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Participatory co-development of sustainable transport scenarios: case of Madrid

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Abstract

Sustainable mobility policies are unlikely to succeed without targeted efforts to tackle the significant disagreement between different social groups over the need for change and the specific actions that such change should entail. In this context, we describe a participatory scenario development process for strategic planning of sustainable mobility in the city of Madrid, Spain, motivated by the need for the city to align with international directives and recommendations on greenhouse gas emissions and air quality. The scenarios were co-constructed through semi-structured interviews with stakeholders representing academia, business, public administration and civil society. Systematic analysis of stakeholders' responses allowed four distinct scenarios to emerge: Remote Working, The Fifteen-Minute City, Electric City and Public City. These scenarios are focussed on implementation and are not tied to specific policy objectives or aspirational goal-oriented scenario frameworks like the shared socio-economic pathways (SSPs). In this sense they provide a basis for the preparation of realistic and achievable sustainable mobility strategies to address the twin challenges of air pollution and greenhouse gas emissions, aspects that are rarely addressed together in urban policy. Participatory approaches of this kind can help to formulate consensus responses to societal problems in highly contested contexts like sustainable transport planning.

Keywords: Participation, sustainable mobility, transport, pollution, scenarios

1 Introduction

The EU's Climate and Energy Policy for 2030 sets out clear strategies to help member states meet the goals of the Paris Climate Agreement and the UN Sustainable Development Goals, including reducing greenhouse gas emissions, increasing renewable energy and improving energy efficiency by 2030. At the same time, concern about poor air quality in European cities has led the EU to adopt clean air policy measures with targets for 2030, in particular the reduction of NO_x and PM_{2.5} emissions from vehicles. European cities, such as London, Paris and Madrid, are addressing these issues through transport-oriented strategies that seek to reduce vehicle circulation and promote sustainable mobility. However, incorporating such schemes into broader urban planning strategies remains a challenge, and achieving buy-in from stakeholders often means the difference between success and failure. In two recent cases, an attempted increase on fuel duty in France, and the introduction of a low emissions zone in central Madrid, were met with furious responses from some citizens and parts of the political spectrum (ref, ref). In both instances, ideological arguments around the role of government and the freedom of citizens to choose were prominent in discourse of the policies' opponents. In Madrid, disagreements broke down along party political lines, mirroring the division noted by Baumann and White (2012) in transport policy generally, between stakeholder coalitions prioritising values like material growth and individual freedom, and those concerned with environmental health and social equity. However, the forceful rejection of sustainability policies by large sectors of society can be seen as a symptom of poorly designed policy which viewed attaining consensus as impossible or unimportant. In large cities, housing costs are prohibitive in the most accessible areas, and a century of car-centred transport policy, combined with inadequate or expensive public transport means that many citizens achieve quality of life by commuting in to city by car from low density residential suburbs.

For sustainable transport policies to be effective, they need to show how restrictions on drivers like increased fuel costs or low emissions zones are clearly linked to benefits elsewhere, and, crucially, who benefits from the proposed changes. Even if policymakers feel that the benefits are obvious (i.e. in terms of avoided deaths from contaminated air, safer streets, reduced congestion etc), the argument needs to be clearly articulated and buy-in needs to be sought from a range of social groups. One way to do this is do build consensus widely through participatory approaches that seek to reconcile conflicting points of view (Baumann and White 2012). Different perspectives on how to achieve common goals can be structured through formal narratives called scenarios (Bishop et al 2007, ref, ref). Participatory scenario development is increasingly commonly used in

deliberative approaches to environmental policy (Palomo et al 2011, Duckett et al 2017).

In this paper, developed within the framework of the EU-funded INTRANCES project, we adopt a participatory approach to explore the feasibility of possible future sustainable mobility, social conflict points and implementation problems in the case of the city of Madrid. The research was undertaken from a participatory action-research (PAR) perspective (McIntyre 2008), in which stakeholder hierarchies, conflicts and power imbalances are explicitly recognised and diverse viewpoints and opinions are welcomed. Specifically, we developed a range of future mobility scenarios in Madrid from information supplied by local stakeholders with specific knowledge of Madrid and its problems around mobility, air quality and urban planning. This paper describes the participatory process, carried out through semi-structured interviews, and presents and describes the analysis of the stakeholders' discourse leading to the formulation of four scenarios. We aimed, following the definitions of Bishop et al (2007) to collect and structure stakeholder visions to inform sustainable transport policy generally, rather than to plan for specific actions. However, the interviews from which the scenarios emerged were oriented around problem-solving and implementation, rather than open, imaginative visioning of possible futures. In this sense, our paper provides a necessary snapshot of what is collectively understood to be possible by the stakeholder coalitions we engage.

The paper is structured as follows. After this brief introduction, we explain the importance of sustainable mobility to the specific case of Madrid, which justify its selection as a case study to inform sustainable mobility policy elsewhere, and summarize relevant literature on the subject. Next, we describe the stakeholder engagement process and the methods used to elicit information from them. In the results section, we analyse stakeholders' discourse based on the verbatim responses from the semi-structured interviews, and propose four distinct scenarios emergent from that discourse. Finally, we use a strengths, weaknesses, opportunities and threats (SWOT) framework to identify pathways and barriers to the implementation of policy actions embedded in the four scenarios.

2. Research background: Madrid and the sustainability challenge

Madrid is a municipality with more than 3 million inhabitants, with an area of 604.3km² (Figure 1). The urban area occupies 330km² and has a population density of 5265.91 inhabitants/km². A city of these dimensions, under the current model of mobility, inevitably generates major emissions of greenhouse gases and other airborne contaminants arising from travel within it, from the first-line metropolitan suburbs that surround the municipality of Madrid, comprising the core city, and further afield in the wider region, for which the city is the most important economic attractor (Figure 1).

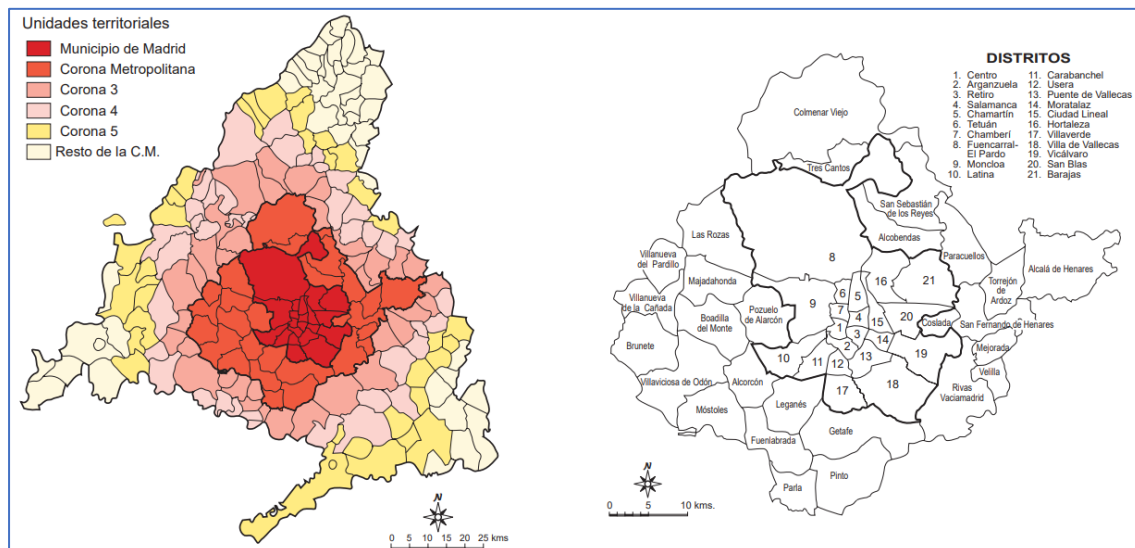


Figure 1. The municipality of Madrid (red), the “Madrid Central” LEZ and suburban municipalities comprising the

metropolitan area.

In the whole Madrid region of 6,507,184 inhabitants, this gives an estimated total of 15,847,266 trips per day (2.44 daily trips per person). Of those 15.8 million daily trips, 39% are made by private vehicle, 34% on foot, and 24% by public transport. This gives a total of 6,280,433 daily trips by car (CRTM 2018). This amount of travel places transport as the sector that emits the most greenhouse gases (GHG), accounting for 29% of emissions in terms of CO₂ equivalent. Specifically in the Community of Madrid, cars are responsible for 23.49% of GHG emissions, thanks to the high percentage of cars per inhabitant and the high number of trips made with this mode. At the same time, air pollution in Madrid causes 88 deaths per year from particulate matter (PM) and 519 by nitrogen dioxide (NO₂), which is equivalent to 4 deaths per 100,000 inhabitants in the first case, and 23 deaths per 100,000 cases in the second (Izquierdo et al 2020). Within the municipality of Madrid it has been estimated that 74.4% of all local NO₂ emissions (i.e. those arising from within the core city itself), are attributable to road traffic (Ayuntamiento de Madrid 2019).

The scale and severity of this problem, together with the high economic and social cost of pollution caused by this mobility model, points to the urgent need to actively seek a more sustainable future for the city. There are a lot of social Participants – public or private transport users, politicians, companies, administrators, social movements, etc. who may have something to say about a more sustainable future. To avoid the failure of political measures considered "partisan" or insufficiently inclusive, it is necessary to listen to the various visions proposed and try to seek consensus among them. Even if you do not have a vision that has the necessary political support to carry it out, expanding the search for visions from various social Participants increases the space for dialogue, and can have repercussions beyond the local and immediate context. In this way, a social turning point is sought (Otto et al 2020) in which the minority becomes the majority, giving way, with a rapidly accelerating cascade effect, to the social transformation necessary to achieve a better future.

3. Methods

In order to obtain the views of as wide a variety of social Participants as possible, interviews were conducted with representatives of several sectors: The academic sector; representatives of public institutions; and private institutions, such as companies or civil society organizations. The interviews were conducted in a semi-structured way, they had 7 questions, though participants were not required to answer all the questions. Once the interviews were completed, the information was transcribed and the answers were classified. Each interviewee was assigned a code to preserve their anonymity (Table 1).

Institution	Code
Municipal Transport Company of Madrid	Participant 1
Cambiamo Cooperative	Participant 2
Regional Transport Consortium of Madrid	Participant 3
Local Forum of Vallecas neighborhood	Participant 4
Regional Federation of Neighborhood Associations of Madrid	Participant 5
"A Pie" Association	Participant 6
Sub-Department of Energy and Climate Change of the Madrid City Council	Participant 7
Associated European Motorists	Participant 8
Tomillo Foundation	Participant 9
Research Group of Transport, Infrastructure and Territory (t-GIS) of the Complutense University of Madrid (UCM)	Participant 10
Chair of Disaster Risk Reduction Universidad de la Laguna	Participant 11

Department of Industrial Chemical engineering and the Environment of the Polytechnic University of Madrid

Participant 12

Table 1: INTRANCES project stakeholders

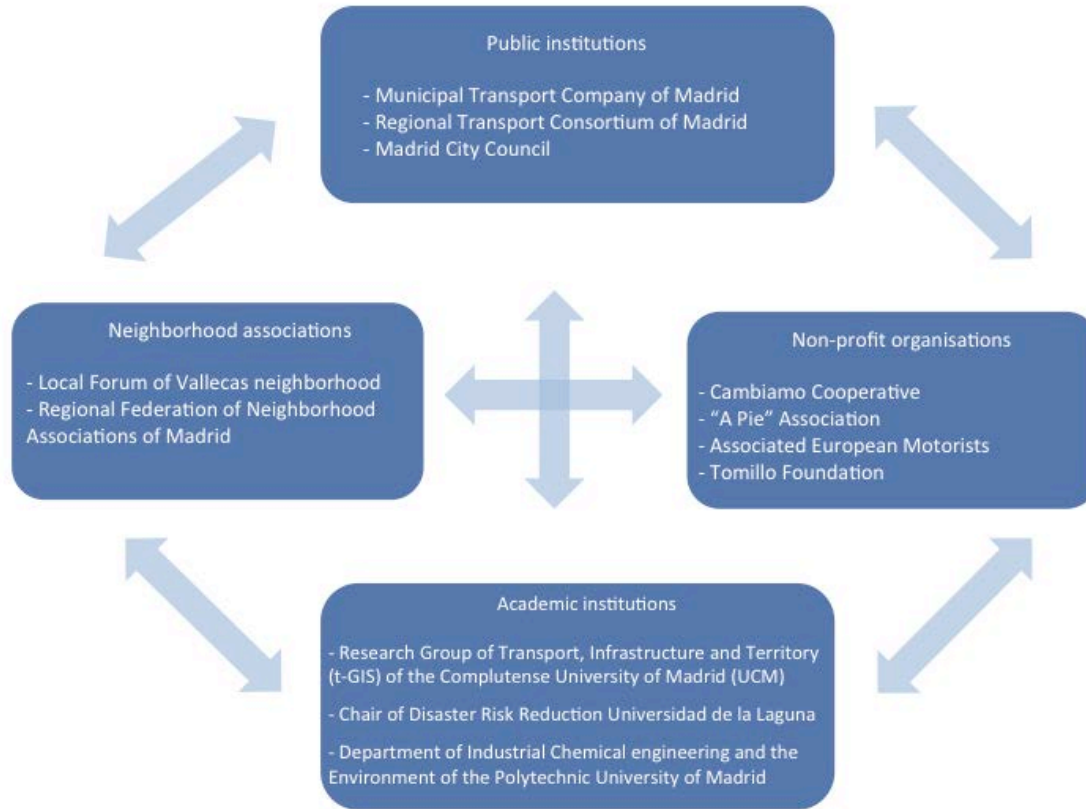


Figure 1: Interviewed stakeholders classified into four groups

4 Results

In the following section, the results are presented, moving from the general to the specific. The results of the interviews show several common points among all the participants. On the one hand, all the interviewees agree on and recommend, in addition, a greater use of public transport. Related to the use of the car, it is suggested that despite representing less than 50% of the displacements, the amount of resources and public space allocated to the car is very high. Three (25%) interviewed agree that this factor is so influential that the morphology of the city in recent years has been subjugated to the needs of the car. Six of the Participants interviewed (50%) consider that public space is "invaded" by the car and should be recovered in favor of pedestrians and more sustainable forms of public transport. Participant 9, from the Tomillo Foundation, refers to the excess of cars and how it is reflected in the use of the land. He explains that most of the land is designed for transport by private vehicle, and also points out the health problems derived from the excess use of the private vehicle, from deaths due to pollution, to noise, through accidents. Participant 4, from the local forum of Vallecas points out that the electrification of cars would not be an adequate solution to the problem from his point of view, *"A problem is tackled while it is generated. Congestion cannot be solved by investing in vehicle electrification. People should be discouraged from using private vehicles, either electric or combustion."* Participant 10, from the academic field, also points to the car as the cause of an air quality problem.

Another commonplace among the actors is the need to adapt bicycle mobility. None of the interviewees considers that the appropriate way is how it is conceived by the municipal bicycle service (BiciMAD) today. Although they considered that BiciMAD was "*a step forward*", the Participants interviewed consider it insufficient. From the Regional Transport Consortium of Madrid, Participant 3, opts for an extension of BiciMAD, which could cover other municipalities. They also consider that many of the lanes are designed for recreational use over a really functional use. There are lanes that are designed to be used in a recreational way during the weekend, especially surrounding the central almond, this is the opinion of Participant 4, from the Local Forum of Vallecas. Some actors consider that the bike lane should be a specific isolated lane focused solely on the use of bicycles, others consider that users should be integrated into the usual traffic lanes, making them friendlier towards them. In Madrid it is going in this second direction, with very poor facilities to promote the bicycle, according to Participant 4. In addition, Participant 10 points out that it is important to see the profile of the types of trips that BiciMAD "eliminates", which are possibly not those that were previously made by car, but other forms of sustainable mobility, such as walking or cycling.

Regarding public transport, all the Participants interviewed (n=12, 100%) consider that public transport is essential to move towards the decarbonization of transport in large cities. They consider that greater investment in public transport is necessary, this is the opinion of Participant 5, of the Regional Federation of Neighborhood Associations of Madrid (FRAVM). From the Transport Consortium, Participant 3 points out that before the 2008 economic crisis there was more supply than demand for public transport, but that after the crisis there is more demand. Participant 10, from the T-GIS group of the UCM, believed that if people were to stop using the car, they should be offered an efficient alternative, and in many situations public transport in Madrid is not. The same participant observed that a trip by public transport is sometimes 3 or 4 times slower than by private vehicle. A shortcoming pointed out by Participant 1, of the Municipal Transport Company of Madrid, is the difficulty of going from one peripheral neighborhood of Madrid to another, the participant comments that public transport is mainly designed to go from the periphery to the center or vice versa, and to move within the center, but in the periphery it is very lacking. From the Consortium, Participant 3 emphasizes the idea of using Big Data to improve the efficiency of public transport; using mobility data, routes in which the bus is empty would be avoided, and more means would be allocated when some stops or stations are more crowded. This use of Big Data can be used for the integration of all modes of sustainable mobility in a single app, thus forming the so-called MaaS (Mobility As a Service), which in Madrid is still very incipient, but will be increasingly important, as expressed by Participant 10.

From the Local Forum of Vallecas, Participant 4 points out that Madrid has a higher percentage of trips on foot than other cities, it is a more "walkable" city, although in part it may be due to the fact that it has a favorable climate for walking, compared to other European capitals, much rainier. Participant 6 also indicates that adequate steps towards pedestrianization are not being taken. This opportunity to enhance the role of the pedestrian is also pointed out by the Regional Transport Consortium of Madrid. According to Participant 2, the walkability of a city is imperative to achieve sustainable mobility goals and walk towards a city where 1/3 of the trips are made on foot, 1/3 by public transport, and 1/3 by bicycle. As for the first mode, the objectives have been achieved, but by bicycle, it has hardly increased compared to recent years.

Regarding the territorial development model, some participants considered that the current Urban Action Plans (PAUs) are a problem for a city that wants to carry out a sustainable transport development. Both Participant 4 and Participant 5 (17%) identify PAUs as one of the most important challenges for sustainable mobility. They explain that by specialising spaces, uses are dispersed and public transport becomes less efficient because there is less population density. In addition, separation of spaces makes many more car trips necessary, as it does not have services such as a health center close to home. Participants 4 and 10 point out that the inefficiency of public transport over long distances discourages the use of this mode of transportation. Participant 7 asserted that growth should be oriented towards the city of 15 minutes, only this model of city, said this participant, can considerably reduce pollution. Participant 11 points out that current patterns of urban growth hinder sustainable development.

Another issue on which several participants agree is the need to involve companies. 4 Participants (33%) consider that companies have to be part of the dialogue on mobility. With the COVID-19 crisis, teleworking began to be talked about as a considerably widespread reality. 4 Participants (33%) mention teleworking as an opportunity to improve mobility. That is a trend that can be tried to follow in order to avoid unnecessary daily trips, but for this a dialogue must be established between companies, trade unions and civil society. Despite this, the entire reduction in travel cannot fall on teleworking. Participant 8 points out that we must also walk towards remote work to substantially reduce the mobility needs of the people of Madrid and reduce the number of vehicles in circulation. Participant 8 mentions the importance of teleworking, but that it does not have to be only from home, but offices can be set up in certain areas to avoid excessive displacements.

Participants 4 and 6 mention “Madrid Central”, the low-emission zone established in 2018, as a useful measure to control private vehicle traffic. The interviewees who have mentioned Madrid Central (4, 6, 7 and 9, 33%) think that reducing the number of cars circulating in the city center is a correct decision, but insufficient, more could be done. Even sectors presumably favorable to the use of the car, such as Associated European Motorists, indicate that the environmental measures of Madrid 360 are adequate, and low emission zones and the technological renewal of the vehicle fleet must be promoted.

A problem that several interviewees mentioned ($n=3$, 25%) was the externalities generated by the delivery of packages from online commerce. Participant 3 as well as Participant 5 and 12 urge to find a solution to the problem known as the “last mile”, considering that it is not adequate the way it is currently resolved, since it fills the streets with delivery vans, which sometimes make traffic very difficult for both pedestrians and drivers, in addition to generating pollution.

Another reading that is extracted from the answers is the need to make ambitious plans, adding as many actors as possible, with the City Council and the Regional Government of Madrid as proactive parties in this change. Thus, Participant 7 mentions the need to make systemic policies and leave behind sectoral policies, since they are not very fruitful in the long term. Participant 12 also points to large-scale change, the relocation of businesses and the change of land uses, in the same direction pointed by Participant 10, who mentions “*superblocks*” as a possibility.

4. Discussion

The results of the interviews suggest some clear trends, pointing in different directions, which we have tried to structure in 4 different scenarios (Table 2). We have tried to be as faithful as possible to the discourses of the agents, leaving the scenarios to arise based on the trends that seemed to have the most importance in the speeches. Unlike other scenario development processes, no opposition or dichotomy has been sought in the set of scenarios. Therefore, a Business as Usual scenario has not been established (everything remains the same), since it does not seem likely that no change will be made. Nor have the guidelines of the Shared Socioeconomic Pathways (SSPs) been followed (O'Neill et al 2014) since they try to differentiate between “good” and “bad” futures, an unhelpful simplification in our research, which looks for options considered desirable or viable by the agents interviewed. In this sense, we consider our qualitative approach useful as a means through which agents expose their vision, through which we elaborate the following scenarios.

The first scenario that can be considered is a scenario related to **Remote Working**. In this case, the important challenge would be to generate dialogue between various social agents to facilitate a systematic transition towards a new work model that leaves no one behind. As we have seen during the covid-19 crisis, great inequalities have arisen between those who have jobs easily convertible into remote, and those who do not. Companies will have a key role, along with unions and administrations that would have to negotiate a fair agreement, not only for those sectors susceptible to teleworking, but also for those less susceptible, being manual, related to the care of people, or frontline services. It will also be necessary to solve the difficulty that many

people have encountered in working from their residence, creating or enabling several remote work centres. The latter could help orient the city towards a more polycentric model, thus shortening the distances travelled by work trips, and reducing pollution.

The second scenario, which brings together many key elements of the discourse of the interviewees is that of **The 15-minute City**. This is a radical change from the current conception we have of the city. It is necessary to restrict the use of the car, as well as the creation of the so-called "superblocks", and in general, opt for a traffic-oriented development. An example of this development is in Barcelona, where they have been quite successful, winning the European Prize for Urban Public Space in 2018. Therefore, it seems necessary a great mobilization of resources, and a "master plan" for the city, guided and implemented by benevolent public administrations, dedicated to improving the well-being of citizens. While it is true that this strategy would have a top-down logic, the citizen demands must be heard. At the same time, this cannot cover up the need for an improvement in long-term mobility policies, of which citizens may be reluctant. It is worth asking whether the various coalitions of interest that make up the public policy of the Spanish capital would have sufficient stability to be able to implement the necessary measures in the face of possible citizen opposition.

A third scenario that was identified was the **Electric City**, focused on the electrification and decarbonization of both public and private transport. In this case, the state would make a large investment to electrify the Madrid public transport vehicles fleet. This can be considered, to use the terminology of Mazzucato (2013) "entrepreneurial state". In this case, the state invests a large amount of money, aware that the investment is not only convenient, but necessary. Public spending will be reversed in the long term by higher air quality and cheaper, more effective and efficient transport that improves the quality of life in the city for its inhabitants and visitors. Logically, this scenario presents great economic opportunities for the automotive sector, and other private entities linked to the manufacture and supply of electric vehicles, therefore, the private sector could be considered in part beneficiary of this scenario.

The fourth scenario is what we have called the **Public City**. This scenario requires involvement on the part of public institutions, although not necessarily major institutional changes, megaprojects or non-repayable investment. In this case, the improvement of mobility is sought without leaving anyone behind. Thus, quality public transport must be ensured for everyone, without forgetting the neighbourhoods with less purchasing power, which are usually less connected than those in which the majority of the economy is concentrated. This scenario focuses its efforts on social justice and improving public health. This scenario should also facilitate bottom-up initiatives that occur in communities and civic centres, and listen to the citizen demands regarding mobility. The administration in this case would have to be a facilitator of this participation, since the most disadvantaged sectors tend to participate less in politics than those more affluent.

Table 2 shows the results of the SWOT analysis of the 4 sustainable mobility scenarios.

	Teleworking	15 minutes city	Electric city	Public city
Weaknesses	Low participation of companies and trade unions	Involvement of many multilevel administrations	Need for new infrastructure	It needs citizen involvement of depoliticized sectors
Threats	Excluded sectors of the population	Rejection by citizens	Spending and indebtedness	Rejection of certain sectors

Strengths	Saving	Greater connection and sense of community	Citizens predisposition	Improved quality of life
Opportunities	Improves productivity and quality of life	To be an example of sustainable development	High value-added employment	Promotion of the social lift

Table 2: SWOT analysis of the different proposed scenarios

Table 2 is intended to help to identify the different scenarios and their chances of success, as well as the weak points to consider before starting the dialogue with the agents involved. We can conclude by saying that any of these scenarios proves to have great potential. All are already under consideration, or likely to be taken into account by public administrations during the coming years. In addition, they are not mutually exclusive, the development of one scenario may involve the development of another scenario (at least in part) thus increasing the chances of success.

The scenario development process we have presented in this paper differs from some other scenario approaches that emphasize variations from a “business as usual” baseline (PRELUDES), try to separate possible future pathways into extremes or opposites (see e.g. SRES, SSPs) or look for imaginative visions of (utopian) futures which participants might desire. Our approach has some similarities with so-called Backcasting (Robinson 1990), in which concrete objectives are supposed to have been met at some future moment, and scenario developers then work backwards to see how to attain them – or as Bishop et al (2007) would have it “leap out into the future, jab a stake in the ground, and then work backward on how we might get there”. However, in our case, our objectives are defined by the stakeholders themselves, as a response to the first interview questions (“what are the key challenges for environmental sustainability related to transport in Madrid (Q1) and how can these challenges be met? (Q2)). This was a necessary step given the historic difficulty of securing the agreement of different stakeholder coalitions on objectives for sustainable mobility, and was intended to draw out different lines of action based on different stakeholder priorities. The other main difference with many scenario-based approaches is our interest in the implementation of concrete actions in the short to medium term, rather than in broader imaginaries of possible futures (see, e.g. Hewitt et al 2021). Our scenarios are intended to explore the “art of the possible”, and in this sense are allied with logic-chain or outcomes-based approaches (ref, ref). However, we do not make any attempt to constrain the scenarios, as emergent from stakeholder discourse, around existing policy measures or actions already in force, around which discussion and detailed analytical work already exists (see, e.g. Izquierdo et al 2020). In this sense, our scenarios represent a common-pool resource of ideas from the perspective of divergent stakeholder coalitions, about what should be done to comply with international agreements and improve the quality of the environment in a large European city, and how these broad goals should be achieved.

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