity participation or related impacts.

In this regard, health indicators for instance, are mainly measured according to road traffic casualties, mortality, exposure to air pollutants and noise. There is surprisingly little integration between the different disciplines of transport and health, despite there being common goals. There is very little focus on the experience of travel and the health and well-being impacts relative to different modes and population groups. Hence, the incorporation of a greater range of multidimensional factors has become significant for the travel and social and health impact assessments of transport schemes and networks.

Again, in the Chilean context, in 2013, the DTPM (Metropolitan Public Transport Board) developed an evaluation of the general public transport system through a quantitative evaluation tool, which unfortunately simply measures the level of satisfaction concerning the levels of service for each particular bus companies’ concessioners. This is conventional practice – assessing the ‘quality’ of public transport against journey reliability and cost, and perhaps comfort. This practice ignores wider social issues, perhaps much more important, such as who is using a particular transport mode or not, which neighbourhoods are served, and
what activities are able to be reached, or by whom. There is little consideration of health-related or well-being aspects of transport, despite a requirement to provide tools that cover these wider considerations (Mindell, 2018).

Many of the early scholars writing on social equity argued for a greater focus on distributional issues in public policy – that we should guarantee those worst off in society a fair deal. As seen in Chapter 2, Rawls (2007, p. 397), for example, calls with his Difference Principle for a much greater focus on disadvantaged groups. He states that: “a well-ordered society is [...] designed to advance the good of its members and effectively regulated by a public conception of justice”. However, in many cities, both in develop and developing countries, we can see the opposite, where low-income groups suffer from the lowest quality of life.

In this chapter, the differences in the self-assessment of health-related factors are measured for three types of transport users: private (cars, taxis, colectivos, motos), public (buses and Metro) and active (bicycles and walking). The contribution of the chapter is to apply the Capabilities Approach (CA) (after Sen, 1987; 1999; 2009) in the transport domain, and particularly in relation to transport-related health issues. This involves a multi-dimensional assessment of health impacts across different types of transport users and population groups. A capability-based survey is used in different neighbourhoods of Santiago.

The chapter is innovative on two aspects. First, a multi-dimensional set of transport-related health factors are used, with data derived from individual self-assessment – different to more frequent use of road traffic casualties, mortality, exposure to air pollutants and noise. Second, the Capability Approach (CA) (see Chapter 2) is applied as the theoretical framework for the analysis, with CA operationalised in relation to individual travel behaviours. In particular, the concept of weighted functionings is developed and applied, allowing an assessment of actual activities weighted according to priority given.
The empirical method follows a capability-based survey, measuring perceptions of transport users on health-related factors (such as stress, physical effort, proximity to others, and perceived levels of air pollution), as well as the level of importance assigned to them.

The results show that low-income segments, public transport users and women tend to have a more negative perception on these factors, reflected in a lower assessment, compared to other segments as men or private transport users. This difference is even more evident when considering the levels of importance they attribute to these factors, with an ultimate lower achievement of their well-being. Descriptive and multinomial logistic models are used for the analysis. Primary transport mode and journey times are both correlated to income level. The chapter concludes by suggesting that the focus on the groups with greater disadvantages should be strengthened, as societal well-being is likely to increase alongside intervening on behalf of the most vulnerable members in society.

6.2. Capabilities and health impacts

The exploration on Chapter 2 about the Central Human Capabilities developed by Nussbaum, led into the questions of the applicability in transport. The first part of the list pointed to aspects related to individual’s health conditions – when considering life, bodily health and bodily integrity. This has been actually linked to the idea on comfort and the built environment (see pages 43 – 44). Although she has considered the list of 10 capabilities as central requirements of a life with dignity in different spheres of life, this chapter has explored in detail the first part, looking on these intrinsic capabilities the idea of the “minimum account of social justice”.

The chapter build then on the definitions of CA provided by Sen (1987; 1999; 2009), considering Nussbaum’s categories of capabilities for
framing the theoretical approach. The idea is examining multidimensional health indicators in relation to transport, beyond the more conventional use of traffic casualties (Ling, Cherry, & Dhakal, 2017; Mindell, 2017), mortality (see Methorst, Schepers, Christie, & de Geus, 2017; Noland, Sinclair, Klein, & Brown, 2017) and pollutant exposure.

As a preliminary viewing of the methodological process that has emerged from this capabilities exploration, the chapter has developed the concept of ‘weighted functionings’. This builds on previous work examining transport and social equity in relation to capabilities (Beyazit, 2011; Hananel & Berechman, 2016; Hickman et al., 2017), as it has been found that the use of CA has much potential in transport planning – considering the capabilities (the real opportunities for participation and being) relative to functionings (actual activities and being) (Hickman et al., 2017) (see Chapter 2).

The use of capabilities has been widely used in public health. However, the analysis connecting transport and capabilities is still emerging. Lorgelly et al. (2015) have suggested the CA for measuring public health through quantitative and qualitative methods, while Simon et al. (2013) adds the accessibility dimension by developing an application of a multidimensional instrument for outcomes in mental health. Beyond health, other studies have also highlighted the potential of capabilities for measuring well-being against routinely used cost-benefit analysis, for reducing gaps between potential and realized outcomes (Agee & Crocker, 2013). The study by Lorgely et al. (2015) conduct a similar methodology of surveys, considering a similar structure and reinterpretation of CA concepts based on the Nussbaum CHC list. They take the list and read it according to the parameters with which public health is usually measured. They also consider that the use of quantitative and qualitative information in research is relevant since interviews with people provide additional information to the survey. Even though the study is similar to this research in terms of structure, it has
been done in the context of public health – not even mentioning the transport dimension.

<table>
<thead>
<tr>
<th>Nussbaum’s Central Human Capabilities (CHC) List</th>
<th>Factors considered for reinterpreting Nussbaum’s CHC in transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Life</td>
<td>1. Levels of stress when travelling</td>
</tr>
<tr>
<td>2. Bodily health</td>
<td>2. Physical activity when travelling</td>
</tr>
<tr>
<td>3. Bodily integrity / comfort and built environment</td>
<td>3. Proximity to others at the mode while travelling</td>
</tr>
<tr>
<td></td>
<td>4. Perceived air pollution when travelling</td>
</tr>
</tbody>
</table>

Table 6.1 Interpretation of Nussbaum’s Central Human Capabilities List according to transport planning. Source: own production based on Nussbaum (2009).

This chapter uses the first category for the application of Nussbaum’s Central Human Capabilities List that was exposed in chapter 3. This category recognises that “Life, bodily health and bodily integrity” can be recognised when basic socio economic and socio demographic data are examined against the self-assessment of physical and mental factors. The examples explored in this category were chosen considering factors that relate to dimensions of health when associated with the commute journey – based in previous studies in the field of transport and public health. The search for this type of measures challenges the generally used health indicators as road traffic casualties, mortality, exposure to air pollutants and noise – which have been extensively used for transport appraisal, but not succeeding on embracing all the dimensions associated to health that are impacted by transport.

The factors draw on the concepts exposed in the Central Human Capabilities List can affect in transport and public health. All the factors suggest an individual self-assessment when travelling – preferably when commuting – of different aspects. They help to suggest that the
evaluation of health-related considerations in transport projects should consider the user’s perceptions of the built environment, the relationship with others and the way the users are mentally and physically affected by their trips. The definition of these factors are as follows:

- **Self-assessment of stress**: Existing literature shows a relationship between stress and commuting, primarily considering the commuting time (Evans & Wener, 2006), control and predictability (Gottholmseder, Nowotny, Pruckner, & Theurl, 2009), among other aspects. In the context of this research, the factor of stress level has a negative connotation (as it could be expected that none would choose to be stressed) and examines the internal mental state of the person who travels – based on her commuting trips.

- **Self-assessment of physical activity**. This factor corresponds to the perception of the physical activity when travelling. In this case, the individual establishes if the physical effort is considered as a positive or a negative attribute of the trip. In certain cases, the use of active modes may encourage the realization of physical activity, while in other cases this activity may be a burden for the person who performs it. The self-assessment of physical activity when travelling may vary according to individual fitness, the degree of physical activity, the purpose and type of trip and context within which the journey is carried out (Musthafa, Leh, Omar, & Karuppannan, 2015; Witten et al., 2012). An association between modes, i.e. physical activity and public transport use has been found (Rissel, Curac, Greenaway, & Bauman, 2012). For example, transit use and physical activity have been related to changes in Body Mass Index (BMI) (Brown, Werner, Tribby, Miller, & Smith, 2015; Flint, Cummins, & Sacker, 2014; Martin, Panter, Suhrcke, & Ogilvie, 2015; Wanner et al., 2016). A higher BMI tendency is experienced for private motor car users while switching to public transport (or active modes) has been
associated with a significant reduction in BMI (Martin et al., 2015).

- **Self-assessment of proximity to other people.** This factor refers to the positive or negative perception of users, about having social interactions with other people while travelling. Similarly to the previous factor, the individual establishes if the proximity to other people is considered as a positive or a negative attribute of the trip. Associations between crowdedness and negative health outcomes have been documented before (Cox, Houdmont, & Griffiths, 2006). However, this factor here explores the differences across different transport modes and diverse individual (socio-economic and socio-demographic) characteristics.

- **Self-assessment of exposure to air pollution.** The indicator of air pollution has been usually evidenced through the measurement of air quality indicators through air quality monitoring stations. Research has found that air pollutants can seriously affect human health, including, for example, respiratory problems such as bronchitis, emphysema and asthma (Mabahwi, Leh, & Omar, 2014). Although air pollution is usually expert assessed, it has been found that the individual experience is also of interest for further study (Day, 2004). In this regard, understanding the perceptions of different transport users about their exposure to pollutants may contribute to a better definition of environmental policies for improving air quality (Dietz & Atkinson, 2005) and their physical health.

### 6.3. Reinterpreting CA from the concept of weighted functionings

As explained at the beginning of this chapter, the exploration of health-related factors in transport has required for this research to revisit the CA. Chapter 2 (p. 56) has already suggested that the concepts of capabilities
and functionings are key for understanding the approach. For the analysis of this chapter, functionings have been interpreted as the ‘states of the person’s health while traveling’ – state that is associated to a health-related dimension. The capabilities remain the same as the definition. In the context of the health-related dimensions in transport, capabilities are the combination of the achievable states of a person’s (self-assessed) health while travelling.

Capabilities are challenging to assess on an individual-based level through a questionnaire, as people might not have an idea of how achievable or possible these states are. For example, we can directly ask a person what her state of stress is while travelling, but we cannot ask what her achievable level of stress is (see Error! Reference source not found.). Something that we do have the potential to ask in this case is about her desired levels of stress, expected levels of stress or importance of her levels of stress. These cannot define the capabilities of the person, but they are a proxy for understanding the gaps that separate the current or the achievable health-related states of people while travelling. In the form of the questionnaire defined in the methodological Chapter 3, respondents were asked to assess the health-related factors previously defined. They were also asked to assign a level of importance that they attribute to these factors, in order to understand a proxy towards their capabilities.

If the functionings are related to the assessment of the current situation (or the state) of the person, ‘weighted functioning’ will address the level of importance the person attributes to that state. This is not a direct measurement of capabilities but get us closer to the understanding of: 1) how far a person is from achieving what she values; and 2) what are the priorities for a person in the achievement of the various desirable combinations of functionings. The ‘weighting’ measure will depend on the level of importance the person considered for each health-related question.
Considering the levels of importance for weighting the functionings of a person converses with people’s individual reason for valuing things in life.

*the capability that we are concerned with is our ability to achieve various combinations of functionings that we can compare and judge against each other in terms of what we have reason to value* (Sen, 2009, p.233)

Weighted functionings, therefore, consider the levels of assessment and the value that people assign to the factors assessed. They depend on the options and choices of people, and they are determined by the assets and conversion factors people actually have (see p.68). Weighted functionings can help for defining a potential assessment of individuals' capabilities: the preferences included within weighted functionings take us beyond functionings and towards the capabilities concept – as suggested already by Alkire et al. (2015).

Sen also recognises the difficulty of considering and measuring capabilities in appraisal. Considering that the things to be evaluated have been identified capabilities must be encountered through a further evaluative exercise. As a way of crediting the search for new ways to measure capabilities, Sen allows the “various substantive ways of evaluating functionings and capabilities can all belong to the general capability approach” (Sen, 1993, p.33).

In chapter 1, the Figure 1.2 shows a diagram of concepts defining the use of the CA in this research. The Figure 6.1 above adds to this diagram the concept of weighted functionings, depending on the choices and the context of people.
Hence, the analysis presents a new interpretation of the use of CA in the transport domain. There is also consideration of some of the emotive dimensions not usually considered in health assessments in transport projects. Normative and moral dimension are examined, centred on the individual’s well-being, affecting people’s opportunities and freedoms. Weighted functionings are examined through the individuals’ self-assessment of health-related factors. From the lenses of inequality, the analysis assumes that more inequity exists between population groups where there is a greater gap between ‘assessed functionings’ and ‘weighted functionings’.

6.4. Socio-economic and gender differences in modal use

Table 6.2. explores differences through a p-fisher test according to gender and primary travel mode. Recognising the most vulnerable groups affected by transport has been one of the aims of the research. The analysis of the socio-economic and gender differences in modal use shows that men access to higher income levels compared to women. Significant differences are also evident when considering main transport
mode – as there is a high inequality in mode access (and mode usage) by income in Santiago. The analysis reveals that low-income groups tend to use primarily public and active modes, whereas high-income groups tend to mostly use private modes.

According to the table, a clear difference relates to the type of occupation (p=0.03), where most respondents work full-time (57 per cent) and primarily use private transport, followed by participants studying (22.5 per cent) who tend to use public transport. In the case of students, the percentage of females and males is quite similar. However, the category of full-time workers is mostly occupied by men presenting a significant difference of almost 6 per cent between genders. Differences were also found with duties related to housework, where woman have a much higher percentage of domestic work (7.4 per cent versus 0.5 per cent for men). This shows a conventional patriarchal tendency in Chile, although women have managed to enter the labour market, they still have had to undertake the domestic work in the household. In terms of education, most respondents have some degree of technical or professional education (68.3 per cent), 6.4 per cent of the sample have a postgraduate degree. A 23.1 per cent of the participants have achieved secondary education, while just 2.2 per cent have only primary education. This aspect (though not the focus of this research) is a critical element in the discussion of equity in countries. According to OECD (2017b), in Chile, people who have a primary education score 30.7 per cent lower in adult skills sets than people who have a tertiary education. The inequalities by education level also show significant differences between males and females (p=0.01). This is also noted in the OECD (2017a) inequality index between countries. On average, in Chile, women score 6.5 per cent lower than men in adult skills sets (PIAAC), while in the average OECD countries, women score 2.7 per cent lower than men.
Table 6.2 Descriptive analysis by gender and primary transport mode.

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>p- Fisher</th>
<th>Private</th>
<th>Public</th>
<th>Active</th>
<th>p- Fisher</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>53.7%</td>
<td>46.3%</td>
<td></td>
<td>31.0%</td>
<td>59.9%</td>
<td>9.1%</td>
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<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Less than 18</td>
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<td>1.0%</td>
<td>0.7%</td>
<td>0.7%</td>
<td>0.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 - 24</td>
<td>30.2%</td>
<td>64.1%</td>
<td>10.7%</td>
<td>78.6%</td>
<td>6.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 - 24</td>
<td>25.6%</td>
<td>59.8%</td>
<td>0.45</td>
<td>25.7%</td>
<td>52.1%</td>
<td>11.4%</td>
<td>&lt;0.01</td>
</tr>
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<td>35 - 54</td>
<td>30.2%</td>
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<td>47.9%</td>
<td>40.0%</td>
<td>8.6%</td>
<td></td>
</tr>
<tr>
<td>55 - 64</td>
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<td></td>
<td>12.9%</td>
<td>16.4%</td>
<td>2.1%</td>
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<td>65 or more</td>
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<td>4.8%</td>
<td>2.1%</td>
<td>4.3%</td>
<td>0.7%</td>
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<tr>
<td><strong>Income</strong></td>
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<tr>
<td>Low</td>
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<td>17.2%</td>
<td>36.3%</td>
<td>36.6%</td>
<td></td>
<td></td>
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<tr>
<td>Middle</td>
<td>35.6%</td>
<td>34%</td>
<td>35.7%</td>
<td>35.2%</td>
<td>29.2%</td>
<td>&lt;0.01</td>
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</tr>
<tr>
<td>High</td>
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<td>39.2%</td>
<td>46.5%</td>
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<td>34.2%</td>
<td></td>
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<td><strong>Occupation</strong></td>
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</tr>
<tr>
<td>Full time employee</td>
<td>54.1%</td>
<td>60.3%</td>
<td>70.7%</td>
<td>49.6%</td>
<td>58.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part time employee</td>
<td>2.1%</td>
<td>1.9%</td>
<td>2.1%</td>
<td>2.2%</td>
<td>0.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent worker</td>
<td>5.4%</td>
<td>6.2%</td>
<td>3.6%</td>
<td>5.2%</td>
<td>17.1%</td>
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<tr>
<td>Unemployed</td>
<td>1.7%</td>
<td>1.0%</td>
<td>1.4%</td>
<td>1.5%</td>
<td>0.0%</td>
<td></td>
<td></td>
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<tr>
<td>House keeper</td>
<td>7.4%</td>
<td>0.5%</td>
<td>0.03</td>
<td>6.4%</td>
<td>3.3%</td>
<td>2.4%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Student</td>
<td>22.3%</td>
<td>22.5%</td>
<td>9.3%</td>
<td>30.4%</td>
<td>14.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student and part time</td>
<td>3.7%</td>
<td>4.3%</td>
<td>1.4%</td>
<td>5.2%</td>
<td>4.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retired</td>
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<td>1.4%</td>
<td>2.1%</td>
<td>1.1%</td>
<td>0.0%</td>
<td></td>
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</tr>
<tr>
<td>Other</td>
<td>1.7%</td>
<td>1.9%</td>
<td>2.1%</td>
<td>1.5%</td>
<td>2.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education</strong></td>
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</tr>
<tr>
<td>Primary school</td>
<td>2.9%</td>
<td>1.4%</td>
<td>1.4%</td>
<td>2.2%</td>
<td>4.9%</td>
<td></td>
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</tr>
<tr>
<td>Secondary school</td>
<td>21.9%</td>
<td>24.4%</td>
<td>10.7%</td>
<td>28.9%</td>
<td>26.8%</td>
<td></td>
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<tr>
<td>Technical education</td>
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<td>12.9%</td>
<td>0.01</td>
<td>26.4%</td>
<td>15.2%</td>
<td>14.6%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>University education</td>
<td>47.5%</td>
<td>51.7%</td>
<td>53.6%</td>
<td>48.1%</td>
<td>43.9%</td>
<td></td>
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<tr>
<td>Postgraduate</td>
<td>4.1%</td>
<td>9.1%</td>
<td>7.9%</td>
<td>5.2%</td>
<td>9.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Disabilities</strong></td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>Yes</td>
<td>3.3%</td>
<td>3.8%</td>
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<td>5.0%</td>
<td>2.6%</td>
<td>4.9%</td>
<td>0.32</td>
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<tr>
<td>No</td>
<td>96.7%</td>
<td>96.2%</td>
<td>95.0%</td>
<td>97.4%</td>
<td>95.1%</td>
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<tr>
<td><strong>BMI category</strong></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Underweight</td>
<td>1.7%</td>
<td>1.0%</td>
<td>0.7%</td>
<td>1.1%</td>
<td>4.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>60.3%</td>
<td>42.6%</td>
<td>48.6%</td>
<td>55.6%</td>
<td>41.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight</td>
<td>22.3%</td>
<td>41.1%</td>
<td>31.4%</td>
<td>28.5%</td>
<td>46.3%</td>
<td>0.07</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>6.2%</td>
<td>11.5%</td>
<td>12.9%</td>
<td>7.4%</td>
<td>2.4%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Journey time</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-20</td>
<td>25.2%</td>
<td>14.8%</td>
<td>30.7%</td>
<td>7.0%</td>
<td>73.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-40</td>
<td>21.5%</td>
<td>24.4%</td>
<td>26.4%</td>
<td>22.6%</td>
<td>12.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40-60</td>
<td>24.4%</td>
<td>25.8%</td>
<td>27.1%</td>
<td>27.0%</td>
<td>4.9%</td>
<td>&lt;0.01</td>
<td></td>
</tr>
<tr>
<td>60+</td>
<td>25.6%</td>
<td>34.0%</td>
<td>12.1%</td>
<td>41.9%</td>
<td>7.3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Closer to the analysis of aspects related to health, the majority of respondents (93.4 per cent) of our survey report data that allows an estimation of self-reported BMI. Males in general tend to be closer to the 25 points (kg/m2), which is in the low limit of overweight⁴. Male users of private transport are significantly more likely to be overweight and obese, compared with those cycling or walking to employment or their principal activity. This relationship is even higher comparing female users of private and public transport, although the results are not significant by male-female groups according to transport mode. Female users of public transport are likely to have less BMI compared to users of private and active modes.

Regarding modal split, 31 per cent of participants use motorised transport as a primary transport mode (82.1 per cent of this is for car users). 59.9 per cent of the sample uses public transport and 9.1 per cent active modes. The results show a significant relationship between journey times and main transport mode, as public transport users have much lengthier commutes versus other modes – 41.9 per cent take more than one hour in getting to work.

Although this is a descriptive but revealing summary of the main differences according to socio-demographic groups, it has highlighted gender differences and inequalities produced by modal split. This first exploration of the data was followed by the analysis of the health-related factors indicated in the first part of the chapter, revealing even more significant differences among groups.

### 6.5. Health-related factors defined by mode and journey times

⁴ BMI bellow 18.5 is considered underweight; between 18.5 and 24.9 is considered healthy; between 25 and 29.9 is considered overweight; and 30 or higher is considered obese.
This chapter has considered factors that can reduce the gaps of social inequality\(^5\), from a perspective of public health – or factors that, coming from public health, can affect transport policies. For this purpose, the four factors that have been examined are: stress, physical activity, proximity to other transport users and exposure to air pollution.

After the socio-demographic analysis in the previous section, when considering these factors, the public transport users group tend to be the most disadvantaged of them all. In this case, the comparative analysis between the level of assessment (functionings) and its weighting (weighted functionings) tends to be similar for all four factors considered. However, weighted functionings also show evidence on the level of importance that people attribute to these factors, revealing more significant differences between types of users and journey time.

\(^5\) Suggested on the main research question of the research: “Which factors in transportation projects can reduce the gaps of social inequality, and how they can be incorporated in the design and assessment processes?”
Boxplots show graphically these differences. The boxplots show the distribution of data based on the categorisation of primary transport mode and journey times. Each factor (stress, physical activity, proximity to users and exposure to air pollution) have been illustrated in boxplots, showing the differences between functioning total values and weighted functioning values – the latest reflecting the levels of importance people attribute to these factors. When considering levels of stress, the boxplots in Figure 6.2. show notable differences by primary mode – both for current assessment and levels of importance. Active users (i.e. walking and cycling) show a better assessment on their levels of stress (they have reduced stress whilst travelling) compared to other modes. Public and private users tend to have similar levels when assessing the stress factor.

Figure 6.2. Stress while commuting and primary transport mode. Functioning total values (A) and weighted functioning values (B).
Boxplots in Figure 6.3 reveal the relationship between stress and journey times, where commuting time is proportional to a more negative assessment of stress levels. When asked about the weighting of this factor, 79 per cent of the respondents agree on assigning a high level of importance – with an insignificant difference in terms of gender, primary mode or journey times. There is some overlap in terms of mode choice and journey time – often public transport journeys are the longest in length and time, with long commutes to the centre of Santiago from the poorer suburbs to the southwest.

Figure 6.3. Stress while commuting and journey times. Functioning total values (A) and weighted functioning values (B)
The factor of physical activity while commuting is assessed more positively in the case of active transport users – compared to the other modes. Following the same trend as above, the boxplot in Figure 6.4 shows that private and public transport assess similarly both for functioning and weighted functioning values the levels of physical activity. Something interesting about the results, is the quite wide variance in responses when assessing the levels of importance of physical activity – perhaps due to non-active modes not expecting to gain physical activity whilst travelling. The lack of association between the use of motorised modes and physical activity is another possible explanation for the variance in assessing the importance of this factor.

![Boxplot](image)

*Figure 6.4. Physical activity while commuting and primary transport mode. Functioning total values (A) and weighted functioning values (B)*
The questions about the level of physical activity in the survey do not define whether the activity is (classified as) something positive or negative. This was a decision when designing the survey that intended to avoid user biases when answering the question. However, this opens a new (and necessary) research window. For example, it might be interesting to know if public or private transport users make their modal decisions based on gains (positive) or the expense (negative) of physical activity – in order to see the positive or negative attributes within their decision making.

*Figure 6.5. Physical activity while commuting and journey times. Functioning total values (A) and weighted functioning values (B)*
When considering the factor of physical activity against journey times (Figure 6.5), the analysis follows a similar pattern. As the trip increases the time, the lower is the evaluation of the physical activity. This makes sense when analysing not only the distances but the conditions of the trip. In general, people who must travel more than 60 minutes are public transport users. This is the group most affected by the factor of physical effort while commuting. While this is something that has been discussed, the current Transantiago buses do not have the capacity to carry enough seated passengers during long journeys – which is when the feeling of physical effort mostly affects them. On the other hand, the buses have not regulated the optimal frequencies that allow people to choose to take another bus when the capacity of seats is covered. The problem increases when considering that the bus stops are efficiently distanced from each other in order to provide a better travel performance of the buses. This evidently decreases the access to stops for the users, since they have to walk long distances before boarding and after the bus route. Again, this is an open window for further exploration on active travel and its consequences by mode and transport users’ profiles.

A third health-related factor is the proximity to other transport users. Again, this is a subjective measure that did not imply in the question a positive or negative consideration of the factor. This was then an assessment of the user’s perception on the physical distance or the value of the presence of other people while commuting. In cases of private vehicles, the lack of other users could be experienced as positive, given the nature of driving a private vehicle. However, in the case of public transport this relationship is more complex as it could depend on the level of crowdedness (see Ettema et al. (2012)). For respondents of the survey, this factor shows public transport users to have the lowest levels assessment to the proximity of transport users (Figure 6.6). A 44 per cent of public transport users score a low level of functionings, with similar trends in weighted functionings.
A detailed examination of the boxplots in Figure 6.6 shows that women from medium and low-income segments are more likely to give higher importance concerning proximity to other transport users, but they score lower for the assessment of functionings. This may be explained by women often having longer trips and tending to feel more vulnerable or discouraged by the physical conditions of interaction with other passengers.

As a matter of context, it is important to note that Chile, particularly Santiago, has a serious problem – not yet fully exposed – of street sexual harassment, which is well evidenced in public transportation. This is possibly one of the aspects that more strongly justifies the addition of 'proximity to other users' as an element to be considered in health-related factors, since it can seriously affect the mental health of people, especially women. Street sexual harassment has been defined as a practice of sexual connotation exercised by an unknown person in public.
spaces, public transport or on the street (Observatorio contra el acoso callejero Chile, 2017). The action affects the victim unilaterally, while the harasser has no interest in establishing a real communication with the person who is being attacked, having a negative mental impact, that influences the way she mobilized, considering changes of mobility patterns, modes and even implies a dependence to move accompanied by other people. This violent practice, both in public spaces and in transport, has been well documented in many publications\textsuperscript{6}. In 2014, the first online street harassment survey was conducted in Chile, with people in the range from 10 to 64 years. Among the most recurring forms of harassment (more than 90 per cent of cases) are whistles, sounds, kisses, gasps and lascivious looks. Seventy-one per cent of respondents believe that these experiences of harassment have been traumatic. One of the effects produced by these experiences, which occur mainly in public spaces and public transport, is the modification of transport routes and schedules of use of these spaces. The survey does not explicitly refer to transport modes where the harassment occurs - which exposes a profound and necessary niche of knowledge.

The levels of importance considering journey times follows a similar tendency as the previous cases, regarding proximity to users. As the trip increases, the levels of evaluation of proximity to other users decrease. For example, looking at the last section of the graph, of a person who takes more than 60 minutes a day to travel, it is understandable that the distance and interaction with other passengers would be more relevant.

\textsuperscript{6} In the context of Chile and other Latin-American countries, see for example about the definition of street as gender violence (Garrido et al., 2017); sexual harassment gender differences on safety measures in public transport in the context of US (Yavuz et al., 2010); women’s fears using public transport (Schulz & Gilbert, 1996); the influence of harassment over apprehensions and changes in travel patterns on women (Lynch & Atkins, 1988); and Rainero (2009) from a feminist position on the conflict un insecurity for women in Latin America.
Figure 6.7, below, shows that for the group that takes 20 minutes in their usual trips, the evaluation is better. However, the variability of this group is high since the relevance of tolerating the proximity of other users in short trips could not be so obvious.

The factor of exposure to air pollution shows little difference between modes (Figure 6.8) and journey times (Figure 6.9) for the assessment of functionings. It is interesting to analyse this component of public health in the case of the measurement of environmental pollutants. Both in Santiago and other cities of the country, transportation is recognised as one of the main reasons for environmental pollution. This evaluation
comes from pollution monitoring stations. However, this information is not frequently shared with civil society. The public perception of air pollution and its health risks are not public domain, although they may be a relevant factor in the decision to use or exchange with an active mode of transport. In the analysis, all modes indicate similar assessment of the current exposure to air pollutants – despite that in practice, a user of active transport is prone to feel a greater exposure to environmental pollutants. However, this slightly changes when weighted functionings are considered. Then public transport users and longer journey time scores are lower than the other modes. More detailed analysis shows that male users of private transport tend to show higher concerns for air pollution relative to women.

![Figure 6.8](image)

*Figure 6.8. Air pollution and primary transport mode. Functioning total values (A) and weighted functioning values (B)*
Figure 6.9. Air pollution and journey times. Functioning total values (A) and weighted functioning values (B)
The spatial variant of the location of the points of origin of the surveys is also interesting to include in the analysis. Figure 6.10 shows, for example, the distribution of the surveys considering the factor of stress and primary transport mode. The cyan points represent respondents who use public transport as the primary transport mode, the blue dots represent active transport users, and the red dots represent private transport users. The size of the circle represents the user’s perception of stress. The figure is consistent with the statistical analysis in that stress levels are high for both public transport users and private transport, while active transport users - located mainly in central areas of the city - tend to be less stressed than the other modes.

Figure 6.10. Surveys considering stress and primary transport mode. Source: own production.

One of the objectives of this chapter has been the measurement of social inequalities, which has been explored through the recognition of the differences between the assessed and weighted functionings – and how this impact on the well-being of different population groups. The assessment of the health-related factors is lower for low-income groups relative to higher incomes. By interpreting these results under the scope of the CA, it can be said that people with disadvantage tend to have an increased gap between their current situation and the value they assign
to these factors. People with a higher income level, active transport users and short trip commuters are consistently in a better position in terms of transport-related health assessment (Figure 6.11). And although the statistical analysis does not reveal significant differences by gender, there are small differences where female score lowers for functionings and weighted functionings.

Figure 6.11. Total score of functionings for the four health-related factors, by income.
After a descriptive analysis of the factors, a Chi-square analysis is carried out for the four health-related factors by gender, mode and journey times (Table 6.3)\(^7\). The objective is to go examine further the differences between the assessment of functionings and weighted functionings by different population segments.

![Figure 6.2. Aggregate score of functioning and weighted functionings for the four health-related factors, by gender.](image)

\(^7\) The assessment is scored from 'not important' (1) to 'very important' (5). Responses are grouped on the extremes: (i) bad or negative: lowest scores for each factor (1 or 2 points), (ii) indifferent: intermediate score (3 points) and (iii) good or positive: the highest scores for each factor (4 or 5 points).
The differences on the assessment of functionings tend to be more significant than the weighted functionings. Hence prioritisation of health-related factors does not differ significantly by population group, only on the scoring of functionings. The most significant differences (at the <0.01 level) relate to the perception of having to perform some physical activity or effort while commuting. The group of active transport users tends to ascribe a much more positive assessment when referring to physical effort compared to other modes (80% versus 41% and 37% for private and public transport respectively). When comparing to other modes, public transport users tend to present lower scores in both assessment and weighting of their functioning dimensions. There are no significant differences by gender for assessed or weighted functionings. The most distinctive factor comes from the weighting of the levels of importance of proximity to other transport users, which is more highly scored by females than males (72% female versus 60% male). Journey times are significant (at the <0.01 level) for functionings for stress, physical effort and proximity to other users.
As part of the analysis, four multinomial logistic models were carried out using SPSS Statistics, considering only the functioning element analysis. The independent variables included were primary mode, journey time and income (Table 6.4). The dependent variables were constructed using the answers of surveyed participants for each health-related factor (stress, physical activity, proximity to other users and perceived air pollution).

<table>
<thead>
<tr>
<th>Mode</th>
<th>Journey time</th>
<th>Chi-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>Public</td>
<td>Active</td>
</tr>
<tr>
<td>31.0%</td>
<td>59.9%</td>
<td>9.1%</td>
</tr>
</tbody>
</table>

| Stress Functionings | 32.9% | 33.0% | 56.1% | 50.0% | 33.3% | 35.4% | 27.1% |
| Stress Functionings | 36.4% | 29.3% | 36.6% | 29.3% | 44.1% | 30.1% | 25.6% | <0.01 |
| Stress Functionings | 29.3% | 37.8% | 7.3%  | 18.5% | 23.5% | 34.5% | 47.4% |
| Physical Activ. Functionings | 77.9% | 76.3% | 87.8% | 70.0% | 75.7% | 78.8% | 78.2% |
| Physical Activ. Functionings | 14.3% | 12.2% | 9.8%  | 10.0% | 17.5% | 9.7%  | 12.0% | 0.34  |
| Physical Activ. Functionings | 6.4%  | 10.0% | 2.4%  | 20.0% | 1.9%  | 11.5% | 6.8%  |
| Proximity users Functionings | 40.7% | 36.7% | 80.5% | 28.6% | 42.7% | 44.2% | 25.6% |
| Proximity users Functionings | 33.6% | 36.7% | 14.6% | 12.5% | 36.9% | 23.9% | 38.3% | <0.01 |
| Proximity users Functionings | 25.0% | 26.3% | 4.9%  | 6.3%  | 20.4% | 31.9% | 35.3% |
| Proximity users Functionings | 56.4% | 53.7% | 82.9% | 68.5% | 54.4% | 49.6% | 57.1% |
| Proximity users Functionings | 31.4% | 27.0% | 9.8%  | 21.7% | 28.2% | 33.6% | 24.8% | 0.12  |
| Proximity users Functionings | 11.4% | 17.8% | 7.3%  | 8.7%  | 17.5% | 16.8% | 15.0% |
| Proximity users Functionings | 33.6% | 17.8% | 48.8% | 42.4% | 31.1% | 19.5% | 13.5% |
| Proximity users Functionings | 31.4% | 18.5% | 22.0% | 22.8% | 24.3% | 24.8% | 20.3% | <0.01 |
| Proximity users Functionings | 32.1% | 62.2% | 29.3% | 32.6% | 42.7% | 54.9% | 63.9% |
| Proximity users Functionings | 65.0% | 65.6% | 75.6% | 72.8% | 71.8% | 67.3% | 56.4% |
| Proximity users Functionings | 23.6% | 20.0% | 24.4% | 18.5% | 22.3% | 20.4% | 24.8% | 0.15  |
| Proximity users Functionings | 10.0% | 12.6% | 0.0%  | 6.5%  | 5.8%  | 11.5% | 15.8% |
| Air pollution Functionings | 13.6% | 9.6%  | 19.5% | 17.4% | 17.5% | 8.0%  | 6.0%  |
| Air pollution Functionings | 33.6% | 18.5% | 24.4% | 23.9% | 24.3% | 27.4% | 18.8% | 0.04  |
| Air pollution Functionings | 51.4% | 71.1% | 56.1% | 57.6% | 56.3% | 63.7% | 75.2% |
| Air pollution Functionings | 77.1% | 74.4% | 85.4% | 75.0% | 75.7% | 75.2% | 77.4% |
| Air pollution Functionings | 13.6% | 15.2% | 9.8%  | 12.0% | 17.5% | 17.7% | 10.5% | 0.48  |
| Air pollution Functionings | 8.6%  | 9.3%  | 4.9%  | 12.0% | 6.8%  | 7.1%  | 9.8%  |

Table 6.3. Chi-square test by mode and journey time, for the four health-related factors.
Multinomial logistic models are developed for the four factors assessed, considering the functioning scores (Table 6.5 and Table 6.6). The independent variables are selected according to the analysis of significance – meaning that the result is likely to be attributable to a specific cause. The results show that ‘primary transport mode’ is significant at 0.001 for physical activity and significant at 0.012 for stress. ‘Journey time’ is significant at 0.035 for physical activity and significant at 0.018 for stress. Both transport mode and journey time are the main predictors for a negative assessment of stress and physical activity whilst commuting.

Table 6.4. Independent variables considered in the model

<table>
<thead>
<tr>
<th>Primary transport mode</th>
<th>Private</th>
<th>Public</th>
<th>Active</th>
</tr>
</thead>
<tbody>
<tr>
<td>Journey time</td>
<td>0 – 20 minutes</td>
<td>20 – 40 minutes</td>
<td>40 – 60 minutes</td>
</tr>
<tr>
<td>Income</td>
<td>Low 1 - Less than $423.000</td>
<td>Low2 - $423.000 - $639.000</td>
<td>Middle 1 - $639.000 - $977.000</td>
</tr>
</tbody>
</table>

Table 6.5. Multinomial logistic models carried out for stress and physical activity.
This means that mode choice is relevant for defining the good or bad assessment of the trip based on these two factors. In this context, the group of users that chooses to cycle (or walk) for their regular short-distance trips are more likely to assess positively their experience in terms of physical activity and stress. In the case of Santiago this strongly restricts the scope of users, since being a monocentric city in terms of uses, most of the destinations are concentrated in communes located centrally in the city. If considered that these trips are mainly of commuting, it means that a very privileged sector of the population are able to live in the most central and well-off areas are the most advantaged to be able to have that mode choice. In a different case, the group of users living further away from these central areas, are more likely to evaluate these factors of stress and physical activity negatively. Although the portrayal of both groups of users of public and private transport is similar when evaluating their functionings, having the information of the weighted functionings allows understanding that the group of users of public transport is more disadvantaged. This is evident, for example, when analysing the particular case of public transport users, who tend to experience greater distances travelled, longer times in their daily transfers and greater proximity to other users compared to private and active transport modes. In addition, there is a relationship between public transport usage and lower-income level segments. This demonstrates the key problem for transport planning in Santiago, when viewed from a social equity perspective – the levels of inequity must be tackled primarily in the suburban neighbourhoods, such as southwest Santiago, where incomes are low and public transport inadequate.
Proximity to other users is mainly defined by the transport mode, where public transport users have a more negative scoring. Although Metro de Santiago has, historically, had a better evaluation in terms of levels of service – certainly compared to the bus fleet – at present, both modes of public transport score poorly in terms of the level of crowdedness. This is evidenced by the negative assessment of proximity levels towards other people during daily commuting trips. In Santiago, this condition is manifested mostly in central areas (such as Santiago Centro, Providencia, or along the corridor of the central business district area) and some catchment hubs in the most peripheral areas – usually converging on a particular Metro station. The problem, however, is again more significant for people who make longer journeys and live further away from the city centre.

6.6. Conclusion

The social impacts of transport systems and projects are poorly assessed in almost all contexts internationally. As a result, the disadvantaged groups gain the poorest travel experiences and access to activities in cities, impacting on their life experiences. There is a focus on appraising projects against economic efficiency goals, and distributional issues are
often overlooked (Hickman & Dean, 2017; Lucas, 2012; Martens, 2017). The use of CA in transport allows us to explore social impacts in terms of the opportunities for travel, activity participation and well-being, relative to the actual travel, actual activity participation and actual levels of well-being. This may seem a subtle distinction but is important if we are to consider how to improve levels of public transport accessibility and how to use this most effectively.

The transport-related health factors explored in this chapter are all associated with lower scores in the case of low-income groups, consistent with other research such as Hickman et al. (2017). There are clear social equity issues here – the current transport systems are disadvantaging low income groups and neighbourhoods in Santiago, and most likely in many other contexts in the Global South. The low-income areas often suffer from locational disadvantages, located on the edge of the urban metropolitan area, and are served very poorly by public transport networks. This results in the lower income groups perceiving health-related factors more negatively, particularly when using public transport as the primary mode and travelling for lengthy journey times. There are important issues by gender; females using public transport score poorly across the health indicators, thus policy and projects should aim especially at this group, improving access and journey conditions. The journey experience on public transport is very different by gender and needs much closer attention – with projects directly developed for improving the experience of female users and other ‘disadvantaged’ groups.

The analysis aimed to consider a wider range of multidimensional transport-related health impacts than usually considered in social impact assessment. It uses the concept of functionings to foster discussion on service levels and journey experience, also considering the user priority given to factors through weighted functionings. The value of performing this analysis in the context of Santiago is significant, with most of the
previous research carried out in the Global North, and with better economic and social indexes than those currently existing in Chilean society.

In reflection, the extent to which transport systems impact on people's opportunities in life, and how this may be improved, can be the subject of further research. Other issues can also be explored, examining different evaluations of capability, beyond weighted functionings; considering individual decision making and agency, relationships with the built environment (built form, public realm, climate), access to jobs and also harassment issues. The current discussion points towards the development of transport policies and projects, which more thoroughly consider the range of social and health impacts. In this regard, incorporating social, health and well-being indicators into the appraisal process will assist in developing improved projects relative to policy goals. Further evaluative research can lead us to a more comprehensive understanding of how transport projects have impacts on well-being.

The factor of BMI has not been deeply addressed in this chapter, although it challenges for further research on the differences by split mode and gender. Transit use and physical activity have been related to changes in BMI in previous studies (see for example Brown et al., 2015; Martin et al., 2015; Flint et al. 2014) revealing that there is a tendency of a higher BMI on private (motor) transport users. They have also suggested that switching from these modes to public transport or active modes is associated with a significant reduction in BMI – while switching inversely might increase levels of BMI (Martin et al., 2015). Previous results have also shown that commuting by public or active modes significantly predicts lower BMI scores both in women and men – even lower in the case of active modes as bicycle or walking. The association between BMI and various forms of disadvantages as unemployment, low income and isolation for overweight and obese groups has also been well documented. Recent publications suggest that BMI is related to gender
inequalities leading to a decrease on opportunities of employment, lower salaries and even less social interaction (see for example Sarlio-Lähteenkorva and Lahelma, 1999; Sarlio-Lähteenkorva, 2004; Cawley, 2000).

The motive of incorporating this index in the survey carried out is meaning to foster the use, evidence links and present a possibility of further utilization in the transport and heath field. The use of this index when related to transit use has shown potential in health implications and health cost reductions (Sener et al., 2016), so further research is needed, as empirical evidence is limited and insufficient. In this regard, the majority of respondents (93.4%) of the survey reported data that allowed including BMI in the analysis – from these respondents a 41.8% is located in a segment of overweight and obesity. Correspondingly with other suggested studies, both woman and men tend to have higher values of BMI when private transport is the main transport mode, while they have lower values when considering public transport as main mode. Although for the three groups men tend to be closer to the 25 points (kg/m2), men users of private transport are significantly more likely to be overweight and obese, compared with those cycling or walking to principal activity – which is also coincident with previous literature. This relationship is even higher comparing women users of private and public transport, although the results do not report significant differences within male female groups according to transport mode. Woman users of public transport are likely to have less BMI compared to users of private and active modes.

A more arduous analysis of gender has also remained a point that would require more attention in future research. It has been found that women have more prominent disadvantages in the aspects that have to do with health and transport (considering the factors explored). However, it is also the group that makes the most trips, both in number and diverse nature. The perceptions of this group, and the subgroups accorded to the different transport modes, can be complemented with the activities they
carry out. The presumption that women assess only slightly differently than men does not help us understand the reasons for their choices and preferences. The topic that has been mentioned about street harassment and other forms of gender violence present in society should not be ignored in urban planning or transportation. Much more analysis is required in this line in future chapters and investigations.

The analysis in this chapter challenges not only academic research but also public policy, to look for improvements in the well-being of the most disadvantaged groups and helping them to achieve better standards of life quality. This takes us back to Rawls (1971) who argued that we should promote the interests of the most disadvantaged in society. Planning our transport systems in this way would result in very different investment patterns – with less highway investment and much increased investment in higher quality and more extensive public transport and walking and cycling networks, closely linked to the urban strategy.
7. Examination of travel experience disparities through the measurement of subjective well-being

7.1. Introduction

Following on the discussion on capabilities, and based on the same questionnaire as exposed in the previous chapter, this chapter works on the links between the capability space of functionings (doings and beings), defined by subjective well-being (SWB) factors. The assumption is that, given the inequalities and strong differences in the transport network, the perception of SWB factors will be different depending on the primary transport mode – and, as shown correlated in the previous chapter, potentially by their socioeconomic background.

The link between capability and wellbeing has been explored in Sen (1993, p.36). He describes that mobility is one functioning that is relevant for wellbeing. The assessment a person makes on wellbeing should consider these basic elements. On the other hand, Sen emphasises that in poor economies the distance between functionings and the basic capabilities (as e.g. being well nourished or being mobile) can be quite extensive, and thus the evaluation of this distance would make the difference even more evident. Some of these differences were exposed in the previous chapter, exploring the functionings weighting.

Sen also recognises that ethical connections between capability and wellbeing are well known, and evident from previous ethical studies. He gives the example of happiness, one of the SWB factors explored in this chapter:

"The inability to be happy, which will be widely recognised as a failure of an important functioning (...) may arise either from
sources within one’s own life (…) or from sources outside it (Sen, 1993, p. 37).

Therefore, people’s own assessment of their wellbeing would imply for them measuring their space of functionings or, in this case, their capability. As Sen explains, because capability is a set of functionings, they represent the various combinations of beings and doings that a person can choose (1993, p.38).

This chapter aims to assess the wellbeing specifically through the understanding of people’s affective and instrumental SWB factors. The previous chapter considered the first part of the CHC Nussbaum’s list – specifically focused on the first three factors related to bodily and health. Although the questionnaire has addressed the whole CHC list, this chapter has highlighted the relevance of the section of emotions and affections that transport users relate to the transport modes they usually are aquatinted with. Considering that mobility is one of the fundamental functionings, relevant for wellbeing, is seems pertinent and relevant to evaluate and delve in the concept of SWB for exploring how different transport users self-assess their capability space. Poor assessment of affective factors related to transport modes will reflect how travel experience is a reflection of the social inequalities. Certain groups have no alternative but to move in transport modes that do not correspond to their affections and neither correspond instrumentally to their needs. Living far away from work centres, and having to reach long distances for performing their main activities accentuates these inequalities.

The chapter contributes on suggesting the possibilities of increasing the SWB while travelling, as the consequence would positively impact on the attractiveness of public transport or active travel in the studied socio-demographic groups. This can help not only to minimise the use of private transport but also decrease the inequality gap between these users.
The methodology used analysis of correspondence for exploring how positive affective/emotional or instrumental factors of SWB correspond to the election of the primary mode. It considers the actual primary mode versus the mode that each individual associated to both utilitarian (designed to be useful or practical rather than attractive) and emotive (expressing a person's feelings) SWB factors. For example, it will be analysed if a person who uses public transport as the primary mode, tends to associate these modes with positive emotive factors (as freedom, enjoyment or happiness) or positive utilitarian factors (as security, time-savings or efficiency). The analysis shows a more persistent non-correspondence or mismatch within the more disadvantage groups or within the users of public transport.

The chapter contributes to the literature in three areas. First, there is no such analysis in the context of Santiago. Even using a reduced sample like the survey carried out for this research, it is possible to identify problems and show gaps between the different socioeconomic segments. Second, the second part of the analysis focuses on the emotional factor of enjoyment. Although there is current literature on the enjoyment of commute, and transport and well-being, from hedonic and even eudaimonic perspectives, the analysis has not been applied in terms of distributional issues, i.e. which groups are most disadvantaged. In the Chilean context, the active transport group is expected to be found as that the most advantaged group in terms of enjoyment. Also in terms of the literature, in the capability space, the chapter suggests a discussion that goes beyond the hedonic understanding of happiness proposed by Sen (1993). Finally, the analysis shows the attitudes of people towards their primary mode and their perception towards ideal modes. The attitudes of people towards modes are critical factors to be considered by policymakers in case they want to promote and increase the use of public transport or active modes. The chapter explores these
positive and negative associations within the transport options used in Santiago.

7.2. Subjective wellbeing (SWB)

Transportation planning for decades has focused on providing mobility for the private automobile. Given environmental concerns (i.e., climate change; Chapman, 2007) as well as other social (Boschmann and Kwan, 2008), health (Khreis et al., 2016), and equity issues (Bocarejo and Oviedo, 2012), the current transportation agenda has shifted focus in recent years to the reduction of car-use. In order to successfully achieve this aim, it will be essential to attract new users to public transportation and active travel (Ettema et al. 2011). Within this context, it has been argued that sustainable transportation policies require all participants in the transportation system to challenge what Gossling and Cohen (2014) term “transportation taboos”: deep-seated ideas concerning the contribution to emissions by individuals, the inequality of market-based approaches, and the social and psychological functions of transportation. With respect to the latter, moving beyond a purely utilitarian focus, it is important to understand how users perceive emotive and instrumental elements on their transportation experience, since this can help to incorporate adequate improvements in alternative transportation, including transit and active modes, to make them more attractive to users.

The transportation community has for the most part already agreed to the need of looking at mobility and transport issues from the lens of well-being, in an attempt to broaden the commonly used utilitarian perspective on projects. Users’ travel satisfaction (Bergstad, 2001) has been the primary way to direct this challenge towards everyday mobilities, resulting on research about satisfaction with different transport modes. For example, active travel tends to have the highest levels of satisfaction (Smith, 2017; St-Louis et al. 2014; Paez and Whalen, 2010; Whalen et
al., 2013), while public transport users tend to assess their experience more negatively (De Vos et al. 2016; Abenoza et al. 2017; Ettema et al. 2012). Multi-modal trips also influence satisfaction levels; for instance, when an individual chooses a particular travel mode, she will report a higher level of satisfaction with that chosen mode (Susilo and Cats, 2014). Other studies show that car users have a higher level of satisfaction compared to other transport modes (Bergstad et al. 2011; Eriksson et al. 2013).

While the use of travel satisfaction has been mainly used in the context of daily trips – typically been linked to cost-benefit and utilitarian measurements –, the estimation of the Subjective well-being (SWB) over time has risen as an alternative measure. Ettema et al. (2010; p. 725) have defined SWB as the degree to which an individual positively evaluates the overall quality of their lives, where the general life satisfaction encompasses a more extended temporality – which implies assuming a tendency to be more stable over time. Increasing amount of research has risen for complementing and applying SWB in a broader range of satisfaction scales. The definition of other factors such as travel choice mode, attitudes and external elements of the built environment has been studied for a broader understanding of the changes produced in the SWB. As these factors do not necessarily apply to the general life satisfaction on the long term, the studies have aimed to determine both the direct and indirect effects on the perception of users (see, e.g. Ye and Titheridge 2017). Other concepts have also emerged as the Satisfaction with Travel Scale (STS), a measurement devised by Ettema et al. (2011) as well as different scales based on people’s travel perceptions. De Vos et al. (2015) for instance, explore in detail the underlying dimensions of the affective domain of STS in which SWB is based (for more on STS see also Friman et al. 2013).

Recent literature on SWB and its link with transport have demonstrated a relationship between people’s perceptions and satisfaction with their
daily travel (Smith, 2017; St-Louis et al. 2014; Paez and Whalen, 2010; Whalen & Carrasco, 2013). Scholars have shown, e.g. that accessibility has been the most developed factor influencing people’s well-being (Delbosc, 2012), and activities have a direct impact on travel satisfaction (Bergstad et al., 2011). Delbosc (2012; 28) for instance, has summarised the most significant influences on psychological well-being: poverty and employment, meaningful relationships and health. However, understanding the components affecting people’s perceptions implies the differentiation between the emotional (also named as symbolic-affective) and the instrumental reasons (Bergstad, 2001). Steg et al. (2011) have compared symbolic-affective opposed to instrumental-reasoned motives based on car-use, and other studies have also found associations between affective and symbolic aspects of car-use (see, e.g. Gatersleben, 2007; Lois & López-Sáez, 2009). Previous studies have demonstrated how socio-demographic factors affect the levels of SWB. The effect of income on SWB (Clarck and Oswald, 1996, Ferrer-i-Carbonell, 2005); education and unemployment (Argyle, 1999); age (Diener and Suh, 1997) and gender (Tesch-Römer et al., 2008) have already been studied. Recent research also suggests the links between commuting, SWB and emotional well-being assessment (Olson et al. 2013; Kahneman et al. 2004). However, more research is needed to understand how these socio-demographic variables, connect as well with the decisions on main transport mode choices; or research distinguishing between hedonic (journey experience) and eudaimonic (flourishing) value of trips.

7.3. Affective associations towards transport modes

This chapter has considered an analysis of correspondence comparing the election of primary mode with emotive and utilitarian SWB factors. There is a correspondence when the individual associates their primary mode to a positive either instrumental or emotive factor of the SWB. For example, this chapter aims to explore if someone using the car as primary
transport mode, associates the car towards feelings of happiness, freedom, efficiency or safety.

Previous research (De Vos et al., 2013; 2015) and Schwanen and Mokhtarian (2004; 2005a; 2005b) have developed the concept of modal dissonance for referring to the mismatch between the actual mode and the mode that enables users to experience positive affective/emotive or instrumental factors. Schwanen and Mokhtarian (2004; 89) define the dissonance based on the incongruence between residential neighbourhood where the individual currently resides and her preference structure toward such characteristics of the residential environment.

The survey asked about the association between the primary transport mode and 18 positive and negative feelings. The question was: “Indicate the modes that you associate to the following feelings”. The respondents could indicate all the modes they associated to the feelings on the list. Figure 7.1 shows the format of the survey in which this question has been asked – the full survey is available on the Annex. Just three affective and three instrumental factors, all positive, have been considered for this analysis (in Figure 7.1 where A=freedom, D=enjoyment, Q=happiness, G=security, C=Time savings, F=efficiency).
Figure 7.1. Format of the survey for answering the question on feelings on transport.
7.4. Analysis of dissonance considering SWB factors

The first step of analysing results seeks to understand where the statistical significance is located. The analysis considers the dissonances or the cases in which there is no correspondence between the primary mode choice and the 6 SWB factors. The Table 7.1 summarises socioeconomic variables against SWB factors, based on analysis of correspondence.

| Table 7.1. Dissonances between the election of primary mode and modes chosen to represent SWB concepts. |
|---|---|---|---|---|---|---|
| **Affective/Emotive factors** | **Instrumental factors** | **Chi-sq** | **Chi-sq** | **Chi-sq** | **Chi-sq** | **Chi-sq** |
| Age | Disson | | | | | |
| 18 - 34 | 77.0% | 86.2% | 81.6% | 70.5% | 71.6% | 62.8% |
| 35 - 54 | 63.2% | 0.013 | 77.4% | 0.045 | 70.7% | 0.038 | 59.4% | 0.041 | 81.2% | 0.149 | 57.9% | 0.217 |
| 55 or more | 64.8% | 74.1% | 70.4% | 57.4% | 75.9% | 70.4% |
| Education | | | | | | | | |
| Obligatory | 78.1% | 86.8% | 85.1% | 77.2% | 66.7% | 67.5% |
| Tech Univ | 70.1% | 0.082 | 81.3% | 0.200 | 74.7% | 0.060 | 61.8% | 0.010 | 77.3% | 0.070 | 62.2% | 0.259 |
| Postg | 58.6% | 72.4% | 69.0% | 58.6% | 86.2% | 48.3% |
| Income | | | | | | | | |
| Low | 83.9% | 81.0% | 86.9% | 76.6% | 68.6% | 73.0% |
| Middle | 70.7% | 0.000 | 82.8% | 0.639 | 75.8% | 0.001 | 65.6% | 0.003 | 75.2% | 0.100 | 56.7% | 0.017 |
| High | 60.0% | 82.0% | 68.7% | 56.0% | 81.3% | 60.0% |
| Mode | | | | | | | | |
| Car | 36.5% | 67.0% | 47.0% | 25.2% | 93.9% | 53.0% |
| Metro | 95.6% | 93.8% | 97.5% | 68.8% | 84.4% | 48.1% |
| Bus | 96.4% | 0.000 | 94.5% | 0.000 | 98.2% | 0.000 | 98.2% | 0.000 | 29.1% | 0.000 | 95.5% | 0.000 |
| Active | 17.1% | 43.9% | 26.8% | 87.8% | 100.0% | 56.1% |
| Other | 60.0% | 88.0% | 76.0% | 56.0% | 92.0% | 64.0% |
| Journey | | | | | | | | |
| time | | | | | | | | |
| 0-20 | 46.7% | 75.0% | 58.7% | 57.6% | 93.5% | 62.0% |
| 20-40 | 76.7% | 82.5% | 77.7% | 68.9% | 72.8% | 62.1% |
| 40-60 | 68.1% | 81.4% | 79.6% | 59.3% | 72.6% | 61.9% |
| 60+ | 88.0% | 90.2% | 89.5% | 75.2% | 66.2% | 64.7% |
The concept of dissonance means, for example, that a private transport user selects the bicycle when associating the concept of freedom to a transport mode. In this case, the person is using a private vehicle as primary transport mode, and however, attaches positive emotional and instrumental factors to another mode – in this case to the bicycle. It could be the case that the dissonance corresponds just to one of the types of factors, either emotional or instrumental. For example, a person who uses the Metro as the main transport mode, that associates the Metro to the instrumental factors (security, time savings, efficiency) but relates the positive emotional factors (freedom, enjoyment, happiness) to the bicycle.

Table 7.1 shows the results of the dissonances between the election of the primary mode and SWB concepts. The categories of analysis are age, level of education, income, primary transport mode and journey time. It shows the dissonances for both affective/emotive or instrumental factors. When considering the variable of income, for instance, the graph shows that the low income segment has more total dissonances than the middle and high-income groups. The highest income group has in average a larger number of matches between the primary mode and the way they relate to positive subjective factors. The Table 7.1 also shows that the low-income segment has a higher percentage of cases of dissonance between the primary mode and the mode chosen for representing the positive subjective factors. In the case of Freedom, for example, low-income has 83,9% of mismatch, versus 60% mismatch for high-income segment. Figure 7.2 represents the dissonances by income.
The analysis of dissonances by primary transport mode shows statistical significance for the chi-square analysis (Table 7.1). Feelings of freedom, happiness and security are highly coincidental for car users as the dissonance is lower compared to public transport (p=0). This percentage of coincidences is much more significant than any other modes. Active transport modes such as bicycle and walking also show high coincidences (or lower levels of dissonance). However, this relationship is only expressed on emotive factors, and not for the instrumental ones. For active travel, the concept of freedom has the most significant coincidences (83%, p=0) and the highest dissonances are around instrumental factors as security and time-savings (88% and 100% respectively, p=0).

This analysis coincides with the studies presented in the initial section, demonstrating a disadvantage in the appreciation of both emotional and instrumental factors when the primary mode is Metro or bus. The results show that the relationship is mainly negative with respect to both types of factors. With a significance p=0 in all factors, both Metro and bus have the higher dissonances between the primary transport mode and the way users relate to positive subjective feelings. Figure 7.3 shows this relationship, through the sum of the dissonances on the six factors studied by primary mode. As mentioned previously, Metro and bus have
As shown in Figure 7.4, the analysis carried out by journey time also reveals coincidences with previous research in this area, since for shorter trips (up to 20 minutes) the analysis shows less dissonance between the primary mode and positive subjective associations mainly for emotive factors. On the contrary, as journey time increases, higher is the dissonance. Strangely, the feelings of Security and Efficiency have not been statistically representative for the Journey Time analysis.

Figure 7.3. Number of total dissonances by primary transport mode.

Figure 7.4. Number of total dissonances by journey time.
Figure 7.5 shows the percentage of dissonance by primary transport mode, for both affective/emotive and instrumental factors. For instance, the graph at the top shows that the highest percentages of dissonances come from users of Metro and bus\(^8\), compared to other modes as the car or active transport. This is consistent with previous studies that have separately demonstrated that public transport users tend to assess more negatively subjective factors (explored e.g. in Stradling et al., 2000; Gatersleben and Uzzell, 2007). For example, although car users have higher dissonance values than active transport, comparatively this segment has much lower percentages of dissonances than public transport, idea also supported by research that has shown that car users tend to attribute importance to symbolic aspects that positively contribute to their perception on driving (Steg et al., 2001; Mokhtarian and Salomon, 2001).

Freedom and happiness tend to have a lower percentage of dissonances in the case of active transport, which means that cyclists and individuals who mainly walk for their commutes, tend to associate positive subjective values while using these modes. This is also consistent with other studies that have shown positive affective associations with the use of cycling and walking (Anable and Gatersleben, 2005; Gatersleben and Uzzell, 2007). The question at the survey has not specify the dimensions of freedom, thus has open the door for different interpretations as the freedom to choose certain mode or route, freedom while using the mode, or the freedom to access to certain places while travelling.

\(^8\) Differently to the other modes, public transport has been segmented between Metro and Bus users, as the surveys of satisfaction and perception of users carried out in Chile show differences in those modes – generally favouring the use of the Metro network over the buses.
In terms of instrumental factors, interestingly Figure 7.5 shows that bus users have the lowest percentage of dissonance regarding time savings (29%). However, considering the other instrumental factors, bus users have a high percentage of dissonance for security and efficiency. In the case of security, this means that most bus users (71%) have considered the bus as a mode that they associate to time-savings, although it is the mode that has more dissonant evaluations in all other SWB factors. This also seems difficult to explain considering the negative evaluation that the Transantiago system has consistently had. Some data provided by the Survey of Satisfaction with Transantiago Operators (DTPM, 2017) is
about users’ perception of journey time from origin to destination. In this question, and after 10 years of implementation of the system, users diagnose an average journey of 47 minutes, a value that tends to increase with respect to the data delivered by the same survey 5 years before (43.5 minutes on average). Worryingly, long trips of more than 30 minutes have had inconsistent variability over the years, reaching an average of more than 37 minutes in 2016. Short trips, however, remain roughly equal to previous years, and do not show significant changes in the average of 6-7 minutes per trip\(^9\). This survey has the peculiarity\(^10\) of being developed by the Metropolitan Public Transport Board (DTPM), whose mission is to articulate the functions of the different modes of public transport with a specific interest in buses Transantiago and Metro de Santiago. Another big gap on these instrumental factors relates to the perception of security that is especially significant for car users. This means that a 75% of car users have chosen as primary mode the same one as they relate to the feeling of security, which is completely opposite to other transport modes, specially bus users. Bus users have the highest dissonance (98%), which means that practically all this group of users have chosen another mode for referring to the feelings of security. The recently referred DTPM survey does not have any particular question that addresses the issue of safety – mostly related in this context as security. Figure 7.6 shows the points of origin of the survey for the case of public transport users. Metro users as primary mode are shown, bus users are

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\(^9\) The report of 2017 details, for example, that the operator company Red Bus Urbano, which runs mainly the eastern and northern areas of the capital (Huechuraba, Renca, Las Condes, Lo Barnechea), presented an average of 57 minutes bus trips. The company that presents the lowest averages of travel time is Buses Vule (41 minutes).

\(^10\) Another particularity is the nature of the survey since it is focused on the comparative evaluation between different Transantiago operators. This means that the averages that the study provides are not necessarily the same among operators, so in terms of travel times (which only concern trips only made by bus), there is a difference of more than 15 minutes average.
shown in cyan. The size of the points represents the number of dissonances. The higher the point, the greater the number of SWB factors that do not coincide with the primary transport mode. The image shows that the intensity or size of the circles is homogeneously distributed in the territory, even though the blue circles (metro) tend to show slightly less dissonance. The visualisation of this map is more dramatic when it is compared to the following Figure 7.7.

Figure 7.6. Location of the survey origin points, level of dissonance (the larger the point size, the higher the level of dissonance with the SWB factors) for public transport. Source: own production.

Figure 7.7 shows the points of origin for the case of private transport (cars) and active transport (walking and cycling). Again, the size of the circles represents intensity levels of dissonance. The number of dissonances is lower than in the case of Figure 7.6, which indicates that
users of private and active transport tend to use a mode of transport that they relate to one of the positive factors derived from subjective well-being. In this sense, it could be said that this type of user tends to be more advantaged than the public transport user, in a dimension not only utilitarian but also emotional and attitudinal.

Figure 7.7. Location of the survey origin points, level of dissonance (the larger the point size, the higher the level of dissonance with the SWB factors), for private and active transport. Source: own production.

7.5. Conclusion

The relevance of exploring the attitudes of people towards transport modes is important for policymaking if the aim is the promotion of public and active transport. Providing people with more access to their
preferences would increase the levels of correspondence between their elected modes and the positive attitudes leading to improve their SWB. For example, if a person feels more likely to cycle, then the person should be given both the physical access and the mode itself for him/her to use that mode. If this question of preferences was carried out today in the city of Santiago, most people would probably choose to use the car for most of their daily trips – despite the high level of congestion and low efficiency in central areas. Although several political leaders tempted by populism might agree, is clear that this exercise would mean a retroactive and damaging transport policy in the long term. All the unfavourable effects that this may cause are not analysed in this chapter, but the presentation of this idea of the equitable distribution of a transport modes aligned with people’s attitudes is needed for discussion.

The field of urban and transport planning has already approached the improvement of instrumental factors such as efficiency, safety and travel times. In fact, transport policies have pointed to that aim in recent years, as is the case of Santiago. The display of interest on the part of the political and technical agents and their willingness to improve the logistical issues of trips made in the shortest possible times have supported the option of continuing with time-savings as a predominant factor in transport decision-making.

The security factor has been cross-sectionally sensitive according to the data analysed in the survey. Severe problems in public transport related to security issues are part of the daily panorama of the use of buses and, to a lesser extent, of the use of Metro. In the case of Metro, there is a closed space, monitored by security guards and closed-circuit cameras that allow intercepting attempts of robbery or assault inside the stations. However, outside the limits of the turnstiles that allow access to the stations, Metro loses the privileges and therefore the guarantee of protection that it can offer to its users. Following the route from the stations to the bus stops, in cases of modal interchange, the security
differences are much more noticeable since the conditions of luminosity, protection and state of the sidewalks differ depending on each of the municipalities in which the stations are located. The following chapter comment upon the interactions of policymakers at the metropolitan and municipal level, and considering the private organisations that spatially and logistically interact at different levels – which in most cases does not generate the best results.

Improving the efficiency of public transport, the efficiency in transfers and the security of users both on-board and on the walking routes to access stations and bus stops, is mandatory. These are some of the factors that can make public transport a more competitive mode in relation to the use of the car. Active transport through bicycles and the use of walking have proven to be instrumentally more efficient in some instances, so their use has been increasing in recent years. Improvements on cycling infrastructure and sidewalks for pedestrians are minimum requirements to increase the use of these modes, in order to make them more competitive also with respect to motorised modes. Although these are assertions that currently produce a high level of agreement, the study of the emotional factors that can promote the use of these modes has not been sufficiently explored in transport planning. Factors such as happiness, enjoyment and freedom have been much less examined than the recently mentioned instrumental factors, although they are strongly related to the definitions of subjective personal well-being.

The differences in user profiles of different transport modes are something revealing from the analysis throughout this chapter. The users of motorised private vehicles (of which 95% are car users) show less dissonance on the emotional factors, versus public transport users. That is why this last group has been highlighted – coincidentally with the previous chapter – as the most disadvantaged group compared to the other transport users. Users of active modes such as cyclist or pedestrians also have low dissonance in emotional factors, which
explains a positive relationship between subjective well-being concepts with the use of these modes. However, in their relationship with instrumental factors, these modes have more significant dissonances than car users.
8. Project appraisal in the context of Santiago using a multi-actor multi-criteria exercise

8.1. Introduction

Both previous chapters have measured and applied the capabilities in the context of Santiago’s mobility, considering the functionings space of their transport users. This chapter develops how the concept of equity and the measurement of social impacts has not been considered enough in the Chilean context. The chapter explores the missing factors that evidence a wider understanding of social equity, through a BRT project that was designed, evaluated and withdraw throughout the course of this research.

The transport system has, for decades, involved much political debate and controversy in Santiago de Chile (see Chapter 4), including recent public protests and demonstrations on the cost of travel and poor journey experiences for public transport passengers. There are serious problems of traffic congestion, urban highway building, crowding on public transport, pedestrian safety and harassment whilst travelling, and poor public realm. Journey experiences are very different for income groups and by neighbourhood. The implementation of Transantiago in 2007 – now rebranded as Red Metropolitana de Movilidad (Red) – the Bus Rapid Transit (BRT) system for Santiago, was supposed to resolve many of these issues. However, the controversy has continued, with poor implementation of the BRT system, with too few buses, inconsistent frequencies and poor routing, crowding, little travel information, and missing and limited infrastructure. Passengers have reverted to the Metro, wherever possible, again leading to crowding problems. This is a tale of poor planning and implementation of BRT, where the views of different actors, stakeholder and neighbourhoods have failed to be
adequately considered.

One of the most complex mobility corridors in Santiago is the Alameda-Providencia, which crosses the city transversely, more than 12km in length, between Pajaritos and Tobalaba Avenues. During the last century this corridor has undergone a series of transformations focused on improving the efficiency of movement, however the immediate and near built environment of this corridor has had a sustained and progressive deterioration (Bosch et al., 2016).

The Metropolitan Public Transport Directory (DTPM), created in 2013, undertook a comprehensive analysis of the city's public transport system. This included rethinking the Alameda-Providencia corridor in terms of mobility and quality of the public space (DTPM, 2019). DTPM, together with the Metropolitan Regional Government of Santiago, called for a public urban design contest for the urban transformation of Alameda-Providencia. The project sought to consider all the requirements of an efficient public transport system, but especially the recovery of the public and urban space. Modifications had already been made to the bus corridor in 2007 to ensure a constant flow of close to 20 km/h (Allard, 2019), but even with an exclusive segregated pathways for buses (shared with taxis), the modification was not sufficient for a corridor with this level of patronage.

In April 2015, the initiative was announced, and a public design contest was opened for a US $223 million project. In February 2016 the project design began, including citizen participation processes of different public services, municipalities and neighbours. The social and political complexity of the project was widely evident in these processes, as well as the lack of social criteria that could support the development of inclusive mobility infrastructure, i.e. planning beyond the efficiency of motorised flows. What appeared to be a future high-quality urban project suffered a series of criticisms and discussions concerning the evaluation and financing processes. With this context, a participatory workshop was
held in May 2018, and the discussion is presented in this chapter. At the
time, there was still no certainty of the future of the project, and different
options for changing the design of the corridor were still being
considered. In December 2018, the Ministry of Transport and
Telecommunications (MTT) informed the Regional Government of the
need to terminate the agreement, since the project does not surpass the
minimum threshold of social profitability (Olivares and Hormaechea,
2019). In March 2019, the Regional Government suspended the project
(Fernandez, 2019) due to the lack of social profitability, i.e. progress
towards social goals. The focus of the discussion so far has been mainly
the process of project management. Financing and the need for
integrating the built environment in the design were also discussed.
Finally, the lack of social profitability of the project resulted in financial
unfeasibility, contract suspensions and, ultimately, missing the deadline
for the execution of the project.

With this context, it is critical to inquire about the criteria that eventually
established the presence or the lack of social profitability. We ask what
factors should be part of the social evaluation of the project as it was
planned? Moreover, what are the social impacts that should be
considered in this type of project?

When budgets are limited, the process of deciding how to spend
monetary resources becomes critical. In transport planning, this is
evident in the way in which specific projects are prioritised over others.
In the case of Santiago, it was decided to prioritise the construction of
public transport corridors through state budgets and subsidies. The
decision is always complex since it considers the assessment and
appraisal of projects by different sectorial, regional and local actors.
Eventually, the realisation of the projects involves evaluation by the
public – especially when it comes to projects with a high profile or political
cost. There are currently several types of appraisal of transport
infrastructure projects. Cost-benefit analysis, a method that is most
frequently used in assessing transport projects, fails adequately to consider social impacts and wider distributional issues beyond time savings. In the Chilean context, the National Investment System (SNI) determines the framework for social impact assessment, outlining the procedures necessary for the evaluation of spending public funds.

This chapter discusses how the decision-making process and transport appraisal can be improved in the current context. The chapter explores the Nueva Alameda Providencia project through a multi-actor multi-criteria analysis (MAMCA) approach (drawing on Mella Lira, 2020). The exercise considers how transport policymakers perceive the strengths and limitations of current project assessment and their perceptions on incorporating new measures in the analysis for improving social equity. There is wide agreement with participants about the need for incorporating more comprehensive social impact assessments. The project is assessed using the MAMCA methodology and views shared on the methodology and its potential for use in future projects.

8.2. The Nueva Alameda Providencia (NAP) project

Implementing a new BRT corridor which reduces travel times was the focus of the project (Bosch et al., 2016) – hence we can see how the measurement tool shapes the project. The Nueva Alameda Providencia (NAP) project proposes a transformation of the Alameda-Providencia corridor, located in the historic urban centre of Santiago. The project has emerged as a comprehensive urban regeneration project, expecting to positively to impact the transport modes converging on this corridor, benefiting users of public transport, and cyclists and pedestrians. The 12-kilometre length would serve the municipalities of Lo Prado, Estación Central, Santiago and Providencia, from the section Pajaritos Avenue to Tobalaba Avenue. Five million users are likely to benefit from the project, including people with physical disabilities, children and the elderly.
The modal integration through separate lanes (for buses, private vehicles and bicycles) has been one of the project challenges. The design considers prioritising some modes over others to ensure the continuity of the use of the space. The objectives of the project are to improve public transport, accommodate other modes of sustainable and active transport, including the use of bicycles, and walking on the sidewalks. In this context, the NAP project involves different stakeholders and these are likely to have different views on the project. Figure 8.1 shows one of the images of the project, elaborated by the architectural firm, a bus stop with high standard of urban design, integrated to the pavement, off-vehicle ticketing, and segregated corridor.

![Figure 8.1. Bus stop proposed for the project. Source: Bosch et al. (2016).](image)

8.3. From CBA to MAMCA in the NAP project

The comparison of CBA and multi-criteria analysis (MCA) has been considered in terms of the outcomes for urban transport investments (Tudela et al. 2006; Annema et al., 2015). The inclusion of some variables which are more complex to quantify, such as noise, accidents or air pollution, has been challenging for CBA in different contexts. The expansion of the monetary evaluation and inclusion within MCA, either quantitatively or qualitatively, has emerged from the difficulties arising from the measurement of impacts and externalities in monetary terms (Macharis et al., 2010). However, in the Chilean context, the existing
process of social project assessment based on cost-benefit and cost-efficiency is not enough for covering the complexities of a project such as NAP. Hence the regional government tendered a study considering wider impacts. The approach was based on MCA, considering the social, environmental, economic and transport impacts.

**Error! Reference source not found.** Table 8.1. shows the impacts of the project considered. The external consultant producing the study had to look for assessment criteria in accordance with the formulation of the project. The criteria reflect the willingness to cover a broader spectrum of impacts than the usually considered criteria when assessing transport projects. For instance, travel time savings was just one criterion used for determining the impacts of the project. In this sense, the original incorporation of different criteria was innovative, considering indicators that have not been widely quantified in previous projects. However, the list also reflects the difference in measuring different indicators. The transport and economic criteria are more quantifiable relative to the environmental and social criteria. For example, travel time savings – already used in the conventional assessment – are easier to quantify when compared to the urban landscape, environmental or health benefits. Many of these wider impacts cannot be effectively incorporated into the quantitative analysis, hence there is a partiality to the analysis even within a weak application of MCA (Hickman and Dean, 2018).
<table>
<thead>
<tr>
<th>Impact</th>
<th>Criteria</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Impacts on Transport</td>
<td>Efficiency</td>
<td>- Number of trips per mode</td>
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<td></td>
<td></td>
<td>- Average travel times by mode</td>
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<td></td>
<td>Quality</td>
<td>- Private transport</td>
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<td></td>
<td></td>
<td>- Public transport</td>
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<tr>
<td>Economic Impacts</td>
<td>Users</td>
<td>- Travel time savings</td>
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<td></td>
<td></td>
<td>- Private transport operation costs</td>
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<td></td>
<td>Operators</td>
<td>- Cost of operation of public transport vehicles</td>
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<td></td>
<td>- Income</td>
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<td></td>
<td></td>
<td>- Decrease of the transport fleet</td>
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<td></td>
<td>Public sector</td>
<td>- System implementation costs</td>
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<tr>
<td></td>
<td></td>
<td>- Operation and maintenance costs</td>
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<td>- Subsidies to the operation of the system</td>
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<td></td>
<td></td>
<td>- Residual value</td>
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<tr>
<td></td>
<td>Efficiency</td>
<td>- Calculation of private profitability indicators</td>
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<tr>
<td></td>
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<td>- Effects on local pollution</td>
</tr>
<tr>
<td>Impacts</td>
<td>Noise</td>
<td>- Noise</td>
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<td>Visual intrusion</td>
<td>- Urban landscape</td>
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<td>- Sustainability of the resource</td>
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<td>Energy</td>
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<tr>
<td>Social Impacts</td>
<td>Accessibility</td>
<td>- Access to work and educational destinations by mode</td>
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<td>Modal integration</td>
<td>- Modal integration with other modes of transport</td>
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<td>Safety</td>
<td>- Traffic accidents</td>
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<td>- Security in public spaces</td>
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<td></td>
<td>Quality of urban space</td>
<td>- Impact on users and residential and commercial property</td>
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<td></td>
<td>Urban Segregation</td>
<td>- Barriers for the displacement of non-motorized modes</td>
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<td></td>
<td>Health</td>
<td>- Health benefits due to more active mobility</td>
</tr>
</tbody>
</table>

Table 8.1. Original list of impacts considered in NAP. Source: UDP.

8.4. Workshop structure

A summary of the MAMCA methodology is presented in Table 8.2 through a sequence of seven steps based on Macharis (2000, 2007) that allows the inclusion of stakeholders in the analysis. The table presents a second column with the transferability of Macharis’ steps used in NAP workshop.
<table>
<thead>
<tr>
<th><strong>Definition of the steps based on Macharis et al. 2010</strong></th>
<th><strong>Summary of the description and transferability of Macharis’ steps, used in NAP workshop</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong> Definition of the problem and identification of the alternatives</td>
<td>Presentation of the project to the attendants to the workshop (state of the art NAP). Presentation of two scenarios: current project and expectations.</td>
</tr>
<tr>
<td><strong>Step 2</strong> The various relevant stakeholders, as well as their key objectives, are identified</td>
<td>The workshop brought together actors who had some degree of participation in the project – academics examining transport, participants from regional government, consultants working on design, data, etc.</td>
</tr>
<tr>
<td><strong>Step 3</strong> Objectives are translated into criteria and then given a relative importance (weights)</td>
<td>The indicators and criteria used in the workshop were selected from the document delivered by the NAP project management. Some criteria that has been reviewed throughout this research was added to the list of original criteria. A table with a list of 32 criteria (20 original and 12 incorporated) was given to the participants. Having set up the criteria, the participants were asked to assess from 1 to 5 the criteria in the two scenarios presented in Step 1.</td>
</tr>
<tr>
<td><strong>Step 4</strong> For each criterion, one or more indicators are constructed</td>
<td>Selection of criteria. The definition of metrics and indicators was not part of the workshop. Step 4 considered the selection of 3 criteria from the list, for defining each dimension of the project: economic, social, environmental and transport – 12 in total.</td>
</tr>
<tr>
<td><strong>Step 5</strong> Construction of an evaluation matrix, aggregating each alternative contribution to the objectives of all stakeholders</td>
<td>Priority assessment and comparison of alternatives, allocating a percentage from 1 to 100% for each category. The sum of the scores of the four categories must sum up to 100% in total. 'Current' and 'expected' impact scores were afterwards.</td>
</tr>
<tr>
<td><strong>Step 6</strong> The multi-criteria analysis yields a ranking of the various alternatives and reveals their strengths and weaknesses</td>
<td>The weighting and selection of factors for each of the dimensions was calculated after the workshop. The workshop ended up with open discussion amongst all participants about the methodological tool design.</td>
</tr>
<tr>
<td><strong>Step 7</strong> Implementation</td>
<td>The final discussion with the participants considered the differences between the two scenarios, as well about the implementation aspects of using MAMCA appraisal in future projects.</td>
</tr>
</tbody>
</table>

*Table 8.2. Transferability of Macharis’ steps used in NAP workshop.*
Steps 1 and 2: Definition of the problem, stakeholders and objectives

During the first part of the workshop, the participants were informed about the aims of the activity, for them to know the context in which the activity and the research is based. Although the use of multicriteria analysis in Chile has been discussed since the year 2000, the consideration of integrated and comprehensive criteria is still a challenge for transport infrastructure investment.

The workshop brought together actors who had some degree of participation in the project. This included experts in transport, planning, urban planning and public policy, so the participants had a high level of knowledge and expertise. They also had previous awareness (and participation in some cases) in the project. In total, the workshop had 15 participants, divided into four groups: public policy, transport planners, architects and others.

Step 2: Definition of criteria and weights

The workshop brought together actors who had some degree of participation in the project. The workshop counted on experts in transport, planning, urban planning and public policy, so the attendants had a high profile in terms of expertise. They also had previous access (and participation in some cases) to the project. In total, the workshop had 15 participants divided in three groups: academics (6), practitioners (6) and government actors (3). Their work on the field of planning was particularly useful towards the evaluation of this type of participatory tools. Some of them had previously participated in other projects that tried to apply some participatory methodology – among members of the community or within a specific group of experts\textsuperscript{11}.

\textsuperscript{11} The quorum had some attendants that have acted as community representatives in other projects, having experience in working with neighbourhoods and local associations. However, this experience does not compare to the possibility of having people from the local communities that would have been impacted by the NAP project.
Step 3: Definition of criteria and weights
The methodology proposed by Macharis et al. (2010; p.305) suggests that the criteria for the evaluation are “the goals and objectives of the stakeholders, and not the effects or impacts of the actions per se as is usually done in a multi-criteria analysis”. The indicators and criteria used in the workshop were selected from the document delivered by the NAP project management. Ideally, the list of criteria would be generated by the stakeholders. However, it would have been almost impossible to carry out a previous workshop (or a much longer one) with the actors who participated in the activity, for the purposes of this research. The exercise added some new factors, other than the already used in the NAP consultancy report. The factors added have arisen from previous studies conducted within the framework of this research, which have considered non-traditional criteria and indicators (Mella Lira, 2019a, 2019b; Hickman et al., 2017). For example, incorporating ethnic integration, the levels of enjoyment while travelling, the quality of the streets and built environment, are just a few examples of indicators that could be integrated into the appraisal of these types of projects. The NAP project needed an assessment both of public space and the transport project, so the use of a more comprehensive and sensible palette of indicators was inherent to the purposes of the project. The focus for defining these factors is the expansion of the use of social indicators in the evaluation of transport projects. Participants received a table with a list of 32 criteria (20 original and 12 incorporated). Table 8.3 shows the criteria that were added for the purpose of testing other new criteria in the workshop.

The project itself covers a significant area of Santiago, including four municipalities. Therefore, the project impact area from the axis of the corridor and towards the adjacent municipalities is broad enough to summon groups of communities. Having this type of participation would have allowed the criteria assessment by members of the community themselves. Time as a scarce resource was a disadvantage of this particular workshop – something to take in consideration in future research.
Table 8.3. List of the 12 criteria added to the initial list considered in the NAP project.

Source: own production based on the results from previous chapters of the research.

Step 4: Selection of criteria and priority assessment

The previously identified stakeholder criteria should be ‘operationalized’ by constructing indicators or metrics. These indicators help define the criteria and measure (with a scale) how useful that criteria is for the project. According to the methodology of Macharis et al. (2010), step 4 involves the construction of the indicators or rules that allow these criteria to be measured. However, the definition of this step was conducted
slightly differently in the workshop. As indicators were already informed together with the criteria in the NAP technical report, the participants did not decide on the indicators. The definition of metrics and indicators was not part of the workshop, but having the indicators written down in advance helped to define and shape the criteria. Participants were instructed in Step 4 to consider the selection of 3 criteria from the list, for defining each dimension of the project: economic, social, environmental and transport – 12 in total. The participants had to select the criteria that seemed most relevant to define these dimensions, having to prioritise, incorporate and give up on with the criteria to configure their final list.

**Step 5: Priority assessment and comparison of alternatives**

Participants were also asked to conduct a priority assessment, allocating points from 1 to 100 for each category: transport, environmental, economic and social impacts. The sum of the scores of the four categories must sum up to 100 in total (Figure 8.2)

![Selection of criteria and priority assessment for the dimensions](image)

*Figure 8.2. Selection of criteria and priority assessment for the dimensions. Source: own production based on the workshop results.*
Step 6: Results
The weighting and selection of factors for each of the dimensions was calculated after the workshop, so the attendees did not have the results at the time they were doing the activity. The following section of this chapter shows the analysis of the results in detail. In the last part of the activity, and once the process of evaluating the factors was finished, the workshop ended up with an open discussion amongst all participants. The discussion considered comments both in the area of methodological tool design and around the implementation aspects of using this appraisal for future transport projects. We also discussed future and potential scenarios of its use in the context of Santiago.

Step 7: Implementation
The final part of the activity was relevant for assessing the implementation opportunities of these type of methodologies. By the end of the session, participants were asked to propose future examples in which this transport appraisal may be used for transport and urban regeneration projects.
8.5. Application results

The results of the MAMCA exercise are presented in Figure 8.4 with participants grouped into discipline groups. The differences between the groups show the diverse emphases of the project, and the importance of considering a range of stakeholders in project assessment. The following shows the average of the assessments for each of the criteria listed. For the transport planners' group, the main impacts of the project are the quality of public realm and efficiency – which is in agreement with the initial spirit of the project that attempted to link a public space project with a transport one. The group of architects tend to assess the level of impacts at a lower level relative to the other stakeholders. Architects
consider that the main impacts are the improvement of urban space, followed by efficiency of the transport system, and mode integration. For the public policy group, the factors that the project mostly impacts relates to safety and improvement of urban space. Security is one of the impacts that presents the most significant discrepancies between the public policy group and the ‘other’ group. The most notable differences between architects and transport planners relate to the aspects of noise and vibration, sustainable transport and social interaction. In these last three aspects, architects tend to have a more negative judgment of the impacts that the project can achieve when compared to the transport planners’ group.

Figure 8.4. Average of scoring by stakeholder groups
The results provide information about the prioritisation of the factors that are most relevant to the participants. The exercise asked participants to reorganise the factors that should be part of the categories of transport, environmental, economic and social impacts. The reorganisation of these factors leads to the redefinition of what is understood by ‘social impact’. It was already said that the project was cancelled due to the lack of social profitability. The broader understanding of the concept of ‘social’ helps this type of project to be better evaluated, in the light of the real needs of the context and the project itself. The results of weighting the criteria show that, in the case of the social dimension, this is where the most significant changes in the choice of criteria are seen, particularly in relation to what had been considered initially in the consultancy NAP report. The main criteria selected were universal mobility (12%), user’s satisfaction (9%), physical activity (8%), quality in public realm (8%) and increase in well-being (8%). For the transport dimension, the main selected criteria were modal integration (20%), quality of trips (20%) and travel time saving (15%). Of these, only quality of trips was originally considered in the NAP report as a transport criterion. In the environmental dimension, the selected criteria were environmental pollution (18%) and noise and vibration (12%). Several criteria selected were related to the built environment, such as visual intrusion (9%), quality in public realm (9%) and improvement in the urban space (9%). In the economic dimension, the main criteria selected were the costs of implementation (19%), operators costs (17%), and financial and cost effectiveness (15%).

Finally, the exercise asked participants to score the importance of the four categories of impacts: transport, environmental, economic and social. Thus, each one had the autonomy to weigh the importance of each category, attributing a score of 1 to 100, where the sum of the four categories should equal 100. The results show that social impacts are generally in second priority, but sometimes first – which illustrates the
importance of social issues in Santiago, even related to a transport project. The group of architects weighs the social impacts over the others. Figure 8.5 shows the prioritisation of each category according to each stakeholder group.

![Figure 8.5. Prioritisation by stakeholders, for the categories of transport, environmental, economic and social impacts.](image)

After the impact’s measurement exercise, the workshop took the format of a focus group, to comprehensively cover the way in which the participants consider the applicability of this type of approach and the potential for future projects in Chile. One of the advantages of understanding the opinion of the participants is that most of them have experience with other types of projects, so they know the operation, limitations and perceptions of the general public regarding the application of participatory methodologies. Although the exercise is within the framework of the NAP project, the discussion can interpret the insights for a possible application on projects of public spaces and other comprehensive transport planning schemes.
8.6. Conclusion

This chapter has reflected on the possibilities of using unconventional measures in the current project appraisal, in the Chilean context. Although some of these unconventional factors have been measured in importance and tested in chapter 6 and 7, this chapter explores how diverse backgrounds acknowledge the relevance of improving social impact assessment.

The MAMCA approach is innovative in considering competing views from different types of stakeholders within a MCA process, including on the categorisation, scoring and weighting of criteria involved in transport projects. The approach considers aspects that the typical CBA does not include in the appraisal of projects – there are often different results from CBA, MCA and MAMCA (Tudela et al., 2006; Dean and Hickman, 2018). This is interesting in that the choice of appraisal approach leads to different projects – and often there is a suspicion that CBA is prioritising projects with time saving benefits, which usually are highway schemes (Hickman and Dean, 2017), but also can be BRT schemes framed in ways that are not reflective of wider policy goals. Hence, the use of MAMCA can confront the usual decision-making processes in transport planning, allowing a greater plurality to project development. This is, of course, critical for complex projects where there are competing views on the planning and potential impacts. In the end, CBA is much too simplistic a process for transport appraisal, and tends to prioritise projects that do not deliver wide-ranging public policy goals.

This chapter uses and discusses the use of MAMCA in the particular case of the Nueva Alameda Providencia project, potentially involving a transformation of one of the most important public transport corridors in Santiago. The exercise has the value of illustrating the steps of MAMCA in a transport corridor and public space project, and to aid the discussion against multiple criteria. The context of Santiago particular demand a consideration of social issues due to the segregated society.
The results show that different stakeholders have a different appreciation of the impacts of the project, including at the individual level and within groups. The approach also makes the exploration of opposing perspectives possible between groups. The multi-actor component is widely required as projects in Chile frequently face a wide range of heterogeneous actors. Usually, these groups of actors have different and even competing views, for example between heritage and conservation interests, cyclists, ecologists, residents who are concerned about expropriations, etc. The use of MAMCA allows a more systematic process to consider different views, including in terms of social ‘profitability’ in this case. The aspirations can also be far-reaching – this type of process can be deliberative and carried out at different stages of project development, with a wider set of respondents. In theory, this can strengthen the democratic nature of transport decision-making, and ultimately lead to better projects, which deliver against wide-ranging public policy goals. The process of transport appraisal is quite remarkable in terms of the inertia in the system – usually only a CBA is used, even on large and complex projects. This is not leading to well-defined projects, and often leads to great public controversy – it is time for a rethink.
9. Conclusions

9.1. Focus and expected contribution

The research has focused on exploring through a critical appraisal of theoretical approaches and empirical evidence, factors that configure the development of transport projects, and resulting impacts associated with social equity, that can potentially reduce the gaps of social inequality. The research also proposed paths for incorporating these factors into the planning and assessment processes. This is part of the narrative of the research, going from a very conceptual and normative discussion, about the relevance of considering equity and social justice in transport planning, to a more practical application towards the end of the thesis.

The first step of the research has been the conceptual exploration, linking transport planning with the concepts of equity and social justice. The research has highlighted the idea that this type of concepts has not been sufficiently considered in the elaboration of transportation policies or projects, so the social impact of these has tended to be overshadowed by economic impacts. The research suggested that business as usual is a substantial threat to the development and consolidation of parameters that allow progress in the improvement of transport appraisal and project implementation. In general, this type of business as usual approach focuses on an instrumental and utilitarian vision of transport, which has only emphasised the importance of factors such as time savings and the efficiency of the system. The currently broad understanding of the efficiency of transport projects in economic terms (time expenditure, transport costs, infrastructure investments versus the number of people favoured, among others) has perpetuated the focus on instrumental factors. Even though the efficiency is thought to be considered as a primary concern for users, the research has revealed that those are not the only considerations when choosing one transport mode over another.
Attitudes, emotions and subjective preferences are, although difficult to measure, also relevant in defining the modes chosen daily and for carrying out daily activities.

The research is then focused on the exploration and development of new approaches, observed through the lens of social equity, and looking at the reduction of inequalities. An extensive literature has been explored to understand the main concepts in social equity applied to the field of transport and urban planning. The exploration has begun from the origins of modern thinking, through the reading of Aristotle and the bases of the ethical-normative discussion that still today define discussions in this line. One of the most widely developed approaches in this research has been the capability approach, which refreshes the economic paradigms that define the distribution of wealth as the most significant conflict to solve social problems. The capability approach opens the door to a discussion based on the opportunities, choices and freedoms of people from a human, individual and holistic perspective.

Opportunities and resources, personal feelings, emotions, freedom, happiness and agency are some of the concepts that have been explored in the discussion of the capability approach. However, the challenge has not been trivial, since the quantification of these factors and the result of their use has been studied before without a vaster empirical impact. This challenge has defined the methodological nature of the research since it has gathered the importance of using a mixed methodology that allows exploring several of the factors that have not been much considered in the analysis of projects.

The Chilean context framed the empirical discussion of the research – mainly through the analysis of the inequalities produced by transportation in Santiago. Chapter 1 introduced the case study and the main characteristics of mobility and access in the city. The empirical chapters
(chapters 4, 5, 6 and 7) have explored and characterised the case study from other diverse angles. Focusing the research in this particular case study is relevant since Santiago has several of the current problems of other Latin American cities and in other developing countries. Although the research does not refer to other contexts, the transferability of the main concepts and key ideas could be replicated in other case studies.

9.2. Research questions and key findings

This research starts by asking the following question:

**Which factors in transportation projects can reduce the gaps of social inequality, and how can they be incorporated in the planning and assessment processes?**

The strategy for answering the main question was disaggregating it into four secondary questions. Each secondary question guided the development of the empirical chapters of the research, as seen below.

1. What are the perceptions of policymakers about incorporating new metrics of social equity in transport appraisal?
2. How might social equity be measured in its relation to transport projects?
3. Who are the most vulnerable groups affected by transport and how do they perceive these inequalities?
4. How can decision/making processes and transport appraisal effectively be improved in the current context?

9.2.1. About the perceptions of policymakers and potential incorporation of new metrics in transport appraisal

Understanding the perceptions of policymakers around the issues of social equity in transport (and cities) was fundamental for grounding the
research, together with the contextual Chapter 4. Their perspectives on the current tools for appraisal and their interpretations of how equity must be taken in consideration were relevant for shaping the potential of implementing unconventional metrics and changes in the evaluation system. Specifically, the question has allowed to explore how policymakers perceive the strengths and limitations of current project assessment and what is their perception on incorporating new measures in the analysis for improving equity.

The first part of chapter 5 explores the impressions of policymakers on concepts related to the perception of social equity and better integration. The results consider their impressions on gender issues and economic and physical inequalities, barriers for coordination of the different agents and the role of the civil society. Answering the question about the perception of policymakers for incorporating new metrics, Chapter 5 reveals that there are several agreements on the diagnosis of the inequalities as result of transport impacts. However, there is not agreement on the resolution to the problem.

9.2.2. About the measurement of social equity in transport projects

Chapters 6 and 7 have used a quantitative approach for the recognition of equity gaps between groups, through a capabilities-based survey conducted in Santiago. The methodology used statistical analysis and multinomial logistic models for quantifying the factors that most affected the social dimension. Chapter 6, develops the capability approach as a theoretical basis to develop a survey that considers unconventional, emotional, attitudinal factors related to opportunities and perceptions of the different transport modes for people. The methodology of data collection allowed having a picture of the total of the city, which considered a variety of socioeconomic profiles, different transport users, and different realities of access to goods, services and infrastructures within the city. With the data from the survey, it was possible to establish
comparisons in relation to the opinions of respondents regarding physical and mental health issues: stress, physical activity, proximity to other users, and perception of air pollution. Chapter 6, in particular, explores factors related to the mental and physical health of the people. The findings show that a multi-dimensional set of transport-related health factors are needed for a broader understanding of inequalities. Today the regular transport-related health factors are road traffic casualties, mortality, exposure to air pollutants and noise. The chapter has discussed that stress, physical activity, proximity to others, and perception of air pollution are other determinants that might affect both in the election of transport modes and the perception of the trip.

Understanding the effects of those determinants in different groups was relevant for understanding the most vulnerable people – that corresponds to women, public transport users and people living further away from their primary activity (causing more travel time).

In Chapter 7, the relevance of exploring the attitudes of people towards transport modes is important for policymaking if the aim is the promotion of public and active transport. Giving people universal access to their preferences would increase the levels of correspondence between their elected modes and the positive attitudes leading to improve their subjective well-being. If a person feels more likely to cycle, then the person should be given both the physical access and the mode itself for him to use that mode. If this exercise were carried out today in the city of Santiago, most people would probably choose to use the car for most of their daily trips – despite the high level of congestion and low efficiency in central areas. Although several political leaders tempted by populism might agree, it is clear that this exercise would mean a retroactive and damaging transport policy in the long term. All the unfavourable effects that this may cause are not analysed in this chapter, but the presentation of this idea of the equitable distribution of transport modes aligned with people’s attitudes is needed for discussion. The chapter reveals that
different transport users perceive differently emotional factors such as freedom, enjoyment and happiness. Car users show less dissonance on the emotional factors, versus public transport users – which means car users tend to have a positive perception towards freedom, enjoyment and happiness compared to public transport users. The chapter shows that most disadvantaged group compared to the other transport users – even more than active travel users.

The research overall allowed the exploration of methodologies of analysis in terms of the measurement of social equity factors. The element of data collection was a survey based on the capability approach, through the central human capabilities list – originally proposed in order to operationalise the theoretical concepts of the capability approach. The measurement of the functionings and the weighted functionings allowed assessing the current situation and of the most relevant factors for the respondents. The measure of equity is considered in the resulting distance between different groups, segments or individuals. For example, empirical evidence has shown that users of public transport, especially buses, assess more aspects related to health more negatively than the group of active transport users. This positions bus and metro users in a disadvantaged position when compared in terms of modal choices. However, the analysis also allowed to account for the negative evaluations made by segments with lower incomes or segments that must carry out longer daily trips.

9.2.3. About the most vulnerable groups affected by transport and how do they perceive these inequalities

Chapter 6 spotlights a series of factors that have not been applied to project appraisal in Chile so far. In other contexts, such as in the UK, the study of these parameters in the implementation of transport projects has been wide more developed – although accounted for the economic benefits of incorporating these criteria. The most critical aspect of this
chapter, apart from the relevance of the use of these factors, is the recognition of the most disadvantaged groups. Women, public transport users and low-income groups are the most disadvantaged, which coincides with those users travelling longer times. Regarding opportunities, these are the groups that have reduced their chances of accessing sectors with higher employment, better facilities or services, since the modes of transport they have available place them in a disadvantage compared to other groups of the society. A focus on actual travel and activity participation (functioning) ignores the concept of real opportunity and the barriers that mean the opportunity is often not achieved.

Regarding income analysis, the results show a significant difference in the perceptions of the different transport users in relation to these factors. Public transport users are usually disadvantaged when compared to any of the other transport modes. The lower income segment tends to use public transport more and is shown to be more disadvantaged. This is also the group that on average travels longer distances and consequently has longer travel times. The analysis does not explore the reasons behind this, but it could be explained by the displacement these groups experience, as result of the current dynamics of land use and housing market – ending up living away from the main work centres of the city. Regarding gender, the first empirical chapter showed no significance in the quantitative analysis – a weakness of using that type of instrument for illustrating gender issues. Although the data revealed that there are no significant differences in the measurement of these factors related to health and transport, more research is needed in order to analyse the existing gender conflicts in Santiago.

In the search for the most vulnerable groups, the research also makes visible concepts such as subjective well-being or happiness. Chapter 7 delivers key concepts in this line, suggesting a turn from the research of instrumental factors to the emotional factors that make possible the
understanding of more complex transport dynamics and decisions. The profiles of the most vulnerable groups in this analysis coincide with the groups mentioned above. Currently, car users and active transport are privileged with respect to emotional factors. They show less dissonance of modal use compared to public transport users, when the analysis is centred in the association between transport and positive well-being factors.

9.2.4. About the applicability of the research in transport appraisal

The last secondary question explores the concepts of equity in the form of appraisal. As the question is centred in the applicability and potential changes on appraisal, Chapter 8 presents an exercise of multi-actor multi-criteria analysis considering one particular project recently developed in Santiago. The project is a holistic BRT that considers a whole new design and implementation of one of the most critical transport corridors for the city.

The chapter presents a series of unconventional factors that had not been originally considered in the project of the BRT corridor, but that had been analysed in previous chapters of this research. The exercise with the attendees showed a broad appreciation of these factors, especially in the definition of the social impacts of the project. The chapter also addressed different profiles of professionals and experts in the field for participating in the activity. This evaluation was carried out with a group of experts, all with knowledge of the project, but from different areas. Engineers, architects, planners, health academics and practitioners were part of the workshop. The multidimensional vision served to describe different characteristics of the subgroups, allowing the comparison and generation of a profile of workshop attendees. Finally, the chapter visualises these type of exercises and participatory tools for future project evaluation in Chile. The general opinion of the attendants is that this is a useful and necessary methodology that can feasibly used in the Chilean
context. However, they also recognised the importance of one particular of the MAMCA steps, related to the joint definition of the factors that define the project – also participative. They suggested that the criteria have to be better defined since they are sometimes overlapped, and sometimes factors involve more than one dimension.

9.3. Originality of the research

The research contributes in one of the most fundamental aspects debated today in Chile, how inequality has impacted negatively in the lives of people. The research grounds the theory of equity and justice in the urban and transport planning context. It also challenges the dominance of a transport theory and practice developed in the global north, with research from a city in the global south.

One of the main originalities of the research has been the understanding, use and application of the Capability Approach (CA) in the Chilean transport planning context. This has no precedent and it is a good contribution both to the literature and the context of study in particular. The challenge of using the CA has come with the joint exploration of a wide range of social equity issues. The social impacts of transport systems and projects are poorly assessed in almost all contexts internationally. As a result, the disadvantaged groups gain the poorest travel experiences and access to activities in cities, impacting on their life experiences. Distributional issues are often overlooked as project appraisal focuses on economic efficiency goals. The use of the CA in transport has allowed exploring social impacts regarding the opportunities for travel, activity participation and well-being. These impacts are related to actual travel, actual activity participation and actual levels of well-being. This may seem a subtle distinction but is important if we are to consider improving levels of public transport accessibility and using this accessibility more effectively for producing advantages.
The discussion about the use of CA in the transport planning context demonstrates the importance of considering real opportunities (capabilities) and functionings (actual activity). This takes us beyond a focus on actual activity which is the usual centre of transport analysis, and allows a greater focus on barriers to access and the constraints for individuals to participate in travel and life. The CA, through the distinction between capabilities and functionings, might be used to determine existing levels of equity in terms of what individuals wish to do and what they are actually able to perform. As presented in the literature section of this research, capabilities represent the various combinations of doings and beings (functionings) that a person can feasibly achieve. The analysis based on weighted functionings brings the measurement of capabilities closer, as the levels of importance that people attribute to their functionings relates to what a person would define in the range of her freedoms and opportunities. However, the significance given to the individual level, considering, for instance, the importance of freedom and personal subjective elements, has shaped an essential criticism of CA. In transport, as well as other public goods, the accomplished differentiation of individual and collective advantages should be closer to the idea of the common good. When transferring these concepts to the applicability of collective solutions, policy targets should consider personal abilities and individual assets but mostly they should be explicit when it refers to the attainment of people’s opportunities – especially the most disadvantaged groups.

The research also explores the inclusion of users’ perceptions beyond the usually considered factor of satisfaction with the trips. Existing evaluations of the perception of transport users are limited to considering satisfaction. Although satisfaction has been related to travel behaviour, factors directly related to the subjective well-being of the individual have not been generally considered in transport appraisal. The research is original in that it provides keys for use, analysis and consideration of
importance for these subjective perceptions. These subjective perceptions, in turn, are supported by a theoretical framework based on the individual’s well-being, considering a broader spectrum than the usual for transport requirements. While travel time savings and efficiency are real considerations for users, the inclusion of new dimensions of analysis in transport appraisal can favour a better quality of travel – and, consequently, it can improve people’s quality of life.

The exploration of the mentioned topics has revealed that unconventional factors can (and should) be used for social impact appraisal. The research highlights the need to incorporate emerging factors for the evaluation of social impact in transport projects through the use of a capabilities-based survey. Chapter 6 and 7, for example, test the consideration and evaluation of these emerging factors, through the use of a capability-based survey. Some of the unconventional factors explored, have considered, for example, the validation of emotive and attitudinal factors for reflecting social inequalities. At the moment, even though the trend is changing, the instrumental factors as efficiency, safety and travel times are the primary factors for measuring social impact assessment.

The methods used along the research demonstrates the relevance of incorporating both qualitative and quantitative methods. Those show different and complementary problems of the current transport project appraisal and the social problems associated with transport. These two methodological paths are complementary, through the design and application of a survey to transport users and the use of semi-structured interviews with policymakers. The third methodological derivation of the research proves a participatory method with policymakers that emphasises the incorporation of the factors explored in previous chapters. This also applies when testing innovative participatory methodologies in the context of Santiago. Chapter 8 explores the use of
a multi-actor multi-criteria (MAMCA) methodology in one particular BRT project in Santiago. The exercise has demonstrated that experts participating in the transport planning scenario agree on the need for incorporating more comprehensive assessments under the lens of social equity. The BRT project has been finally withdrawn from the government agenda – at the moment of writing up the final part of this research. The authorities have commented that the project has not accomplished the social profitability needed for the implementation of these type of projects. The problem is that the primary indicator for measuring social benefits was travel time savings, which this is not enough for covering the social benefits and does not even reflect part of the problems for the non-existence of a high-quality BRT corridor. Simulated participatory methodologies as the MAMCA could have helped in the early stages of the BRT plan.

The research also fosters a transferability of knowledge and theoretical framework in a case study in the Global South. The research uses global north literature related to equity and social issues applied in transport. Even though most of the research has been done in the global north or developed countries, the research approaches these theories assessing social equity in the context of the global south.

On the other hand, the research is transferable to other Chilean cities or other Latin American cities. Firstly, following the methodological path of compiling the factors explored through a survey. Then, the collection of contextual antecedents and interpretations of the application of concepts of social equity in public policy through interviews and qualitative analysis with policymakers. Finally, the simulation of a participatory methodology in some sustainable transport project - complex in terms of actors, results, context or problems to solve. This methodological path and the urgency of the fair and just transport agenda is relevant in several Chilean cities, and indeed in many Latin American cities. This transferability is essential, purposeful and relevant as a result of this research.
9.4. Reflections for future research and practice

The use of qualitative and quantitative methods throughout the research has been a fundamental challenge. The collection and analysis of quantitative data have revealed a perspective that allows the aggregation of results at a medium scale – which could eventually be aggregated on a bigger scale in future research. The results have been conclusive with the research questions that have been proposed at the beginning of the document. The first two empirical chapters have allowed responding to the way of measuring specific factors and the recognition of the most vulnerable groups of society in transport matters. On the other hand, the use of qualitative methods such as the use of interviews and workshops with relevant actors in the public discussion of transport has allowed a complementary data analysis that can be translated into the reality in the context of Santiago. Although both analyses have substantial differences, the results obtained are complementary and allow a more complex and broader understanding of the object of study.

Being able to develop quantitative data collection tools, as the survey, which incorporates new ways of measurement that have not been used in other previous studies has been interesting in the course of this research. This was a risky decision since it involved a process of design, reflection, redesign and final application of the tool that took longer than expected. However, the result was satisfactory in the sense that it allowed a logical and creative learning process – although at the same time it can be refined for future applications. This also feeds the impression of being able to develop future research in this line, without being afraid to innovate in the methodological proposals and the challenges of both obtaining and analysing data. The agenda of research for the following years will take again in consideration the mixture of methods. Qualitative and quantitative research together are powerful tools for better understanding the social impacts.
Being able to share in seminars and conferences the information obtained throughout the process, has also been interesting for the outcomes of the research – especially with people who have different profiles and backgrounds. For example, in the field of transport inequalities, there is broad research on the impacts and consequences of accessibility. The development of this research does not approach the use, measurement or interpretation of the levels of people’s accessibility, but it highlights concepts that have been developed outside the scope of transport such as health, well-being, and even some concepts derived from the psychology and human behaviour. These occasions of exposing research outcomes have made it possible to understand how this information can be interpreted in other contexts. A correct definition of concepts and the explicit evidence that diagnoses and solves the problem is then necessary.

The research challenges the capability approach itself, as it questions if this is the most useful way of understanding social issues in relation to transport. The focus on barriers and even adaptive capacity takes us beyond that just the focus on actual activity and accessibility planning (which is more like a capability). Looking at other conceptual approaches – such as social capital, motility – is relevant for strengthening the theoretical framework and understanding social equity and travel, which has conventionally been underdeveloped in transport planning research. Future agenda of research will consider further development of concepts in more detail – such as adaptive capacity, social assets, agency, among others. One of the threads that future research will have to deal with is the possible misinterpretation of the capability approach due to the complexity in the terminology. Even though theoretically and academically the capability approach is challenging and attractive, it could be difficult to be understood. This can represent an obstacle for the dissemination of the advantages and potentiality of its use. The threat is the misinterpretation or even the distortion of the concept when it is not
appropriately applied. Similarly, another consideration is the lack of a 'useful' interpretation of the approach. The definitions and concepts could sound too sophisticated for running analysis or too complicated for modifying existing tools, indicators or approaches based on the capabilities.

A gender perspective on research needs to be considered in the future research agenda, acknowledging that women have been one of the most disadvantaged groups encountered in the research. Even though the quantitative results were not enough for covering those issues, those were better reflected on the qualitative analysis. Results showed that care role, the mobility patterns, the inclusion of women in the labour force, the male-dominated car ownership and the sexual harassment in public space – and public transport – are the most critical aspects of women mobilities. The research was not designed under the lenses of the gender perspective – as it was expected that in the results the gender issues would appear by default. However, for instance, the questions used in the questionnaire were not conducive enough for understanding the real struggles of women – founded mainly in public transport and their daily mobilities. This is probably the most critical issue encountered in the (missing) results. The lack of the gender perspective has led to the desire to conducting more research advocated to understand the particularities of different disadvantaged groups. If those inequalities are expected to be tackled, the design of the instruments, questions, factors and assessment should be carefully considered.

Regarding practice, this research is relevant since it questions the elements that currently configure the project appraisal system and the components that define this evaluation. It analyses possible novel factors that should be incorporated in the metrics and evaluation standards, suggesting a turn towards the perceptions and needs of the individual, through parameters that value aspects that are not necessarily subject to direct economic evaluation. The research also contributes to generate empirical evidence revealing aspects that have not been previously fully
considered, suggesting them as fundamental for a just transport agenda in the coming years.

The application of this research in other contexts is suggested based on the methodological use of the tools and the analysis of the data obtained. For example, during the course of this research, the use of the capability survey focused on opportunities has been applied in Manila, Philippines. The work evidenced in Manila takes place in a developing city with local problems of high car dependence, lack of a public transport system (as private operators run collective transport) and high rates of social inequality. The results are evidenced by the publication Hickman et al. (2017), illustrating that the conceptual framework and empirical approach can be used in many different contexts in the Global South and even beyond.

Finally, the research aimed to consider a broader range of multidimensional transport-related impacts than usually found in social impact assessment. It used the concepts of capabilities, opportunities and well-being to go beyond the usually considered levels of service and travel satisfaction. The research considers the users as the centre of the analysis, not the infrastructure or the economic impacts. Therefore, applying questionnaires was a way of approaching to them asking unconventional questions, giving credit to the way they prioritise the most significant factors for them to achieve what they value in life. The value of performing this analysis in the context of Santiago was significant, with most of the previous research carried out in the Global North, and with better economic and social indexes than those currently existing in Chilean society.

The extent to which transport systems impact on people's capabilities and opportunities in life, and how this may be improved, can be the subject of further research. Other issues can also be explored, examining different evaluations of capability, beyond the concepts explored in this research. For example, individual decision making and agency,
considering relationships with the built environment (built form, public realm, climate) and access to jobs. The current discussion points towards the development of transport policies and projects, which more thoroughly consider the range of social, well-being and health impacts. Further evaluative research can lead us to a more comprehensive understanding of how transport projects have impacts on well-being impacting – hopefully positively – in people’s lives.
Annex 1 Survey questions – English

SOCIAL EQUITY IN TRANSPORT SURVEY · PUBLIC, PRIVATE AND ACTIVE USERS

This is an invitation to participate in a study focused on the social equity dimensions, in relation to the use of public, private, and active transport in Santiago.

The study is being developed by the PhD student and Researcher in Urban Planning and Transportation Beatriz Malta Lira (beatriz.lira.1@ucl.ac.uk), PhD candidate The Bartlett School of Planning, University College London.

The following survey takes about 20 minutes, and the results will be used exclusively for academic and research purposes. All answers are anonymous and confidential. Thank you very much for your cooperation.

0. Individual characteristics

a. In which commune do you live?

b. Indicate the intersection avenues closest to your home (e.g. Av. Grecia - Macul):

c. Gender

A Female
B Male

d. Age

A Less than 18
B 18 - 24
C 25 - 34
D 35 - 54
E 55 - 64
F 65 or more

e. Weight [kgs.]

f. Height [cm.]

g. What is the highest level of education you have reached?

A Primary
B Secondary
C Technical Education
D University
E Postgraduate (MSc or PhD)

h. How would you define your current occupation?

A Full time employee
B Part time employee
C Independent
D Unemployed
E House keeper
F Student
G Student and part time employee
H Retired
I Other

i. In which communes do you work or do your main paid activities / study?

j. What is your monthly family income?

A Less than $423,000
B $423,000 - $639,000
C $639,000 - $977,000
D $977,000 - $1,550,000
E $1,550,000 - $2,340,000
F More than $2,340,000

k. How many adults live in your house?

l. How many children live in your house?

m. Do you have any physical disability?

A Yes
B No

n. Do you have a driver’s license?

A Yes
B No

o. If you answered YES in the previous question, please indicate what type of disability:

Page 1 of 7
1. Health - physical and mental integrity

a. How do you evaluate the level of stress you experience in your usual trips?

   BAD  High levels of stress
   GOOD Low levels of stress

b. How do you assess your physical activity in your usual trips?

   Negatively 1 2 3 4 5  Positively

c. How do you assess your level of closeness (proximity) to other transport users in your usual trips?

   BAD There is not enough distance between users
   GOOD There is enough space between users

d. How do you assess the level of air pollution that you experience in your usual trips?

   MAL High levels of air pollution
   BIEN Low levels of air pollution

e. How do you assess the level of security (if not assaulted or harassed) that you experience in your usual trips?

   BAD Low level of security
   GOOD High level of security

f. How do you assess the level of comfort you experience in your usual trips?

   BAD Low level of comfort
   GOOD High level of comfort

g. What is the importance that you assign to these aspects?

   Levels of stress 1 2 3 4 5
   Physical activity 1 2 3 4 5
   Closeness to others 1 2 3 4 5
   Air pollution 1 2 3 4 5
   Security 1 2 3 4 5
   Comfort 1 2 3 4 5

The survey refers in various questions to “transport modes” or simply “modes”. The following two questions indicate what these referred modes are:

p. What is your MAIN mode of transportation to go to your main job or activity?
   (Which mode you most depend on to travel to your main activity. Select only one alternative)

A. Car  E. Metro
B. Taxi  F. Bus Transantiago
C. Colectivo  G. Bicycle
D. Moto  H. Walking

q. What is your SECONDARY mode of transportation?
   (The mode with which you make exchanges or the one that complements your main transport mode)
   (Select only one alternative)

A. Car  E. Metro
B. Taxi  F. Bus Transantiago
C. Colectivo  G. Bicycle
D. Moto  H. Walking

r. Would you add some other mode of transport that you use regularly both to go to work and to do other activities?
   (Check all that apply)

A. Car  E. Metro
B. Taxi  F. Bus Transantiago
C. Colectivo  G. Bicycle
D. Moto  H. Walking
2. Feelings and emotions about modes of transport

<table>
<thead>
<tr>
<th>Concept</th>
<th>CAR</th>
<th>TAXI</th>
<th>COLECTIVO</th>
<th>MOTO</th>
<th>METRO</th>
<th>BUS</th>
<th>BICYCLE</th>
<th>WALKING</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Freedom</td>
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<td>B Insecurity</td>
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<td>D Enjoyment</td>
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<td>E Low cost</td>
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<td>F Poverty</td>
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<td>H Waste of time</td>
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<td>I Unreliability</td>
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<td>M Environmental care</td>
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<td>N Health</td>
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<tr>
<td>O Social interaction</td>
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<td>P Discomfort</td>
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<td>Q Happiness</td>
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<td>R Status</td>
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<td></td>
</tr>
</tbody>
</table>
b. How much do you usually enjoy traveling to your daily activities?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little or nothing assessment</td>
<td>I do not enjoy the trip</td>
<td>MUCH</td>
<td>I do enjoy the trip</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

C. What level of importance does the quality of transportation travel have for you?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little or nothing importance</td>
<td>MUST</td>
<td>I much</td>
<td>MUCH</td>
<td>I much</td>
<td></td>
</tr>
</tbody>
</table>

D. Which factor AFFECTS more in your travel experience?

(Mark only one alternative)

- A Lack of comfort
- B Lack of security
- C Poor quality of corridors and / or streets
- D Overcrowding of passengers
- E Physical disability or reduced mobility
- F Travel times
- G All of the above
- H Other:

E. Which factor would FACILITATE your travel experience?

(Mark only one alternative)

- A Improvements in comfort
- B Improvements in security
- C Improvements in corridors and streets
- D Decrease in passenger overcrowding
- E Accessibility improvements for pedestrians
- F Decrease in travel times
- G All of the above
- H Other:

3. Reasoning and Planning

a. How do you evaluate your access to job opportunities through public transport?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAD</td>
<td>Low access to employment through public transport</td>
<td>GOOD</td>
<td>Good access to employment through public transport</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. Does your current access to public transportation allow you to access the job you need?

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO</td>
<td>I do not have access to necessary employment through public transport</td>
<td>YES</td>
<td>I have good access to needed employment through public transport</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

c. What is the frequency with which you carry out these activities?

<table>
<thead>
<tr>
<th>Activity</th>
<th>FEW frequency</th>
<th>MUCH frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Visitar familia/amigos</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>B Actividades recreativas</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>C Actividades culturales</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>D Actividades deportivas</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>E Compras de comida</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>F Actividades sociales</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

d. Which of the following activities are difficult to perform due to transportation-related complications?

<table>
<thead>
<tr>
<th>Activity</th>
<th>LITTLE possible</th>
<th>VERY possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Visit family / friends</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>B Recreational activities</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>C Cultural activities</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>D Sporty activities</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>E Food shopping</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>F Social activities</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>
e. How important do you consider having several options to use different modes of transport?

- Little important
- Less important
- Moderate important
- More important
- Very important

f. How much does your quality of life depend on the access you currently have to public transport?

- Few
- Much

h. What modes are economically accessible for you and your family?

(Choose all that apply)

- Car
- Taxi
- Colectivo
- Moto
- Metro
- Bus Transantiago
- Bicycle
- Moto
- Walking

i. What mode do you NOT use because it is not economically affordable?

(Choose all that apply and leave blank if it is not applicable)

- Car
- Taxi
- Colectivo
- Moto
- Metro
- Bus Transantiago
- Bicycle
- Moto
- Walking

j. Indicate how important it is to improve the following aspects in the public transport system:

- Improve access to office and commerce sectors
- Improve availability of modes of transport
- Improve overall comfort in public transport use
- Incorporate other modes into the integrated fare system

- Few important
- Less important
- Moderate important
- More important
- Very important

4. Social interaction

a. How do you evaluate the level of interaction you have with other people during your usual trips?

- Negatively
- Positively

b. How important do you consider the presence of other people during your usual trips?

- Few important
- Very important

c. Have you ever felt discriminated against while traveling in some mode of transportation?

- Yes
- No

d. If your answer was affirmative (you have felt discriminated), please indicate in which modes:

- Car
- Taxi
- Colectivo
- Metro
- Bus Transantiago
- Bicycle
- Moto
- Walk

5. Nature and Sustainability

a. In the event of a climate event such as heavy rain or flood, do you change your main mode of transport?

- Yes
- No

d. If your answer was affirmative (change of transport mode before a natural event), please indicate which mode you use: (Select only one alternative)

- Car
- Taxi
- Colectivo
- Metro
- Bus Transantiago
- Bicycle
- Moto
- Walking
c. How do you evaluate your access to the currently available sustainable modes of transport? (eg hybrid buses, electric cars, public bicycles)

1 Low access to sustainable modes of transport
2
3 High access to sustainable modes of transport
4
5

d. How important is it for you to have access to sustainable modes of transport?

1 Few important
2
3 Very important
4
5

e. Would you be willing to spend more on transportation in order to have access to more sustainable ways?

A Yes
B No

f. If your previous answer was positive, please indicate how much your transportation expense would increase:

A 5% - 15%
B 15% - 30%
C 30% or +

6. Information and modal exchanges

a. Do you carry out exchanges between modes of transport (in the same route) when you make your usual trips?

A Yes
B No

b. If you have answered YES in the previous question, how is the quality of these exchanges?

1 Poor quality
2
3 Good quality
4
5

c. How do you evaluate your usual trips in relation to:

(A) Waiting times
1 Very bad
2
3 Bad
4
5

(B) Transfer times
1 Very bad
2
3 Bad
4
5

(C) Overall time
1 Very bad
2
3 Bad
4
5

(d. What main aspect makes your transfers more complex?

(Select only one alternative)

A Poor physical connection for pedestrians
B Transfers take a long time
C It is not comfortable to have to transfer
D Bad infrastructure for waiting modes
E Lack of security
F All the above
G Other:

f. How do you evaluate the level of technological information available to see transportation alternatives? (eg applications, smartphones, internet, signs)

1 Low access to information
2
3 Good access to information
4
5

g. How important is it for you to have technological information?

1 Few important
2
3 Very important
4
5
### SOCIAL EQUITY IN TRANSPORT SURVEY - PUBLIC, PRIVATE AND ACTIVE USERS

#### 7. Built environment

<table>
<thead>
<tr>
<th>aspect</th>
<th>VERY BAD</th>
<th>VERY GOOD</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Space for cars</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>B Number of parking lots</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>C Highways quality</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>D Space for pedestrians</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>E Quality of sidewalks</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>F Cleaning of bus stops</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>G Seats in bus stops</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>H Climate protection bus stops</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>I Number of cycleways</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>J Quality of cycleways</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>K Public bicycle systems</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

b. What level of importance does it have for you to improve the aspects of the previous list?

<table>
<thead>
<tr>
<th>aspect</th>
<th>VERY important</th>
<th>IMPORTANT</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Space for cars</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>B Number of parking lots</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>C Highways quality</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>D Space for pedestrians</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>E Quality of sidewalks</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>F Cleaning of bus stops</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>G Seats in bus stops</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>H Climate protection bus stops</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>I Number of cycleways</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>J Quality of cycleways</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>K Public bicycle systems</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

#### 8. Travel to work and productive activities

a. How much do you think your access to the transportation network has affected your chances of having a better job?

<table>
<thead>
<tr>
<th>effect</th>
<th>1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>few or not at all</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>very much</td>
<td></td>
</tr>
</tbody>
</table>

b. How do you evaluate the job opportunities available in your residence commune?

<table>
<thead>
<tr>
<th>job opportunity</th>
<th>1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>bad</td>
<td></td>
</tr>
<tr>
<td>good</td>
<td></td>
</tr>
</tbody>
</table>

c. What level of access to employment are you interested in having in your community of residence?

<table>
<thead>
<tr>
<th>access to employment</th>
<th>1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td></td>
</tr>
<tr>
<td>high</td>
<td></td>
</tr>
</tbody>
</table>

d. How satisfied are you with your current job?

<table>
<thead>
<tr>
<th>satisfaction level</th>
<th>1 2 3 4 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>few or not at all</td>
<td></td>
</tr>
<tr>
<td>very much</td>
<td></td>
</tr>
</tbody>
</table>

e. How long is your usual trip from your home to your work or main activity?

<table>
<thead>
<tr>
<th>travel time</th>
<th>0 - 20 min</th>
<th>20 - 40 min</th>
<th>1 hour or more</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>D</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

f. At what times do you frequently travel?

<table>
<thead>
<tr>
<th>travel time</th>
<th>7:00 - 9:00</th>
<th>9:00 - 13:00</th>
<th>13:00 - 15:00</th>
<th>15:00 - 18:00</th>
<th>18:00 - 21:00</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
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<td></td>
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<tr>
<td>B</td>
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<tr>
<td>C</td>
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<td></td>
</tr>
<tr>
<td>D</td>
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</tbody>
</table>


g. What is your monthly personal transportation expense considering trips to work and other activities?

<table>
<thead>
<tr>
<th>expense</th>
<th>Less than $35,000</th>
<th>Between $35,000 and $75,000</th>
<th>Between $75,000 and $125,000</th>
<th>More than $125,000</th>
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</table>

Thank you for your time spent answering this survey. If you have comments or questions you can send an email to beatrix.ira.14@ucl.ac.uk. Thank you!
Annex 2 Survey questions – Spanish

Esta es una invitación a participar de un estudio centrado en las dimensiones sociales, personales y de equidad social, que no han sido ampliamente exploradas en el uso del transporte público y privado en Santiago.

El estudio está siendo desarrollado por la Doctorante e Investigadora en Planificación Urbana y Transporte Beatriz Mella Lira (beatriz.lira.14@ucl.ac.uk), candidata a PhD The Bartlett School of Planning, University College London.

La siguiente encuesta dura alrededor de 20 minutos y los resultados serán exclusivamente utilizados para fines académicos y de investigación. Todas las respuestas son anónimas y confidenciales. Muchas gracias por su cooperación.

0. Características individuales

a. ¿En qué comuna vive?

b. Indicar las avenidas de intersección más cercanas a su hogar (ej. Av. Grecia con Macul):

c. Género

- (A) Femenino
- (B) Masculino

d. Edad

- (A) Menos de 18
- (B) 18 - 24
- (C) 25 - 34
- (D) 35 - 54
- (E) 55 - 64
- (F) 65 o más

e. Peso

- (A) Menos de 18
- (B) 18 - 24
- (C) 25 - 34
- (D) 35 - 54
- (E) 55 - 64
- (F) 65 o más

e. Peso

f. Altura

- (A) Menos de 18
- (B) 18 - 24
- (C) 25 - 34
- (D) 35 - 54
- (E) 55 - 64
- (F) 65 o más

g. Cuál es el nivel de educación más alto que ha alcanzado?

- (A) Educación básica
- (B) Enseñanza media
- (C) Educación profesional Técnica
- (D) Educación profesional Universitaria
- (E) Posgrado (MSc or PhD)

h. Cómo describiría su ocupación actual?

- (A) Empleado tiempo completo
- (B) Empleado part-time
- (C) Trabajador independiente
- (D) Desempleado
- (E) Dueño/a de casa
- (F) Estudiante
- (G) Estudiante y empleado part-time
- (H) Retirado
- (I) Otro

i. ¿En qué comunas trabaja o realiza sus principales actividades remuneradas/estudio?

j. Cuál es su ingreso familiar mensual?

- (A) Menor a $423.000
- (B) $423.000 - $639.000
- (C) $639.000 - $977.000
- (D) $977.000 - $1.550.000
- (E) $1.550.000 - $2.380.000
- (F) Más que $2.380.000

k. Cuántos adultos viven en su casa?

l. Cuántos niños viven en su casa?

m. Tiene alguna discapacidad física?

- (A) Sí
- (B) No

n. Tiene licencia de conducir?

- (A) Sí
- (B) No

o. Si respondió Sí en la pregunta anterior, por favor indicar qué tipo de discapacidad:
La encuesta refiere en diversas preguntas a los “modos de transporte” o simplemente “modos”. Las siguientes dos preguntas indican cuáles son estos modos referidos:

**p. ¿Cuál es su PRINCIPAL modo de transporte para ir a su trabajo o actividad principal?**
(Modo del cual Ud. más depende para viajar a su actividad principal. Marcar sólo una alternativa)

- A. Auto
- B. Taxi
- C. Colectivo
- D. Moto
- E. Metro
- F. Bus Transantiago
- G. Bicicleta
- H. Caminando

**q. ¿Cuál es su modo de transporte SECUNDARIO?**
(El modo con el que hace intercambios o el que complementa su modo de transporte principal)  
(Marcar sólo una alternativa)

- A. Auto
- B. Taxi
- C. Colectivo
- D. Moto
- E. Metro
- F. Bus Transantiago
- G. Bicicleta
- H. Caminando

**r. ¿Añadiría algún otro modo de transporte que utilice regularmente tanto para ir al trabajo como para realizar otras actividades?**
(Marque todos los que correspondan)

- A. Auto
- B. Taxi
- C. Colectivo
- D. Moto
- E. Metro
- F. Bus Transantiago
- G. Bicicleta
- H. Caminando

1. Salud e integridad física y mental

**a. ¿Cómo evalúa el nivel de estrés que experimenta en sus viajes habituales?**

- MAL Altos niveles de estrés
- BIEN Bajos niveles de estrés

**b. ¿Cómo evalúa el esfuerzo físico que realiza en sus viajes habituales?**

- Negativamente
- Positivamente

**c. ¿Cómo evalúa su nivel de cercanía (proximidad) a otros usuarios de transporte en sus viajes habituales?**

- MAL No hay suficiente distancia entre usuarios
- BIEN Hay suficiente espacio entre usuarios

**d. ¿Cómo evalúa el nivel de contaminación ambiental que experimenta en sus viajes habituales?**

- MAL Altos niveles de contaminación
- BIEN Bajos niveles de contaminación

**e. ¿Cómo evalúa el nivel de seguridad (de no ser asaltado o acosado) que experimenta en sus viajes habituales?**

- MAL Bajo nivel de seguridad
- BIEN Alto nivel de seguridad

**f. ¿Cómo evalúa el nivel de comodidad que experimenta en sus viajes habituales?**

- MAL Bajo nivel de comodidad
- BIEN Alto nivel de comodidad

**g. ¿Cuál es la importancia que asigna a estos aspectos?**

- POCO importante
- MUY importante
## 2. Sensaciones en torno a los modos de transporte

a. Por favor indicar los sentimientos que relaciona con el uso de los siguientes modos de transporte:

(Marque todos los modos que correspondan)

<table>
<thead>
<tr>
<th>Modo</th>
<th>AUTO</th>
<th>TAXI</th>
<th>COLECTIVO</th>
<th>MOTO</th>
<th>METRO</th>
<th>BUS</th>
<th>BICICLETA</th>
<th>CAMINATA</th>
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</table>
b. ¿Cuánto disfruta viajar habitualmente hacia sus actividades diarias?

<table>
<thead>
<tr>
<th>Opción</th>
<th>POCO o NADA</th>
<th>MUCHO</th>
</tr>
</thead>
<tbody>
<tr>
<td>No disfruto el viaje</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Si disfruto el viaje</td>
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<td></td>
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</tbody>
</table>

c. ¿Qué nivel de importancia tiene para Ud. la calidad de los viajes en transporte?

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<tr>
<th>Opción</th>
<th>POCO o NADA</th>
<th>MUCHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poca frecuencia</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Mucha frecuencia</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

d. ¿Qué factor AFECTA más en su experiencia de viaje?
(Marcar una sola alternativa)

- Falta de comodidad
- Falta de seguridad
- Pobre calidad de corredores y/o calles
- Hacinamiento de pasajeros
- Discapacidad física o movilidad reducida
- Tiempos de viaje
- Todas las anteriores
- Otra razón:

e. ¿Qué factor FACILITARÍA su experiencia de viaje?
(Marcar una sola alternativa)

- Mejoras en la comodidad
- Mejoras en seguridad
- Mejoras en corredores de buses y calles
- Disminución del hacinamiento de pasajeros
- Mejoras de accesibilidad para peatones
- Disminución en tiempos de viaje
- Todas las anteriores
- Otra razón:

c. ¿Cuál es la frecuencia con la que Ud. realiza estas actividades?

<table>
<thead>
<tr>
<th>Opción</th>
<th>POCA frecuencia</th>
<th>MUCHA frecuencia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visitar familia/amigos</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Actividades recreativas</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Actividades culturales</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Actividades deportivas</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Compras de comida</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Actividades sociales</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

d. ¿Cuál de las siguientes actividades son difíciles de realizar por complicaciones relacionadas al transporte?

<table>
<thead>
<tr>
<th>Opción</th>
<th>POCO posible</th>
<th>MUY posible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visitar familia/amigos</td>
<td>1 2 3 4 5</td>
<td></td>
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<tr>
<td>Actividades recreativas</td>
<td>1 2 3 4 5</td>
<td></td>
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<tr>
<td>Actividades culturales</td>
<td>1 2 3 4 5</td>
<td></td>
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<tr>
<td>Actividades deportivas</td>
<td>1 2 3 4 5</td>
<td></td>
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<tr>
<td>Compras de comida</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>Actividades sociales</td>
<td>1 2 3 4 5</td>
<td></td>
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</tbody>
</table>
ENCUESTAS DE EQUIDAD URBANA Y SOCIAL · USUARIOS DE TRANSPORTE PÚBLICO Y PRIVADO

e. ¿Cuán importante considera tener varias opciones de usar distintos modos de transporte?

f. ¿Cuánto depende su calidad de vida del acceso que actualmente tiene al transporte público?

h. ¿Qué modos son accesibles económicamente para usted y su familia? (Elige todos los que correspondan)

- [ ] Auto
- [ ] Taxi
- [ ] Colectivo
- [ ] Moto
- [ ] Bicicleta
- [ ] Metro
- [ ] Bus Transantiago
- [ ] Caminando

i. ¿Qué modo NO utiliza porque no es asequible económicamente? (Elige todos los que correspondan y deje en blanco si no es aplicable)

- [ ] Auto
- [ ] Taxi
- [ ] Colectivo
- [ ] Moto
- [ ] Bicicleta
- [ ] Metro
- [ ] Bus Transantiago
- [ ] Caminando

j. Indique qué tan importante es mejorar los siguientes aspectos en el sistema de transporte público:

- [ ] Mejorar acceso a sectores de oficinas y comercio
- [ ] Mejorar disponibilidad de modos de transporte
- [ ] Mejorar comodidad general en uso de transporte público
- [ ] Incorporar otros modos al sistema de tarifa integrada

4. Interacción Social

a. ¿Cómo evalúa el nivel de interacción que tiene con otras personas durante sus viajes habituales?

b. ¿Cuán importante considera la presencia de otras personas durante sus viajes habituales?

c. ¿Se ha sentido alguna vez discriminado viajando en algún modo de transporte?

- [ ] Si
- [ ] No

d. Si su respuesta fue afirmativa (se ha sentido discriminado), por favor indique en qué modo/s:

- [ ] Auto
- [ ] Taxi
- [ ] Colectivo
- [ ] Moto
- [ ] Bicicleta
- [ ] Metro
- [ ] Bus Transantiago
- [ ] Caminando

5. Naturaleza y Sustentabilidad

a. Ante un evento climático como lluvia intensa o inundación, ¿cambia Ud. su modo principal de transporte?

- [ ] Sí
- [ ] No

d. Si su respuesta fue afirmativa (cambia de modo de transporte ante un evento natural), por favor indique qué modo utiliza: (Seleccione sólo una alternativa)

- [ ] Auto
- [ ] Taxi
- [ ] Colectivo
- [ ] Moto
- [ ] Bicicleta
- [ ] Metro
- [ ] Bus Transantiago
- [ ] Caminando
ENCUESTAS DE EQUIDAD URBANA Y SOCIAL · USUARIOS DE TRANSPORTE PÚBLICO Y PRIVADO

c. ¿Cómo evalúa su acceso a los **modos de transporte sustentables** actualmente disponibles? (ej. buses híbridos, autos eléctricos, bicicletas públicas)

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<tr>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bajo acceso a modos de transporte sustentables</strong></td>
<td><strong>Alto acceso a modos de transporte sustentables</strong></td>
<td></td>
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</tbody>
</table>

d. ¿Cuán importante para Ud. es tener acceso a modos de transporte sustentables?

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<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POCO importante</strong></td>
<td><strong>MUY importante</strong></td>
<td></td>
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</tbody>
</table>

e. ¿Estaría dispuesto a gastar más en transporte para poder tener acceso a modos más sustentables?

[ ] A Sí  [ ] B No

f. Si su respuesta anterior fue positiva, por favor indique en cuánto incrementaría su gasto en transporte:

[ ] A 5% - 15%  [ ] B 15% - 30%  [ ] C 30% o más

g. Por favor indique qué tan importante es mejorar los siguientes aspectos en los recorridos de transporte público:

<table>
<thead>
<tr>
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<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POCO importante</strong></td>
<td><strong>MUY importante</strong></td>
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6. Información e intercambios modales

a. ¿Realiza **intercambios entre modos de transporte** (en un mismo recorrido) cuando realiza sus viajes habituales?

[ ] A Sí  [ ] B No

b. En caso de haber respondido Sí en la pregunta anterior, ¿cómo es la calidad de estos intercambios?

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<th>5</th>
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<tbody>
<tr>
<td><strong>Mala calidad</strong></td>
<td><strong>Buena calidad</strong></td>
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</table>

c. ¿Cómo evalúa sus viajes habituales en relación a:

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<tbody>
<tr>
<td><strong>MAL</strong></td>
<td><strong>BUEN</strong></td>
<td><strong>N/A</strong></td>
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<thead>
<tr>
<th></th>
<th>Tiempo de espera</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><strong>Tiempo de espera</strong></td>
<td><strong>MAL</strong></td>
<td><strong>BUEN</strong></td>
<td><strong>N/A</strong></td>
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<table>
<thead>
<tr>
<th></th>
<th>Tiempo de transbordo</th>
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<th>4</th>
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</tr>
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<tbody>
<tr>
<td>B</td>
<td><strong>Tiempo de transbordo</strong></td>
<td><strong>MAL</strong></td>
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<tr>
<td>C</td>
<td><strong>Tiempo de viaje total</strong></td>
<td><strong>MAL</strong></td>
<td><strong>BUEN</strong></td>
<td><strong>N/A</strong></td>
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</table>

d. ¿Qué aspecto principal dificulta sus transbordos?

(Marque sólo una alternativa)

[ ] A Mala conexión física para peatones (veredas)
[ ] B Intercambios de modo toman mucho tiempo
[ ] C No es cómodo tener que hacer intercambios
[ ] D Mala infraestructura de espera entre modos
[ ] E No es seguro tener que hacer intercambios
[ ] F Todas las anteriores
[ ] G Otra:

[ ]

[ ]

e. ¿Tiene Ud. acceso a **herramientas tecnológicas como smartphones e internet**, con los que pueda ver información de servicios de transporte?

[ ] A Sí  [ ] B No

f. ¿Cómo evalúa el **nivel de información tecnológica disponible** para ver alternativas de transporte? (ej. aplicaciones smartphones, internet, letreros)

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAL</strong></td>
<td><strong>BUEN</strong></td>
<td><strong>N/A</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Bajo acceso a información</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><strong>Bajo acceso a información</strong></td>
<td><strong>MAL</strong></td>
<td><strong>BUEN</strong></td>
<td><strong>N/A</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Alto acceso a información</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td><strong>Alto acceso a información</strong></td>
<td><strong>MAL</strong></td>
<td><strong>BUEN</strong></td>
<td><strong>N/A</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

g. ¿Qué tan importante es para Ud contar con información tecnológica?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>POCO importante</strong></td>
<td><strong>MUY importante</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

[ ] A Sí  [ ] B No

Página 6 de 7
7. Medioambiente construido

<table>
<thead>
<tr>
<th>a. ¿Cómo evalúa los siguientes aspectos cerca de su hogar?</th>
<th>MUY MAL</th>
<th>MUY BIEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Espacio para autos</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>B Cantidad de estacionamientos</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>C Calidad de autopistas</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>D Espacio para peatones</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>E Calidad de las veredas</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>F Limpieza de paraderos</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>G Asientos en paraderos</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>H Protección climática paraderos</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>I Cantidad de ciclovías</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>J Calidad de ciclovías</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
<tr>
<td>K Sistemas bicicletas públicas</td>
<td>1 2 3 4 5</td>
<td></td>
</tr>
</tbody>
</table>

b. ¿Qué nivel de importancia tiene para Ud. el mejorar los aspectos del listado anterior?

8. Viajes al trabajo y actividades productivas

a. ¿Cuánto cree que su acceso a la red de transporte ha afectado sus posibilidades de tener un mejor empleo?

<table>
<thead>
<tr>
<th>POCO MUY</th>
<th>MAL BIENTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poco o nada</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Mucho</td>
<td></td>
</tr>
</tbody>
</table>

b. ¿Cómo evalúa las oportunidades de trabajo disponibles en su comuna de residencia?

<table>
<thead>
<tr>
<th>MUY MAL</th>
<th>MUY BIEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muy mal</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Bién</td>
<td></td>
</tr>
</tbody>
</table>

c. ¿Qué nivel de acceso a empleo le interesa tener en su comuna de residencia?

<table>
<thead>
<tr>
<th>POCO BIEN</th>
<th>MUY BIENTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poco o nada</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Bién</td>
<td></td>
</tr>
</tbody>
</table>

d. ¿Qué tan satisfecho se siente con su empleo actual?

<table>
<thead>
<tr>
<th>POCO MUY</th>
<th>MAL BIENTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poco o nada</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Mucho</td>
<td></td>
</tr>
</tbody>
</table>

e. ¿Cuánto dura su viaje habitual desde su casa a su trabajo o actividad principal?

<table>
<thead>
<tr>
<th>0 - 20 min</th>
<th>40 - 60 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 - 40 min</td>
<td>1 hora y más</td>
</tr>
<tr>
<td>40 - 60 min</td>
<td></td>
</tr>
</tbody>
</table>

f. ¿En qué horarios se moviliza frecuentemente?

<table>
<thead>
<tr>
<th>7:00 - 9:00</th>
<th>15:00 - 18:00</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00 - 13:00</td>
<td>18:00 - 21:00</td>
</tr>
<tr>
<td>13:00 - 15:00</td>
<td>Otros</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Menos de $35.000</th>
<th>Entre $35.000 y $75.000</th>
<th>Entre $75.000 y $125.000</th>
<th>Más de $125.000</th>
</tr>
</thead>
</table>

Gracias por su tiempo dedicado a responder esta encuesta. Si tiene comentarios o preguntas puede enviar un correo a beatriz.lira.14@ucl.ac.uk. Gracias!
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