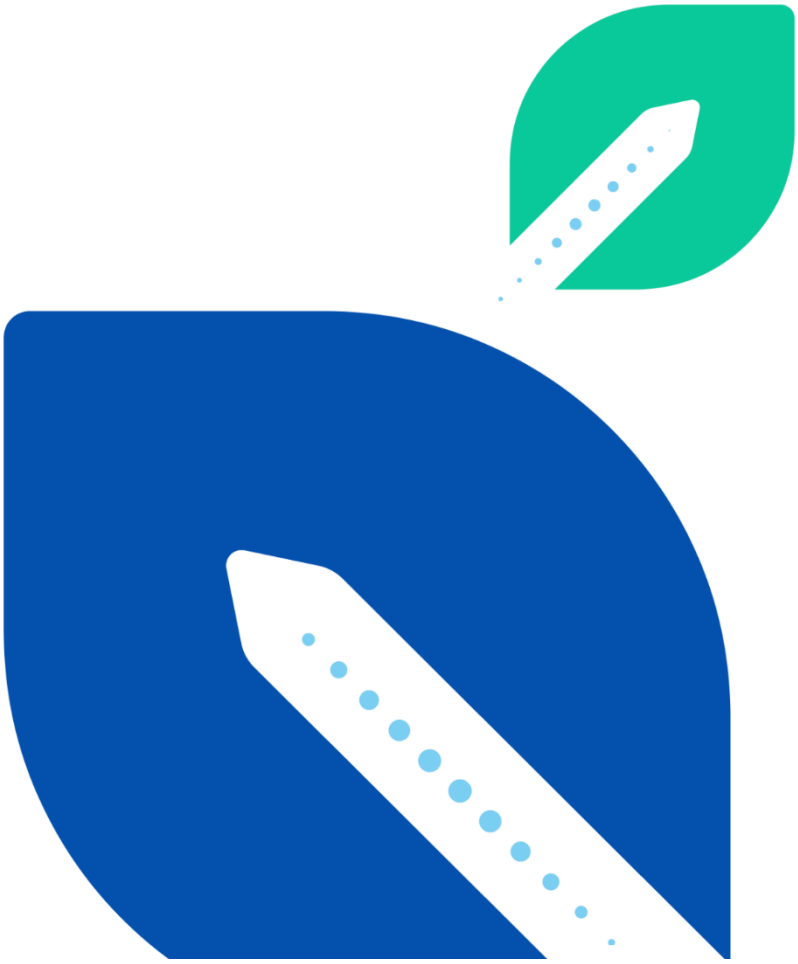
D3.2 Sustainability impact analysis of city-specific scenarios

CERTH



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Contributing Authors

Name	Organisation
Aristos Halatsis	CERTH
Elpida Xenou	CERTH
Georgia Aifandopoulou	CERTH
Sara Marie Tori	VUB
Geert Te Boveldt	VUB
María José Rojo	POLIS
Paulina Mlodawska	ILIM
Malgorzata Kirchner	ILIM
Marcin Wolniak	KALISZ
Aleksandra Kasprzak	KALISZBIF
DÁVID Ákos	BUDAPESTKOZUT
VÁGÁNY András	BKK
LÉNÁRT Máté	BKK
Marco Mazzarino	VIU
Lucio Rubini	VIU
Luca Coin	CDPA
Carlo Masetto	CDPA
Carolina Navarro	FVP
Gabriel Ferrús	FVP
Marcos Roselló	FGV
Ebtihal Sheety	Technion
Ayelet Galtzur	Technion
Simona Leibovich	TLV
Batel Eskohl	TLV
Haggai Yaron	TLV
Beatriz Royo	ZLC
Teresa de la Cruz	ZLC

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List of acronyms

Acronym	Explanation
CA	Consequence Area
CI	Consequence Indicator
PT	Public Transport
VIU	Venice International University
TLV	Tel Aviv

Executive Summary

One of the SPROUTs objectives is to foresee and determine the impact of urban mobility drivers on urban policy which will help afterwards formulating an appropriate city-led innovative policy response to navigate urban mobility in transition.

Towards this direction, city-specific 'do-nothing' scenarios have been created in the framework of Task 3.1. which describe the possible development of the urban mobility system in the first-layer cities if no new policies are introduced to harness transition. Three future scenarios per each 1st layer SPROUT cities have been developed.

Following the development of these scenarios though, it is crucial for the project to identify the sustainability impact of the new technologies, business models and user needs on urban transport and sustainability. Thus, in the framework of this deliverable, a sustainability impact analysis of the narrative future city-specific scenarios has been implemented.

For each 1st layer SPROUT city, the expected sustainability impacts of the future scenarios have been assessed, based on a consequence analysis. The consequences analysis is a process of examining the possible positive or negative effects of a planned activity or a potential incident, independent of frequency or probability. The approach that was followed for assessing the sustainability impact of each SPROUT city's do-nothing scenario in the time horizons 2025-2030, consists of three methodological steps, including seven activities.

- The first methodological step involves the development of the consequence analysis framework that will set the ground basis of the consequence analysis and will guide and support the impact assessment process by the cities. It includes three activities: 1) Identification of the main consequence areas and the draft consequence indicators; 2) prioritisation and finalisation of the list of consequence indicators; 3) Development of the "Continuum of Performance" for each consequence indicator.

- The second step is the data collection from the SPROUT 1st layer cities. For assessing each SPROUT scenario, three dedicated surveys were designed per 1stlayer SPROUT city. The surveys were made available online using the SurveyMonkey platform to the 1st layer SPROUT cities. Due to the Convid-19 pandemic, the surveys were distributed either separately to each stakeholder or the cities implemented a virtual workshop for reaching consensus among their stakeholders.

- The third and final step is the analysis of the data collected and the presentation of the main sustainability impacts of future scenario to each 1st layer SPROUT's city's mobility state.

As a next step, in Tasks 3.3 (Policy impact analysis of city-specific scenarios), these scenarios will then be analyzed through policy impact analysis. The polished version of the narrative scenarios will be presented in Task 3.4 (Validation and development of city-specific narrative scenarios

1 Introduction

1.1 SPROUT project introduction and aims

SPROUT provides a new city-led, innovative, and data driven policy response to address the impacts of the emerging mobility patterns, digitally-enabled operating and business models, and transport users' needs. Previously tested and implemented policy responses employing access restrictions, congestion charging or infrastructure provision, seem unable to adequately address the changes underway in the urban mobility scene. Furthermore, any policy response should take into account all stages of the policy lifecycle and should have an eye not only to the present, but also to the future.

Therefore, starting from an understanding of the transition taking place in urban mobility, SPROUT will define the resulting impacts at the sustainability and policy level, will harness these through a city-led innovative policy response, will build cities' data-driven capacity to identify, track and deploy innovative urban mobility solutions, and will navigate future policy by channelling project results at the local, regional, national and EU level. To achieve its goals, SPROUT will employ 6 pilot cities (Valencia, Padua, Kalisz, Budapest, Tel Aviv and Ningbo) with real-life policy challenges faced as a result of urban mobility transition in both passenger mobility and freight, covering urban and peri-urban areas, different emerging mobility solutions, and context requirements. These pilot cities are the project's 1st-layer cities, the results of which will be evaluated in the project's nine 2nd-layer cities, who are the validation cities. This enables the project to adopt a true city-led approach.

The project pays special attention to the needs of vulnerable groups and users with different cultural backgrounds, also taking gender issues into account. SPROUT ensures an active participation of numerous representatives from authorities of small and medium-sized cities through a 3-layer structure of cities' engagement approach, and through the creation of an Open Innovation Community on Urban Mobility Policy.

1.2 Aim of the deliverable

The main objective of this deliverable is to identify and assess the expected sustainability impacts (consequences) of the mobility scenarios formulated in T3.1.

The impact assessment is based on an in-depth analysis of the economic, environmental and societal consequences of the 1st layer SPROUT cities' mobility scenarios. The consequence analysis is a process of examining the possible positive or negative effects of a planned activity or a potential incident, independent of frequency or probability. In the context of SPROUT, the main questions, that this deliverable responds to, are the following:

1) Which are the main consequence areas that will be affected by the SPROUT scenarios, per each sustainability dimension: *Economy, Environment & Society*?
2) Which are the expected opportunities and threats of each SPROUT scenario to each consequence area and how will these positive/negative consequences evolve in the time horizon, 2030 -2050?

The sustainability impact assessment was undertaken by local experts and stakeholders of the 1st layer SPROUT cities using a consequence matrix that has been structured by the SPROUT research partners and authors of this deliverable.

1.3 How this deliverable relates to other deliverables

This deliverable builds upon the outputs of Task 3.1. “Co-creation of city-specific scenarios”. The main outputs of this document, together with the outputs of Task 3.3 “Policy impact analysis of city-specific scenarios”, will be further validated and (if needed) revised in the framework of Task 3.4 “Validation & development of narrative scenarios”, where the final mobility scenarios and their expected impacts will be presented.

1.4 Structure of the deliverable

The present deliverable is structured in two sections:

1) **The Methodology section**, which presents the context of the sustainability impact assessment. i.e. the structure of the consequence analysis and the design of the implementation phase.

2) **The Implementation section**: which presents the results of the sustainability impact assessment per scenario defined for each 1st layer SPROUT city.

2 Methodology

The approach that was followed for assessing the sustainability impact of each SPROUT city's do-nothing scenario in the time horizons 2025-2030, consists of three methodological steps, including seven activities (Figure 1). The first step is the development of the consequence analysis framework. The second step is the data collection from the SPROUT 1st layer cities through virtual workshops, followed by the third and final step which is the analysis of the data collected and the identification of the impacts of each scenario in the three sustainability dimensions: Economy, Environment and Society.

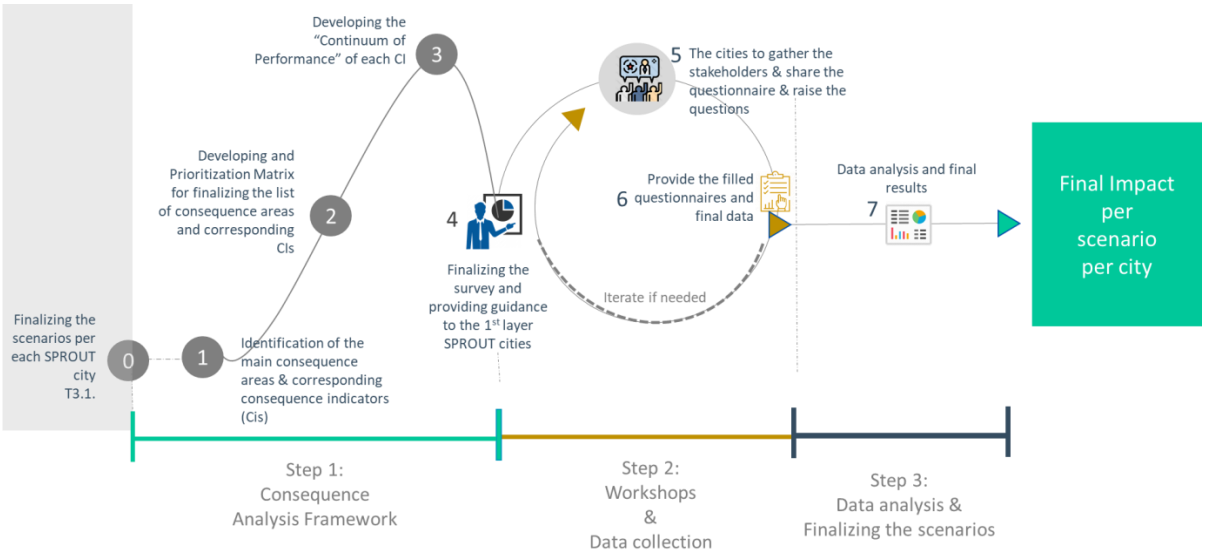

Figure 1 Methodological Approach

Step 1: Consequence Analysis Framework

The first methodological step involves the development of the consequence analysis framework that will set the ground basis of the consequence analysis and will guide and support the impact assessment process by the cities. It includes three activities: Identification of the main consequence areas and the draft consequence indicators; prioritisation and finalisation of the list of consequence indicators; Development of the "Continuum of Performance" for each consequence indicator.

Activity 1: Identification of the main consequence areas and the draft consequence indicators

The first activity within Step 1, concerns the identification of the main components of the consequence analysis (Figure 2) which are: 1) the identification of the main consequence areas within each of the three sustainability dimensions and 2) the definition of measurable consequence indicators for assessing the different aspects within each consequence area

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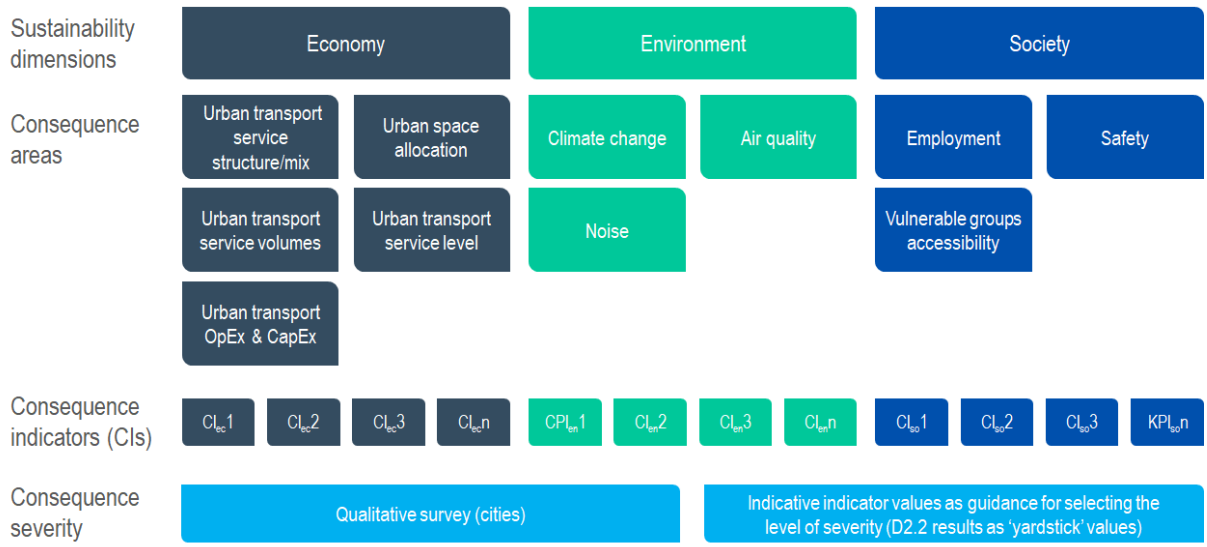


Figure 2 Main components of the Consequence analysis

The identification of these areas and the Consequence Indicators (Cis) preliminary assigned to each area, was a result of a thorough desktop research and a close cooperation, through several web-meetings and iterations, among the research partners involved in this deliverable (CERTH, VUB, ZLC, WI).

The list of consequence areas together with a brief description and the correspondent list of CIs per each area are the following (please see also Annex I):

- **Sustainability dimension: Economy**
  - **Consequence Area Econ CA1: Urban transport service structure and mix:** CA 1 includes all impacts related to the mix of transport modes, the type of vehicles used and the type of mobility services that operate or will operate in the city's' mobility environment. Some indicative assessment questions in order to better identify which are these consequences are: *-Which transport mean will rule the streets? Will the citizens use more public transport (PT), their car or shared car, their own or shared e-scooter/bike or will they just walk? -Will the last mile operators use more environmentally friendly modes for last mile deliveries? – How is micro-mobility (i.e. e-scooters and shared bikes) expected to evolve in your city?*

    CIs initially identified : *Shares of: public transport; private cars; shared cars; cycling/scooters; walking (% of passenger-trips); Number of shared e-scooters; Number of shared dockless bikes; Share of next hour to same day goods delivery services (% of daily deliveries); Share of green deliveries (cargo bikes, electric tricycles, green autonomous/automated means) (% of daily deliveries); Share of electric vehicles (% of fleet driving in the city)*

  - **Consequence Area Econ CA2: Urban space allocation:** CI2 concerns the allocation of public urban space among the different modes of transport. Some indicative assessment questions in order to better identify which will be the related impacts are: *will the public transport /cars/cycling/scooter lanes be more congested*

so the share of urban space for public transport /cars/cycling/scooter will increase? - Will there will be a need for dedicated lanes for autonomous vehicles?

CIs initially identified: *Shares of urban space: public transport; private/shared cars; cycling/scooter lanes; pedestrian areas (% of area); Number of autonomous/automated PT services on dedicated lanes; Number of urban micro-delivery facilities*

- **Consequence Area Econ CA3: Urban transport service volumes:** CI3 concerns the volumes of freight and passenger flows, the level of congestion on the streets, the number of movements that are taking place on the streets e.tc. Some indicative assessment questions in order to better identify which are the related impacts are: *- Will the average number of cars entering the city daily, or the number of goods' delivery trips, increase or decrease?- Do you expect the streets to be more congested or not?*

CIs initially identified: *Average number of private cars entering, driving through or within the city on a daily basis; Average number of daily urban freight trips; Urban traffic congestion (% of travel/trip time in excess of that normally incurred under light or free-flow traffic conditions)*

- **Consequence Area Econ CA4: Urban transport service level:** CA4 concerns the service level of the urban transport services provided. Some indicative assessment questions in order to better identify which are the relatedimpacts are: *-Do you expect the costs of (alternative to PT) transport modes such as bikes, e-scooters to increase? - Do you expect urban delivery prices to increase or decrease? -Do you expect the frequency of goods deliveries within the city to be affected? - Do you expect more passengers to use smart payment/validation methods for public transport services?*

CIs initially identified: *Costs of alternative modes of urban passenger transport; Share of passengers that use a smart method to pay for or validate a PT ticket (%); Share of PT vehicles that are equipped to provide real-time data that is released to passengers (%); Urban deliveries prices (€/package); Goods delivery frequency (average number of weekly deliveries to shops & consumers)*

- **Consequence Area Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):** The final consequence area under the Economy dimension concerns the potential impact on the expenses required for developing and operating the current/future urban mobility system. Some indicative assessment questions in order to better identify which are the related impacts are: *Will this scenario require additional private or public investments (%of existing annual investment costs) or not?*

CIs initially identified: *Maintenance cost of existing infrastructure (% of existing annual cost); Additional public investments required (% of existing annual investment cost); Additional private investments required (% of existing annual investment cost)*

- **Sustainability dimension: Environment**
  - **Consequence Area Env CA 1: Climate change:** Env CA1 concerns the changes related to climate change and is measured by the level of CO2 emissions or GHG emissions.

    CI identified: *CO2 equivalent or GHG emissions from transport (% of GHG emissions from urban transport)*
  - **Consequence Area Env CA2: Air quality index**: Env CA2 concerns the amount of expected increase or decrease of the Air quality index of a city, as a result of urban mobility. The Air Quality Index (AQI) is a number used to report the quality of the air on any given day. The Index is based on measurement of particulate matter (PM2.5 and PM10), Ozone (O3), Nitrogen Dioxide (NO2), and Sulfur Dioxide (SO2emissions.[1]

    CI identified: European Air Quality Index
  - **Consequence Area Env CA 3: Noise :** Env CA3 refers to the amount of expected increase or decrease of the Noise emissions in a city, as a result of urban mobility.

    CI identified: Share of urban population affected by traffic noise, both day and night (% of urban population)

- **Sustainability dimension: Society**
  - **Consequence Area Soc CA1: Employment & social security:** Soc CA1 concerns mainly the potential changes to the structure, types of employment and social security levels and benefits. Some indicative assessment questions in order to better identify which are the related impacts are: *-Do you expect changes in the current levels of urban mobility employment? Do you expect an increase in Gig economy employment (i.e. independent contractors with no insurance & benefits)?*

    CIs identified: *Full-time employment in urban transport, for both passenger and freight transport (number of employees); Gig economy (external contractor) employment (% of total employees)*

  - **Consequence Area Soc CA2: Safety & security:** Soc CA2 addresses the safety and security issues that may come up due to changes in the urban environment**.** Some indicative assessment questions in order to better identify which are the related impacts are*: -Do you expect an increase in accidents involving e-scooters or bikes? -Do you expect an increase in the accidents involving delivering goods with bikes/e-scooters?*

    CIs identified: *Urban mobility accidents per 1,000 inhabitants; Share of urban mobility accidents involving micro-mobility means; Share of urban mobility accidents involving on-demand bike/scooter deliveries*

    Consequence Area Soc CA3: Access to mobility services: Soc CA3 addresses the potential changes to accessibility issues. Some indicative assessment questions

[1]Ricardo Energy & Environment (2016), "Services to develop an EU Air Quality Index", Report for European Commission DG ENV, ED 60428 EU AQI Final Report, Issue 1.1,

in order to better identify which are the related impacts are: *-Do you expect an increase in the affordability of using mobility services or not? -Do you expect an increase in the accessibility to transport services by vulnerable citizens?*

CIs identified: *Affordability of using mobility services (citizens' average annual cost of trips / annual income); Access to mobility services (ease with which all categories of passengers can use public transport); Accessibility for vulnerable groups to mobility services (ease with which vulnerable passengers can use public transport)*

The consequence indicators identified above constitute the initial list of assessment criteria for the scenario's sustainability impact analysis. **Taking into account the large number of indicators identified, and in order to avoid having a very long survey which could have a negative impact on the response rate from the city stakeholders, it was decided to undertake a prioritisation of the previous defined consequence indicators and include these in this cities' survey. This prioritisation process is described in the following section**

Activity 2: Prioritisation and finalisation of the list of consequence indicators

For defining which are these highest priority indicators that should be included in the city survey, a structured objective driven approach was followed, using a prioritization matrix. A prioritization matrix is an, easy to use, decision support tool which prioritizes a range of variables –in our case these are the consequence indicators-based on specific evaluation criteria[2]. The process that was followed for applying the prioritization matrix included two stages: 1) Developing the prioritization matrix by determining the main assessment criteria and their rating scale and 2) Circulating the matrix to the experts involved, collecting their answers and developing the master list of prioritized CIs 3) Deciding on the number of CIs to be included in the survey and concluding on the final list of Cis to be used in the survey.

Stage 1: Definition of the assessment criteria and their rating scale: Five selection criteria were used for prioritizing the draft consequence indicators defined in the previous section. The rating scale for assessing these criteria play also the role of the corresponding criteria weights. The list below presents the criteria selected and their rating scale.

I. **Criterion 1: How difficult is estimating the indicator's future state?** This criterion strengthens the feasibility of the survey and reassures the accuracy of the outcomes by excluding these indicators for which it is not possible to estimate their future state.

Criterion 1	Rating scale				
Estimating the indicator's future state is	not possible	slightly difficult	moderately easy	easy	very easy
	0	1	2	3	4

[2] Carol Gosenheimer, 2012 "Project Prioritization. A structured approach to working on what matters most",Office of Quality Improvement of University of Wisconsisn-Madison, Version 1.1.

I. **Criterion 2: Is the indicator related to an issue that in the past has been researched?** The second criterion highlights the areas where **a knowledge gap is identified** and where SPROUT could provide missing insight.

Criterion 2	Rating scale				
The indicator is related to an issue that in the past has been researched	extensively	to a large extent	moderately	slightly	not at all
	0	1	2	3	4

II. **Criterion 3: Is the indicator directly related to New Mobility Services?**
This priority criterion reflects one of the main objectives of the SPROUT Project, which is to address the impacts of emerging mobility services.

Criterion 3	Rating scale		
The indicator is directly related to New Mobility Services	No	Indirectly	Directly
	0	1	2

III. **Criterion 4: Is the indicator already included in the SPROUT Urban Mobility Transition Inventory?** Giving priority to the indicators that have been included in the SPROUTs Urban Mobility Transition Inventory and assessed regarding their current state of the 1st layer SPROUT cities (D2.2.) will provide additional opportunities for meaningful results. The local stakeholders will have a clearer picture of the current state of these indicators and a better understanding on what is really measured which will eventually result to more accurate outcomes in forecasting their level of change in the future.

Criterion 4	Rating scale	
The indicator is included in the Urban Mobility Transition Inventory	No	Yes
	0	1

IV. **Criterion 5: Does the indicator address a potential consequence already identified?**
In the framework of the scenarios building in D3.1, the local stakeholders involved have identified also a list of potential consequences that they expect as a result of the urban mobility transitions. This prioritisation criterion, ensures that the pre-identification of these impacts is taken into account.

Criterion 5	Rating scale	
The indicator addresses a potential consequence already identified	No	Yes
	0	1

Stage 2: Prioritisation of the CIs

The prioritisation matrix was circulated among the project research partners (CERTH, VUB, ZLC, WI) that were asked to assess each consequence indicator based on the five prioritisation criteria. The final scores have been collected and a prioritisation of the CIs was made.

Stage 3: Selection of the CIs to be included in the cities' survey.

Based on the prioritized list of CIs, three main selection scenarios were formulated: 1) Keeping the CIs that scored over 50% of the max score 2) Keeping the CIs that scored over 55% of the max score 3) Keeping the CIs that scored over 60% of the max score. Following a thorough discussion of the involved partners, the second scenario was chosen as the preferable one, taking into consideration the total no of CIs and the adequate coverage of the vast majority of the originally defined consequence areas. The final list of the consequence areas and corresponding indicators is presented in **Table 1.**

Table 1 Final list of consequence areas and indicators

	Expected impact on:
ECONOMY	**Econ CA 1: The urban transport service structure/mix.**
	Share of public transport (%)
	Share of car transport (%)
	Share of micromobility (%)
	Share of active transport (%)
	Share of car sharing transport (%)
	Share of green deliveries (cargo bikes, electric tricycles, green autonomous/automated means) (% of daily deliveries)
	Share of next hour to same day goods delivery services (% of daily deliveries)
	Number of shared dockless bikes
	Number of shared e-scooters
	Econ CA 2: The urban space allocation
	Share of urban space for public transport
	Share of urban space for private/shared cars
	Share of urban space for cycling/scooter lanes
	Share of urban space for pedestrian areas
	Number of autonomous/automated PT services on dedicated lanes
	Econ CA 3: The urban transport service volumes
	Average number of daily urban freight trips
	Average number of vehicles entering the city on a daily basis
	Econ CA 4: The city' s urban transport service level
	Costs of alternative modes of urban passenger transport
	Share of passengers that use a smart method to pay for or validate a PT ticket (%)
	Share of PT vehicles that are equipped to provide real-time data that is released to passengers (%)
	Urban deliveries prices (€/package)

	Goods delivery frequency (average number of weekly deliveries to consumers)
	Econ CA 5: The urban transport operational costs & required investment costs?
	Additional private investments required (% of existing annual investment cost)
ENVIRONMENT	**Expected impact on**
	Env CA1: Climate change
	CO2 equivalent or GHG emissions
	Env CA2: Air quality index
	Air quality index
SOCIETY	**Soc CA1: Employment & social security?**
	Expected impact on
	Gig economy (external contractor) employment (% of total employees)
	Soc CA2: Safety & security?
	Expected impact on
	Share of urban mobility accidents involving micromobility means (%)
	Share of urban mobility accidents involving on-demand bike/scooter deliveries (%)
	Soc CA3: Access to mobility services?
	Expected impact on
	Affordability of using mobility services (citizens' average annual cost of trips / annual income)
	Access to mobility services (ease with which all categories of passengers can use public transport)
	Accessibility for vulnerable groups to mobility services (ease with which vulnerable passengers can use public transport)

Activity 3: Development of the "Continuum of Performance" for each consequence indicator

For assessing the consequence indicators, identified in the previous activities, it is first necessary to select the appropriate impact rating scale for each CI and develop its continuum of performance. An Impact scale can be expressed either verbally under terms such as: Minor impact, Moderate impact, Major impact e.tc. or numerically such as from - -4 to +4, or -3 + 3 where, each number represents a level of impact. The continuum of performance corresponds to the acceptable values or value ranges that will be aligned to each point of the rating scale.

In order to avoid having different interpretations by the local stakeholders on the meaning of words such as "Minor" "Moderate" e.tc., a numerical rating scale has been chosen as the most

appropriate one for the survey. In terms of the scale's length, although Bendig (1954) [3] supports that the length of the rating scale is irrelevant with the level of reliability of the study, , as many studies reveal that there is a slight connection and it is preferable the number of scale points to exceed the two and three points of a Likert scale. Thus, for the needs of this survey, a 4 points Likert's scale has been chosen[4].

Regarding the selection of the interval values in the continuum of performance, an extended literature review of previous research surveys on assessing the mobility state of a city as well as a desktop research on business related articles as the main source for collecting information about the latest mobility trends, was implemented. Where no references could be found, the experience of the SPROUT partners involved was employed. The main purpose of this research was to avoid any misleading results of the assessment due to non-representative values indicated in the rating scale. The continuum of performance of each indicator and the correspondent references can be found in Annex I.

Step 2: Workshops and Data collection

Activity 4: Finalizing the survey and providing guidance to the 1st layer SPROUT cities

For assessing each SPROUT scenario, three dedicated surveys were designed per 1stlayer SPROUT city. The surveys were made available online using the SurveyMonkey[5] platform to the 1st layer SPROUT cities. CERTH provided, where needed, guidance and further clarifications on the content of the survey to the cities. The survey questionnaires are presented in Annex II of this deliverable.

Activity 5 &6: Circulating the survey to the local stakeholders & Collecting the city responses

As a result of the coronavirus crisis which occurred at the same period with the development of this deliverable, the implementation of physical meetings and workshops was not possible. Thus, the surveys were distributed either separately to each stakeholder or the cities implemented a virtual workshop for reaching consensus among their stakeholders. The main strict instruction that was given to the cities was to approach the stakeholders that are part of the city's' local ecosystem, identified and presented in WP2, D2.2. The implementation process, followed by each city is presented in the following chapter.

Activity 7: Data analysis and Final results

Following the city responses' collection, a statistical analysis of the results was implemented. For the data analysis, two different approaches were followed, depending on the response

[3] Bendig, A. W. (1954). Reliability and the number of rating scale categories. Journal of Applied Psychology, 38, 38–40.
[4] Jon A. Krosnick and Stanley Presser (2015), "Question and Questionnaire Design", Chapter 9 , Handbook of Survey Research, Second Edition, ISBN: 978-1-84855-224-1
[5] SurveyMonkey: An online survey tool, www.surveymonley.co.uk

generation process the cities followed. More specifically, 1) for the cities that implemented virtual workshops and followed a consensus building approach for filling in one questionnaire for each scenario per city, a presentation of the data collected is made. 2) for the cities that followed an approach of collecting responses through individual contacts with stakeholders, either through emails or personal interviews, a statistical analysis following the 70% majority rule is implemented. More specifically, when 70% of the stakeholders agree in a specific survey question, then we considered that consensus had been reached. In the cases, where the stakeholder's opinion is strongly divergent, a presentation of all different responses is included in the results.

The following chapter presents in detail the main outcomes of each scenario's sustainability impact assessment process, for each 1st layer SPROUT city.

3 Implementation phase: Sustainability Impact Analysis (SIA) per 1st layer SPROUT city

3.1 Valencia (Spain)

The first sub-chapter presents in detail the implementation process that was followed by the city of Valencia for collecting the necessary information. Following this, the results of the assessment process per each city-specific scenario are presented in the next sub-chapters

3.1.1 Implementation process: Stakeholders Network, Methods, Data collection

The city of Valencia shared the surveys with the local stakeholders and provided clear instructions in written. The survey was either completed and returned directly by the stakeholders or was completed by the city through interviews by phone. In order to help the local network understand in depth the scope and concept of the survey, the survey was also translated to the mother language of the participants (i.e. Spanish).

The stakeholders that were approached are familiar with the project's main scope and outcomes since they were also involved in the scenario's development process in the framework of Task 3.1. More specifically, representatives from the following entities were approached:

- Fundacion Valenciaport
- FGV
- MYRENTGO
- Autoritat de Transport Metropolità de València ATMV
- Movus
- Motor JR Valle
- ADISLEV-Asoc.Distribuidores de Bebidas y alim. a HORECA de la Com Valenciana
- EMT València
- ELECTRONIC TRAFIC, S.A.
- AYUNTAMIENTO DE VALENCIA
- Deloitte
- Clúster de Automoción de la Comunitat Valenciana, AVIA
- Barrio La Pinada

3.1.2 Sustainability Impact Assessment: Valencia Scenario 1

3.1.2.1 Valencia's first mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

Growing political support for mobility will ensure the completion of line 10 of Metrovalencia, which will mean an expected transfer of users from private transport to the PT option. it will also facilitate the transfer of current bus users to the new line, reducing the number of passengers on busses.

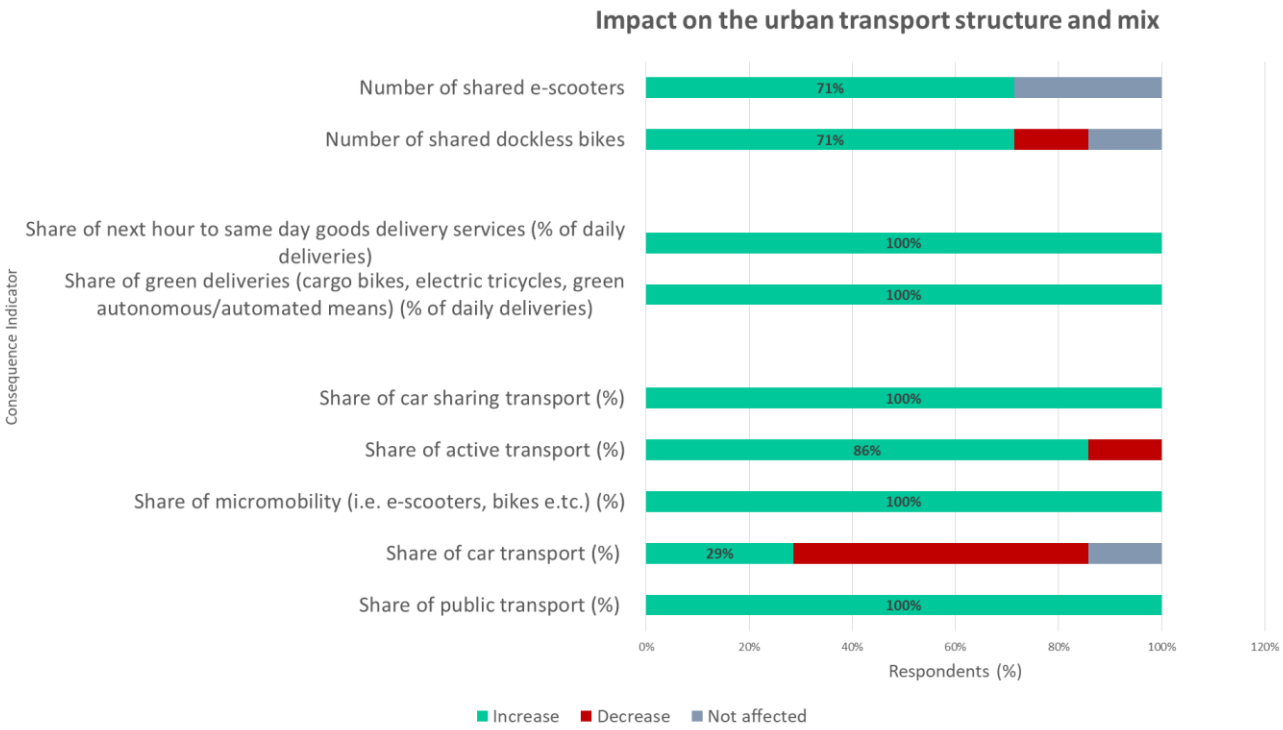
Due to an increase in corruption, the technical specifications for public procurement are not transparent and seem to be awarded in advance, the lack of coordination between administrations generates inefficiencies in the contracting of uncoordinated transport services and continued priority is given to contracts with the lowest budgeted costs proposals, which entails unforeseen costs. Higher taxation in favour of sustainable mobility will result in cleaner mobility. Strong growth in new employment arrangements will promote the efficiency of multimodality and competitiveness in logistics. Increasing tourism will lead to more mobility, but efficiency of services will increase, and lower cost of mobility. Ease of access to certain areas will increase. Packages will be developed for tourists' mobility that includes sustainable options, which provide new business opportunities. Strong growth of new business models will strongly impact last mile logistics, lead to a reduction in the number of private vehicles and lead to more collaboration between complementary mobility companies. **Online retail will grow strongly** and become more efficient with the use of big data technologies. Increasing urban densification will lead to lower transport costs. Strongly growing environmental awareness will influence people's choice of transport. Population decrease will lead to a lower supply of transport services, but strong growth in the electrification of mobility will lead to improved infrastructure. The growth of consumer and citizen-oriented digitalization will improve real-time information on transport options.

- ***Political support*** *for sustainable mobility, corruption, taxation, tourism, economic growth, number of people who choose transport other of car, urban density*: **increase**
- ***New employment arrangements, new business models*** *(e.g. collaborative consumption, sharing economy), online retail, environmental consciousness, electrification of mobility, adoption of smart-city technology, consumer- and citizen-oriented digitalization*: **strong growth**
- I*mmigration, population size*: **decrease**
- *Labour and employment*: **more regulation**

3.2.2.1. Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

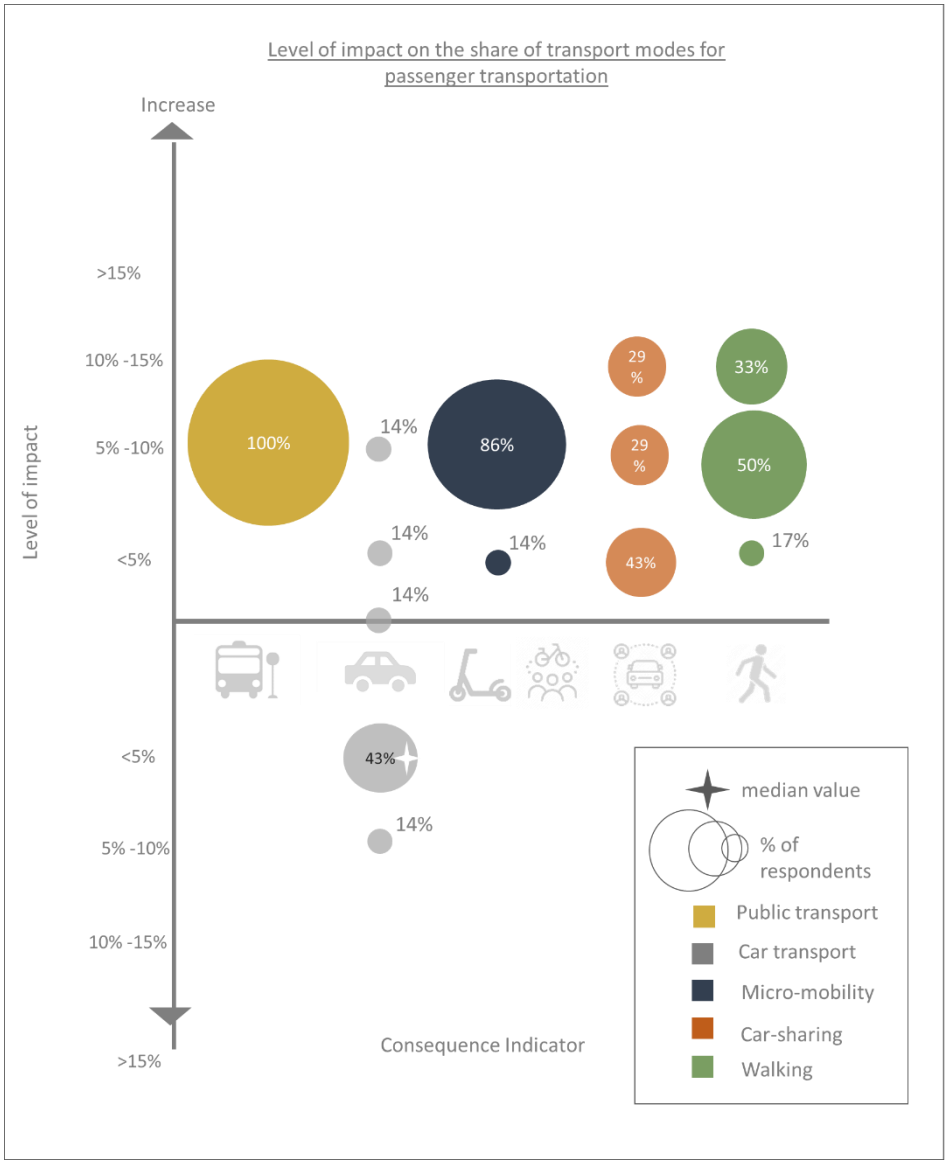
Based on the survey results, a common perception among the respondents on the evolution of this CA can be observed. Consensus has been reached on the assessment of the majority of the consequence indicators, with more than 71%, and in many cases even the 100% of the respondents to agree on the impact of the scenario to each indicator (Graph 1).



Graph 1 Impacts on the urban transport structure and mix (Valencia –scenario 1)

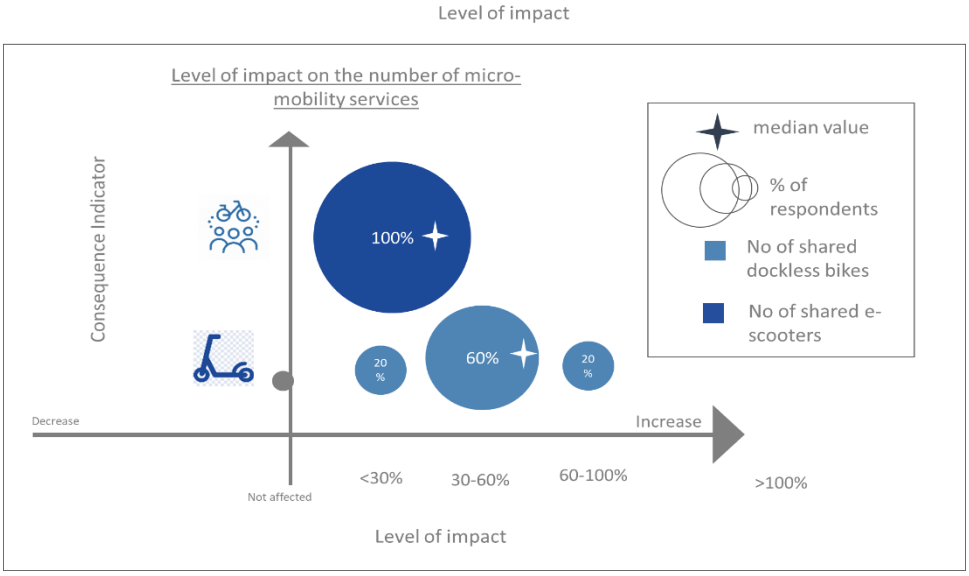
For these indicators, where consensus has been reached and the 70% majority rule was applied, the following analysis focuses on the opinion of the majority group of respondents while in the remaining questions the analysis shows the average opinion (median value) of all the respondents.

As shown in Graphs 2, 3 and 4 the stakeholders expect **a clear increase in the use of environmental friendly transport modes by the citizens**. Regarding passenger transportation, the city expects an increase of up to 10% in the share of active mobility, public transportation, micro mobility and car sharing. The increase in the population's environmental consciousness is also further justified by the slightly decrease -of up to 5%- in the share of private car use.



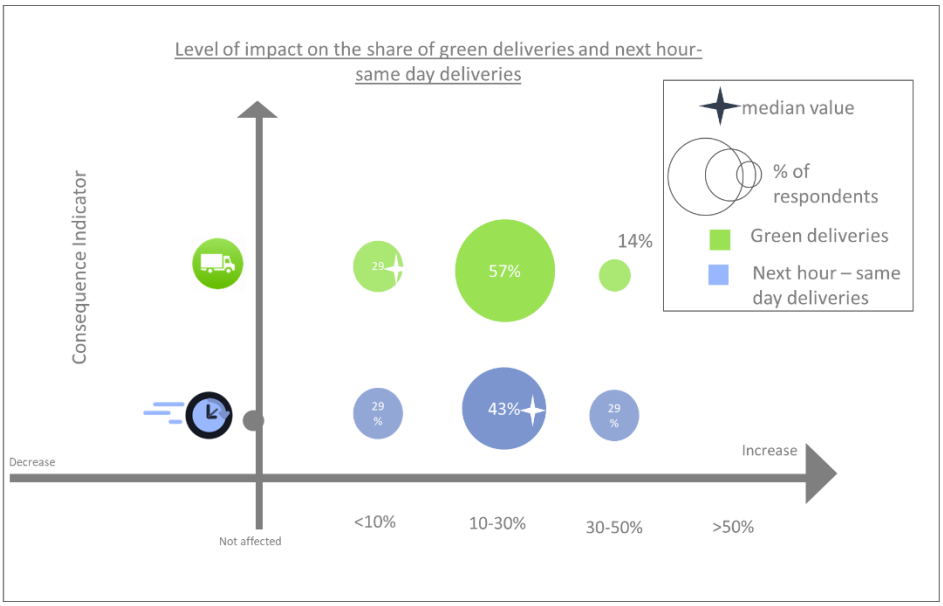
Graph 2 Level of impact on the share of transport modes for passenger transportation (Valencia-scenario 1)

Regarding the application of new mobility services, a stronger tendency towards the use of shared e-scooters rather than the use of dockless bikes is observed (Graph 3). More specifically, according to the following figure, an increase of up to 60% in the number of shared e-scooters is foreseen and an increase up to 30% in the number of shared dock-less bikes.



Graph 3 Level of impact on the number of micro-mobility services (Valencia - scenario 1)

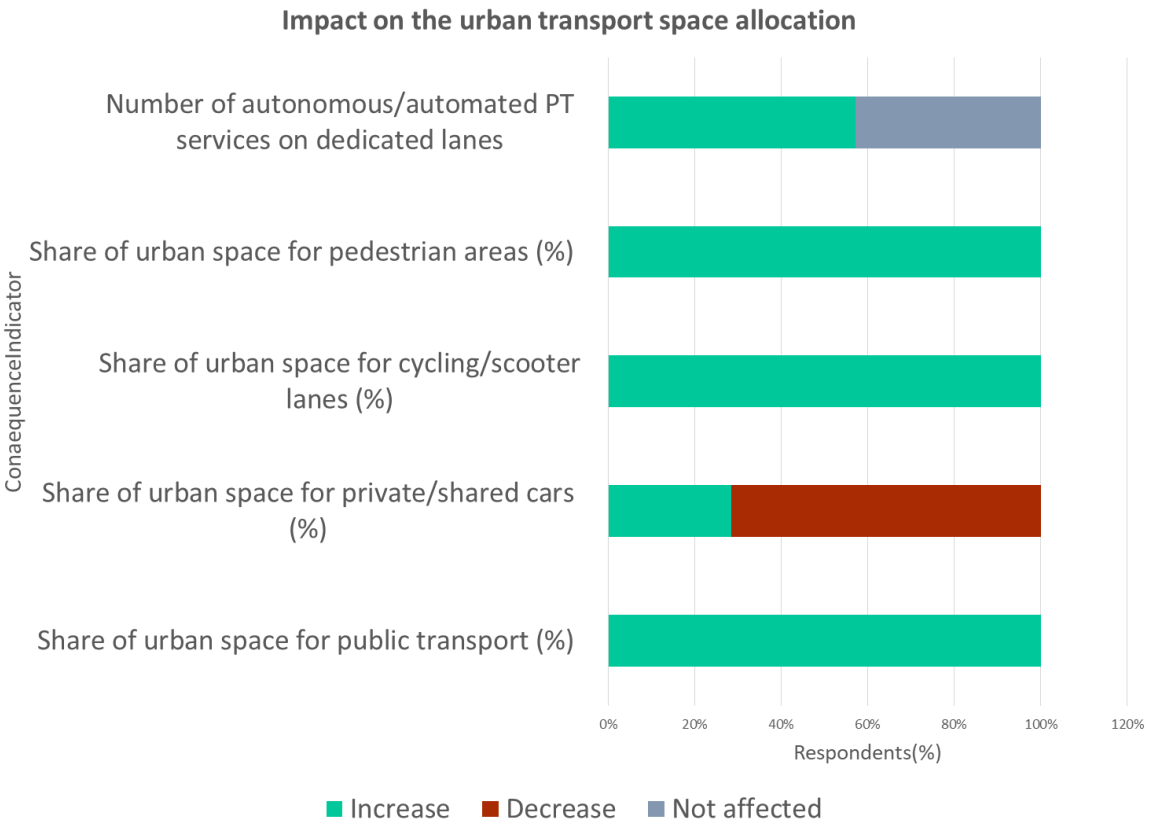
Finally, in terms of urban freight transportation, a full consensus has been reached and the figures show also a clear trend towards more green deliveries, with an **increase of up to 30% in the share of green deliveries** to be expected. **On the other hand though, the same increase in the next-hour to same-day deliveries is also expected (Graph 4).**



Graph 4 Level of impact on the share of green deliveries and next hour-same day deliveries (Valencia –scenario 1)

Econ CA2: Urban space allocation:

Taking into consideration the expected impact on the urban transport structure and mix presented in the previous CA, similar changes in the urban space allocation are also foreseen.

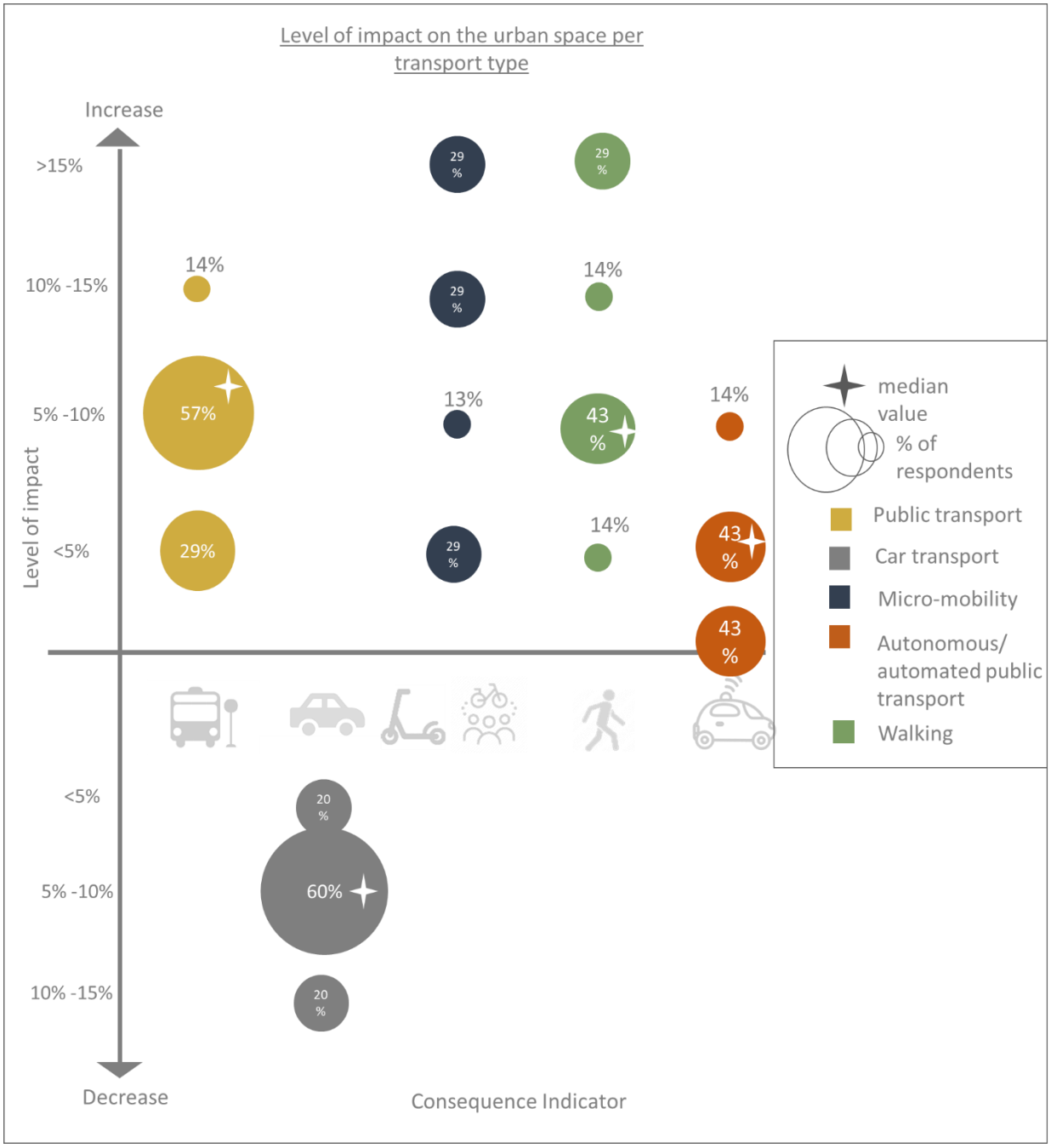


Graph 5 Impact on the urban transport space allocation (Valencia -scenario 1)

More specifically, the majority of the respondents (consensus has been reached), as presented in the following Graph, foresee an increase of up to 10% in the share of urban space for micro-mobility, for pedestrian areas and public transportation and a decrease of up to 10% in the urban space dedicated for car transportation.

A slight transition towards automated and autonomous mobility is also foreseen by the city. Taking into consideration the variety of perceptions regarding the level of impact on this indicator, since this is the only indicator where consensus has not been reached, the median

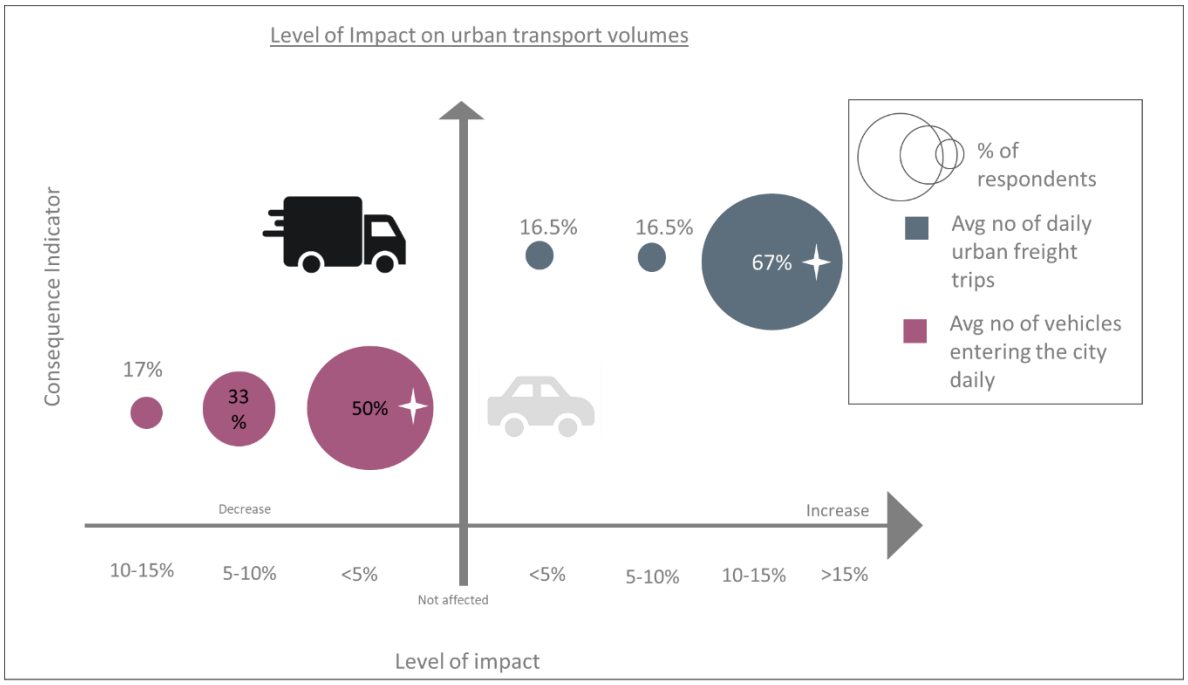
value shows a minor increase - up to 5%- in the number of lanes dedicated to autonomous and automated transportation.



Graph 6 Level of impact on the share of urban space per transport type (Valencia –scenario 1)

Econ CA3: Urban transport service volumes:

The anticipated increased environmental consciousness of Valencia's citizens, presented in the previous consequence area, seems to be enough for reaching an agreement in the potential positive consequences to the volumes of the urban passenger transport sector However this transition is not enough for having a strong impact to this consequence area since only a minor decrease, up to 5%, is foreseen by the majority of the respondents.

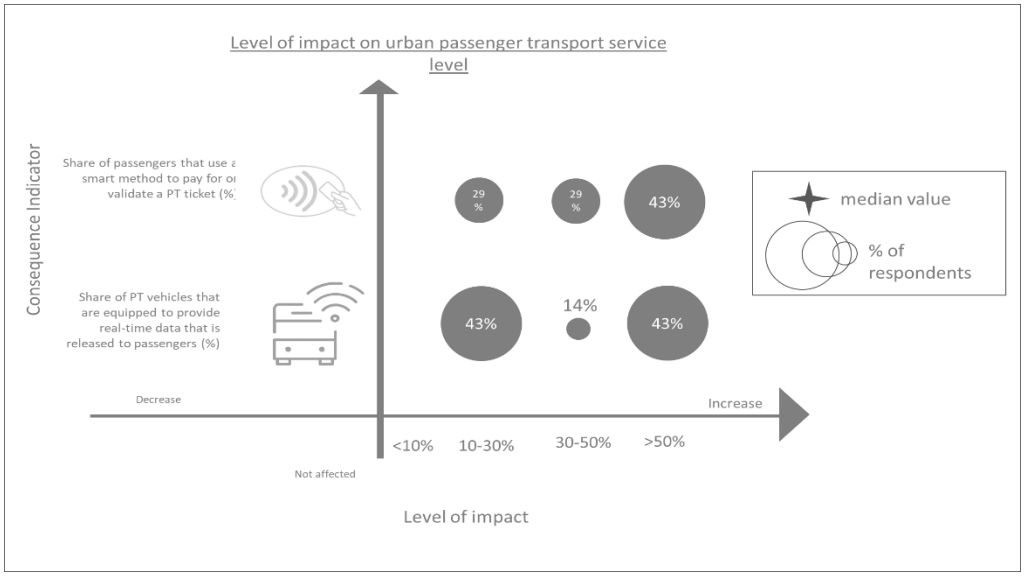


Graph 7 Level of impact on urban transport volumes (Valencia-scenario 1)

On the other hand though, the streets are expected to be more congested due to urban freight transportation. The expected increase in the next hour and next day deliveries, presented above, justifies the expected increase of up to 15% in the average number of daily urban freight trips implemented within the city.

Econ CA4: Urban transport service level:

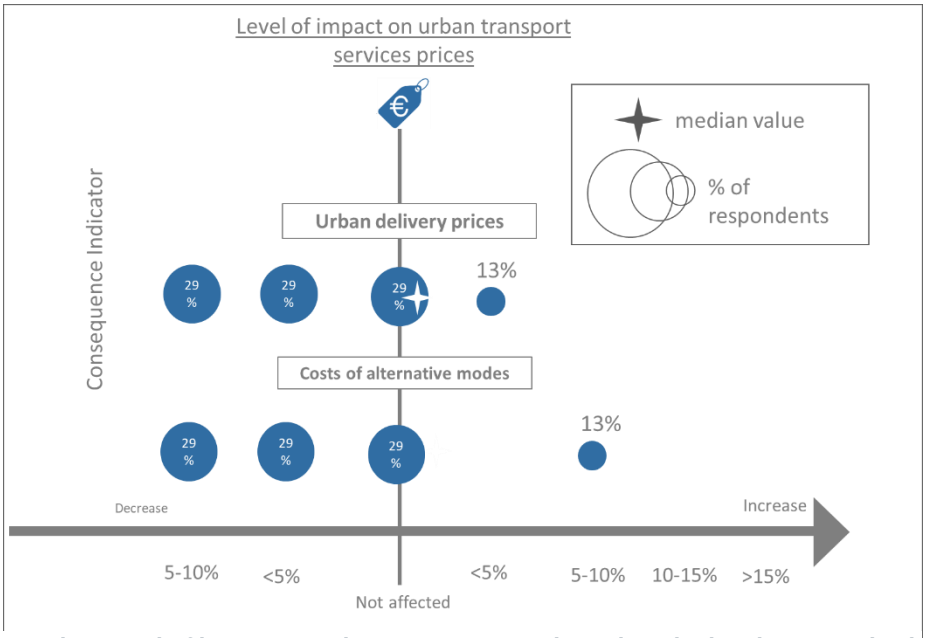
The increased adoption of smart city technologies and automation according to the scenario description, strongly justifies the respondent's positive perspectives on the share of the public transport vehicles to be equipped with smart technologies and the number of passengers that use smart payment methods by 2025-2030. According to the majority of the respondents an increase up to 50% is expected in both the share of PT vehicles that are equipped to provide real-time information to passengers and in the share of passengers that use a smart method to pay for or validate a PT ticket (Graph 8).



Graph 8 Level of impact on urban passenger transport service level (Valencia-scenario 1)

Similarly, the growth in delivery requirements and the transformation of retail will result in a better service level with the 100% of the respondents to foresee, an increase of up to 20% in the weekly deliveries to consumers.

Finally, in terms of prices and costs for both passenger and freight transportation services, the perspectives vary and thus consensus has not been reached (Graph 9). The Graph below, presents the different opinions in terms of the level of impact on the urban transport costs. Taking into consideration the most balanced responses, both the urban delivery prices and the costs of alternative modes of transport are expected to be slightly decreased up to 5%.



Graph 9 Level of impact on urban transport service prices (Valencia -scenario 1)

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a strong increase of 8% in the necessary private investments is foreseen for 2025-2030. Possible explanations for this requirement, is the strong transformation of the retail sector with green transport modes and increased delivery frequency.

3.2.2.2. Environment Impact Analysis

The clear direction to green and public transport modes presented in the previous consequence areas, is a strong argument for justifying the expected slight decrease -11%- of the CO2 emissions by 2025-2030. On the other hand though, a 14% increase in the Air quality index is foreseen by the city's stakeholders.

3.2.2.3. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors with no social security

coverage and benefits). Taking into consideration the expected increase in the share of next hour and same day deliveries, presented in the framework of the CA1 impact analysis, a 17% increase of the Gig Economy employment is foreseen, in terms of the percentage of total employees in the transport sector as independent contractors.

Soc CA2: Safety & security

With respect to safety and security of the urban mobility sector, r60% of the respondents expect an increase of up to 10% in the share of urban accidents involving micro-mobility means while the remaining 40% doesn't foresee that this indicator will be affected. On the other hand, regarding the share of urban mobility accidents involving on-demand bike/scooter deliveries, the respondents foresee almost unanimously an increase of up to 10%.

Soc CA3: Access to mobility services:

Regarding the level of affordability and accessibility of the city's urban mobility services, a positive impact is foreseen with 80% of the respondents to indicate an increase by 2025-2030 in both the affordability and accessibility of the mobility sector. More specifically, an increase of up to 10% in the affordability of using mobility services is expected and a moderate increase in the accessibility for all types of categories of passengers and for the vulnerable groups to mobility services.

3.1.3 `Sustainability Impact Assessment: Valencia Scenario 2

3.1.3.1. Valencia's second mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

Growing political support for mobility will ensure the completion of line 10 of Metrovalencia, which will mean a transfer of users from private transport to the PT option. it will also facilitate the transfer of current bus users to the new line, reducing the number of passengers on busses.

Thanks to decreased corruption, investments are optimized, sustainable mobility will benefit, and participatory processes linked to transport policies positively affect policies and their transparency. Higher taxation in favour of sustainable mobility will result in cleaner mobility. Increasing tourism will lead to more mobility, but efficiency of services will increase, and lower cost of mobility. Ease of access to certain areas will increase. Packages will be developed for tourists' mobility that includes sustainable options, which provide new business opportunities.

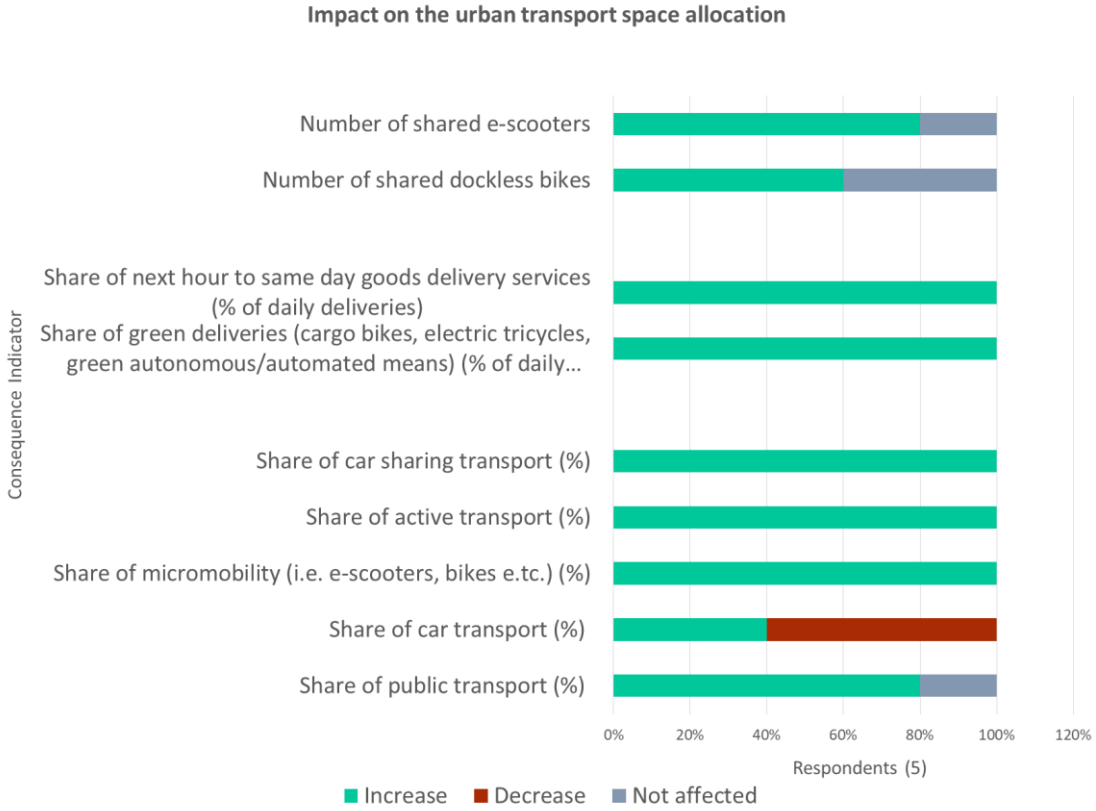
An economic recession will lead to a decline in mobility but increasing urban densification will lead to lower transport costs. Population decrease will lead to a lower supply of transport services. More frequent extreme weather due to climate change means that private mobility will grow but personal mobility vehicles will be more difficult to maintain and local air quality will increase.

- Political support for sustainable mobility, taxation, tourism, urban density, extreme weather due to climate change, local environmental quality: increase
- New business models, (e.g. collaborative consumption, sharing economy), online retail, environmental consciousness, electrification of mobility, smart-city technology, consumer- and citizen-oriented digitalization: weak growth
- Corruption, immigration, population size, economic growth: decrease
- Labour and employment: more regulation

3.1.3.2. Economic Impact Analysis

Econ CA1: The urban transport service structure and mix:

In the framework of the analysis of the first economic consequence area, a common perception on the evolution of this CA can be observed among the respondents. Consensus has been reached on the assessment of the majority of the consequence indicators, with more than 80%, and in many cases even the 100% of the respondents to agree on the impact of the scenario to each indicator (Graph 10).

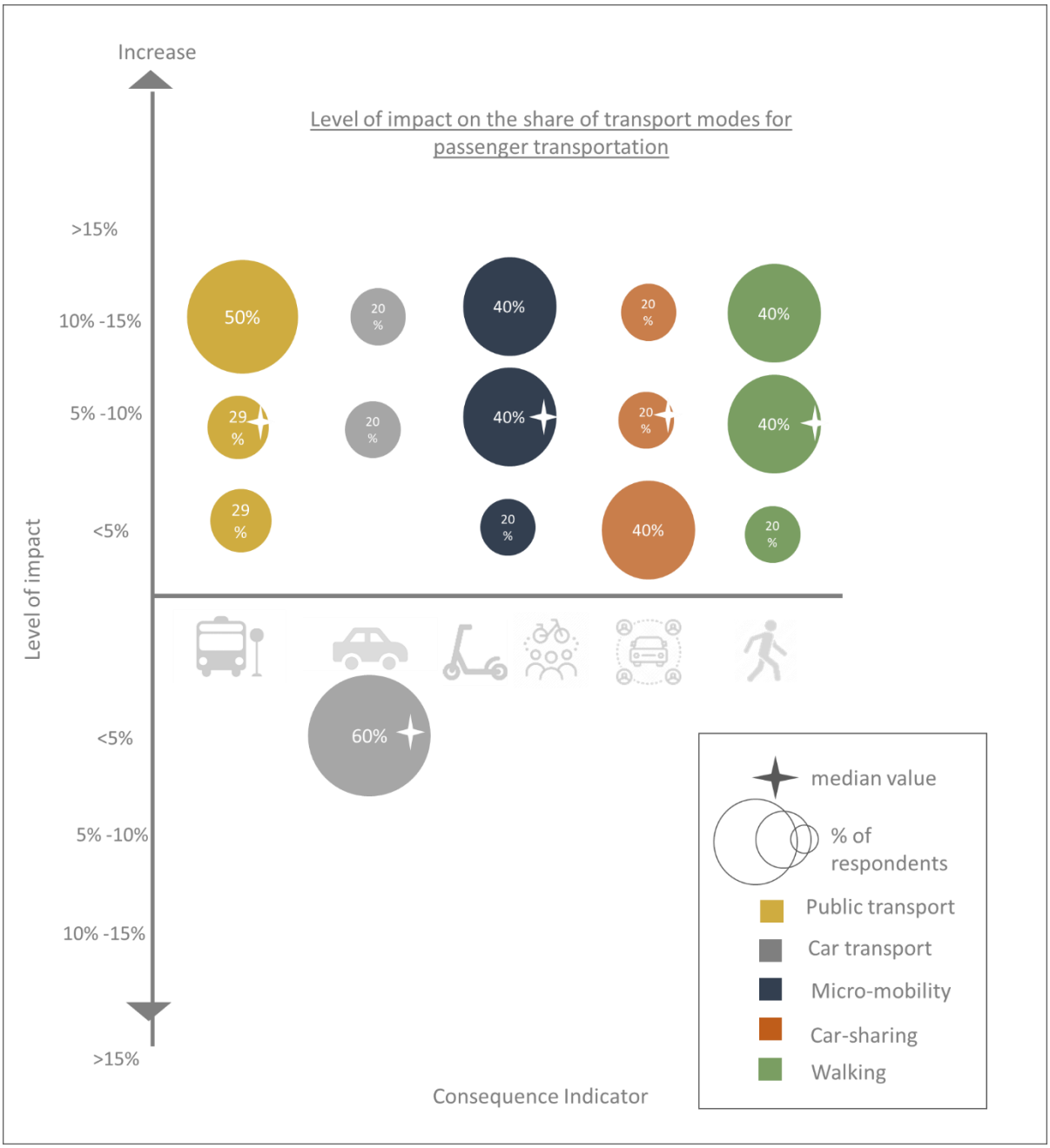


Graph 10 Impacts on the urban transport structure and mix (Valencia -scenario 2)

For these indicators, were consensus has been reached and the 70% majority rule can be applied, the following analysis focuses on the opinion of the majority group of respondents while in the rest of the questions the analysis shows the average opinion among all the respondents.

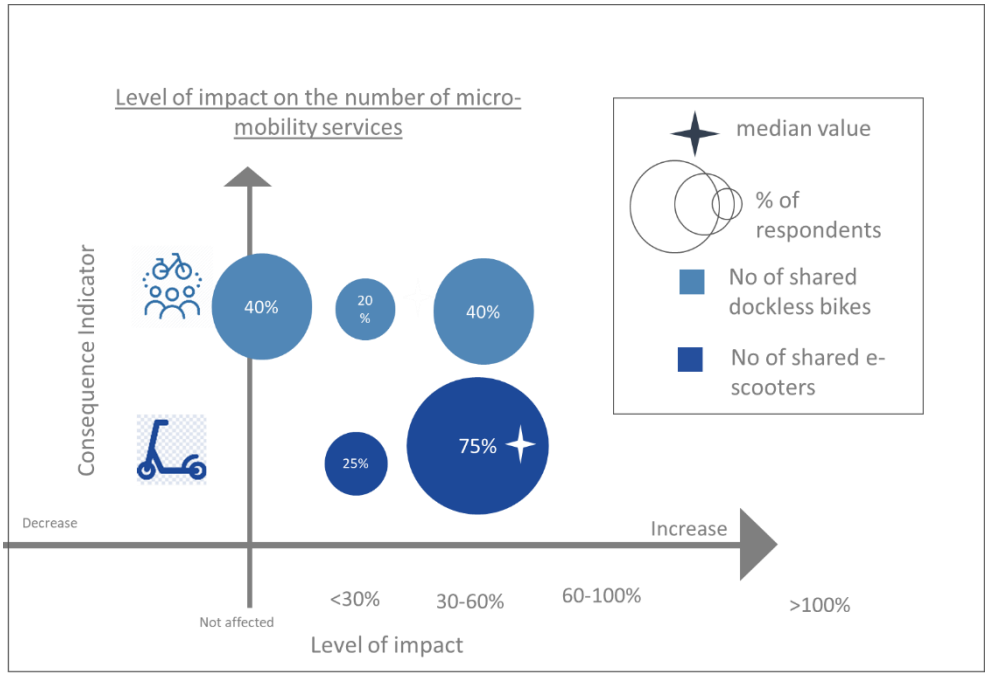
Following Graphs 11 & 12 the stakeholders' expectations show a clear trend towards the use of environmental friendly transport modes and preference to the public transportation by the citizens. More specifically, an increase of up to 10% in the share of public transportation is foreseen by the 80% of the city's respondents. With respect to the rest passenger transportation modes, unanimous consensus has been reached with the 100% of the respondents to expect an increase in these CIs. The average level of increase from all the answers is expected to be among the 5 to 10%. Finally, the strong noted environmental

consciousness of the city's population is further justified by the expected slightly decrease of up to 5% on the share of car transportation.



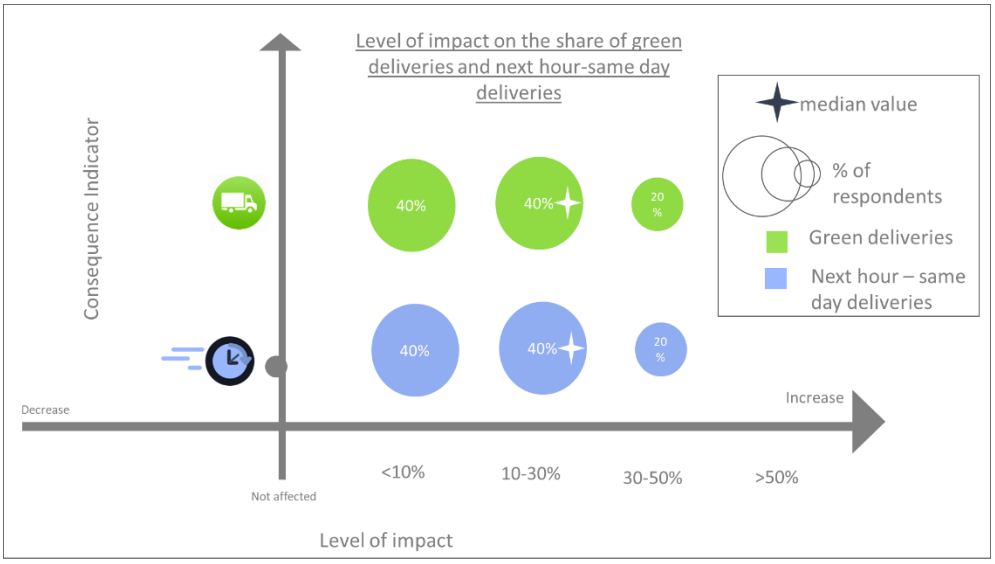
Graph 11 Level of impact on the share of transport modes for passenger transportation (Valencia - scenario 2)

Regarding the application of new mobility services, a stronger tendency towards the use of shared e-scooters rather than the use of dock less bikes is observed (Graph 12). More specifically, an increase of up to 60% in the number of shared e-scooters is foreseen and an increase of up to 30% to the number of shared dock-less bikes.



Graph 12 Level of impact on the number of micro-mobility services (Valencia-scenario 2)

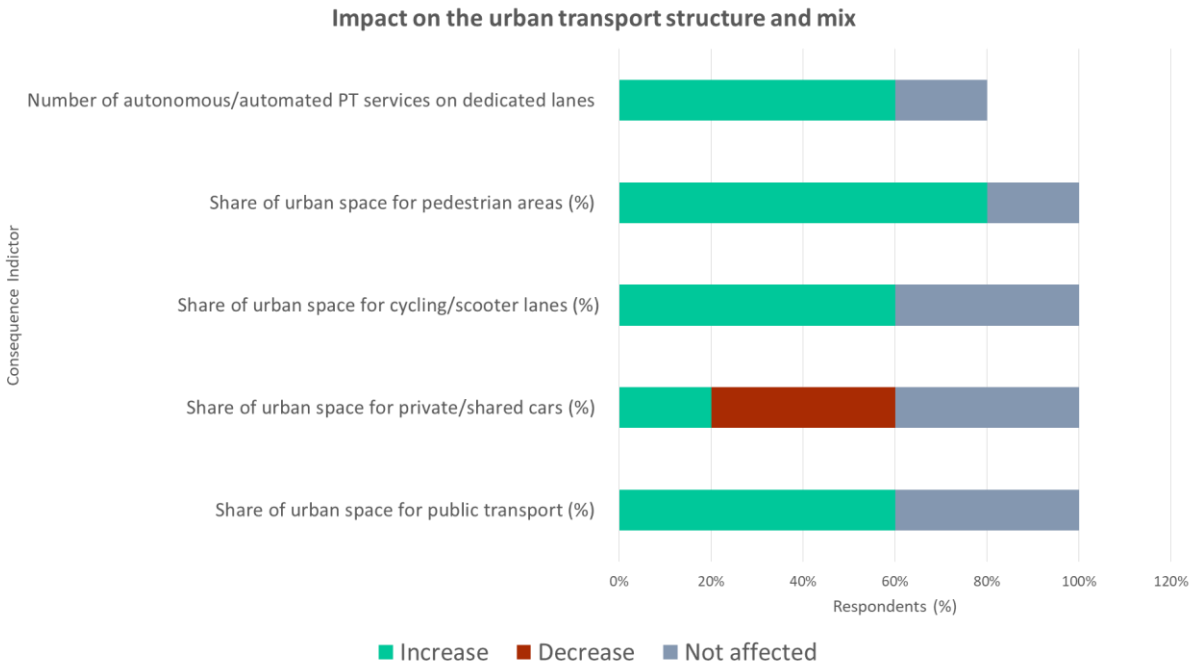
Finally, in terms of urban freight transportation, absolute consensus has been reached and the figures show also a clear trend towards more green deliveries, with an increase of up to 30% to the share of green deliveries to be expected. On the other hand though, the same increase on the next hour next day deliveries is also expected (Graph13).



Graph 13 Level of impact on the share of green deliveries and next hour-same day deliveries (Valencia Scenario 2)

Econ CA2: The urban space allocation:

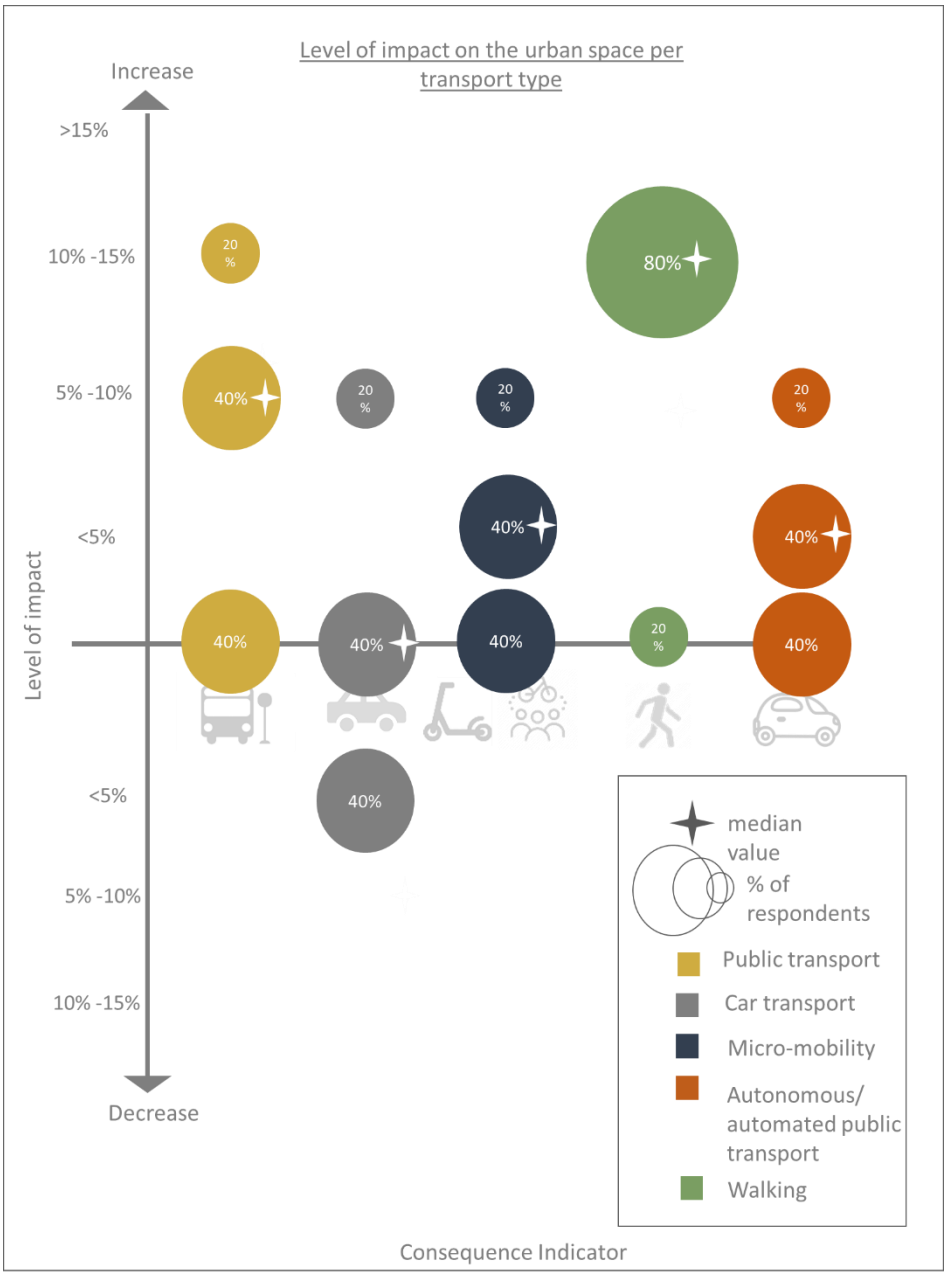
Although the outcomes of the previous consequence area, show a direction towards other modes than car transportation, no significant changes are foreseen for the existing urban space allocation.



Graph 14 Impact on the urban transport space allocation (Valencia -scenario 2)

The survey's outcome shows a variety of perspectives on this matter. More specifically, regarding the urban space allocated for public transportation as well as cycling and e-scooter transportation, the respondent's opinion are divided among the 60% of those that an increase of up to 5% to these indicators and the remaining 40% to not expect a change towards any positive, or negative direction. The median value of these perceptions though lies in the slight increase (up to 5%) of these indicators.

On the other hand, a common view on the evolution of the urban space for pedestrians can be observed, with the strong majority of the respondents to indicate a 10 to 15%, increase in this indicator. Regarding car transportation's urban space allocation, taking also into consideration the slight decrease of the share of car transport, as presented in the previous CA, justifies why the city does not expect this indicator to be affected.

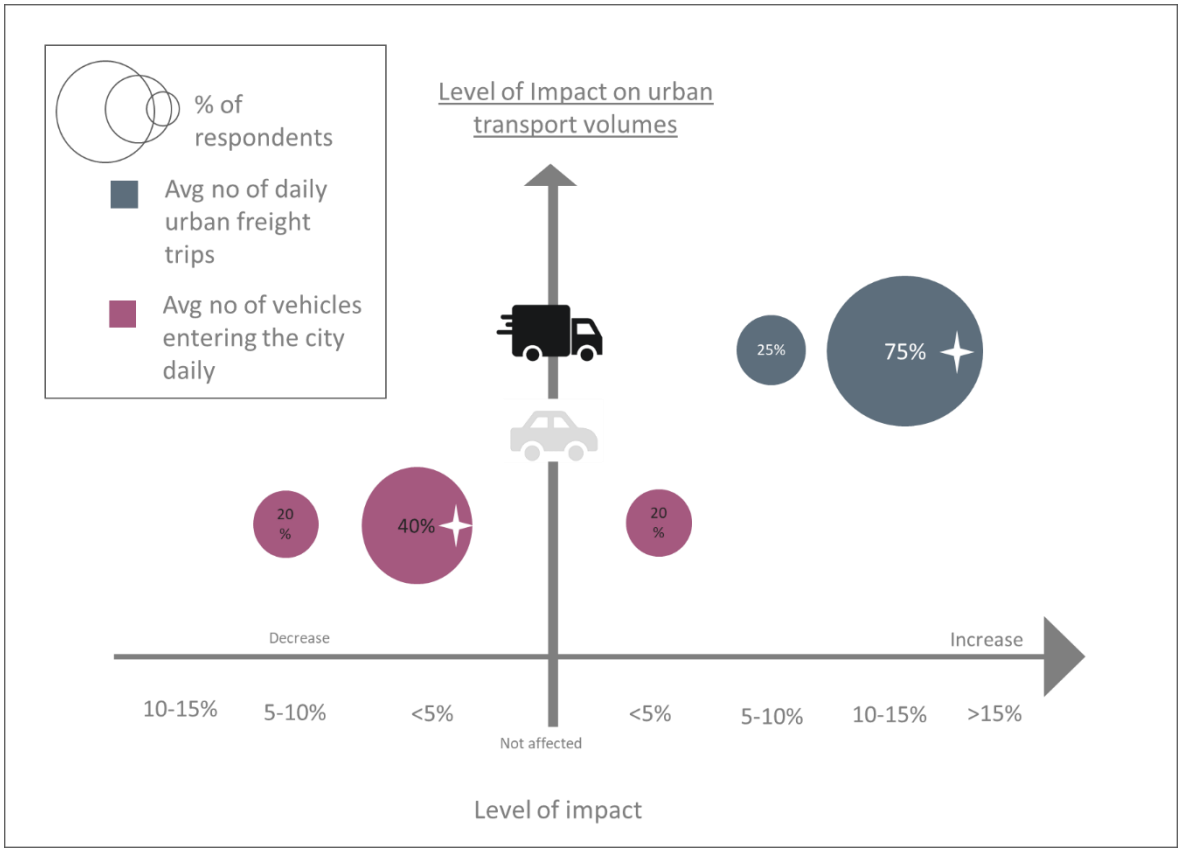


Graph 15 Level of impact on the share of urban space per transport type (Valencia-scenario 2)

A slight transition towards automated and autonomous mobility is, similarly with the 1st scenario impact analysis, foreseen by the city. Taking into consideration the variety of perception regarding the level of impact on this indicator, since this is the only indicator where consensus has not been reached, the median value shows a minor increase -an up to 5%- to the lanes dedicated for autonomous and automated transportation.

Econ CA3: The urban transport service volumes:

The anticipated increased environmental consciousness of Valencia's citizens, presented in the previous consequence area, is not enough for reaching an agreement in the potential positive or negative consequences to the volumes of the urban passenger transport sector. Although, the 60 % of the respondents show tendency (Graph 16), towards a 0 to 10% decrease of the average number of vehicles entering the city on a daily basis, the remaining 40% of the respondents foresees a slight increase (up to 5%) to this figure. **Taking into consideration the median value from all the responses, a slight decrease (up to 5%) of this consequence indicator can be expected.**



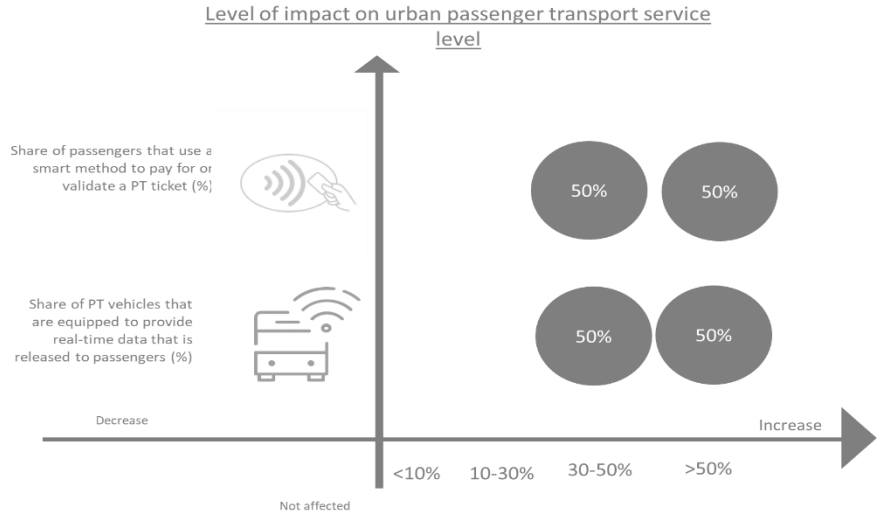
Graph 16 Level of impact on urban transport volumes (Valencia -scenario 2)

With respect to urban freight transportation, consensus has been reached, and the expected increase in the next hour and next day deliveries, presented above, justifies the expected increase of up to 15% in the average number of daily urban freight trips implemented within the city.

Econ CA4: The urban transport service level

The increased adoption of smart city technologies and automation is strongly justified in the respondent's positive perspectives on the share of the public transport vehicles to be equipped with smart technologies and the passengers that use smart methods to pay by 2025-2030.

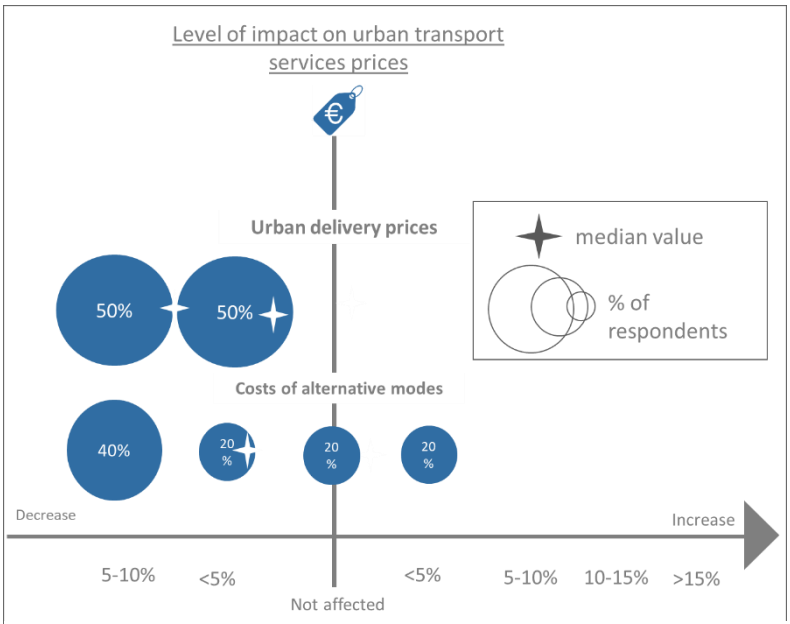
According to the majority of the respondents an increase of up to 50% in both the share of PT vehicles that are equipped to provide real-time data that is released to passengers is expected and the share of passengers that use a smart method to pay for or validate a PT ticket (Graph 17).



Graph 17 Level of impact on urban passenger transport service level (Valencia-scenario 2)

Regarding urban freight transportation, the respondent's opinion is controversial. The 60% of the respondents foresees a moderate increase from 10-15% to the average number of weekly deliveries implemented by the urban freight operators to consumers. However, a 20% of the respondents don't expect any change on that matter, while another 20% expects a strong decrease, up to 20%, of this figure. **Thus, taking into consideration the median value from all the responses, a slight increase (up to 10%) of this consequence indicator can be expected.**

Finally, in terms of prices and costs for both passenger and freight transportation services, the perspectives vary as well and consensus has not been reached. Graph 19 below, presents the different opinions in terms of the level of impact of urban transport costs. **According to this Graph and taking into consideration the most balanced response, both the urban delivery prices and the costs of alternative modes of transport are expected to be slightly decreased up to 5%.**



Graph 18 Level of impact on urban transport service prices (Valencia-scenario 2)

Econ CA5: The urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a strong increase of 10% in the necessary private investments is foreseen for time horizons 2025-2030. Possible explanations for this requirement, is the strong transformation of the retail sector with green transport modes and more delivery frequencies.

3.2.2.4. Environment Impact Analysis

The clear direction to green and public transport modes presented in the previous consequence areas, is a strong arguments for justifying the expected slight decrease -28%- of the CO2 emissions by 2025-2030. On the other hand though, a 16% increase in the Air quality index is foreseen by the city's stakeholders.

3.2.2.5. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into consideration the expected increase in the share of next hour and next day deliveries, presented in the framework of the CA1 impact analysis, only a respective 16% increase of the Gig Economy employment is also foreseen, in terms of the percentage of total employees that are occupied in transport sector either as independent contractors or as freelancers.

Consequence Area Soc CA2: Safety & security

With respect to safety and security of the urban mobility sector, the majority of the respondents expect an increase of up to 10% to the share of urban accidents involving on-demand bike/scooter deliveries and an increase of up to 5% to the share of urban mobility accidents involving micro-mobility means.

Consequence Area Soc CA3: Access to mobility services:

Regarding the level of affordability and accessibility of the city's urban mobility services, a positive impact is foreseen almost unanimously with the 80% of the respondents to indicate an increase by 2025-2030 in both the affordability and accessibility of the mobility sector. More specifically, an increase of up to 10% in the affordability of using mobility services is expected and a moderate increase in the accessibility for all types of categories of passengers and for the vulnerable groups to mobility services.

3.1.4 Sustainability Impact Assessment: Valencia Scenario 3

3.1.3.3. Valencia's third mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

Growing political support for mobility will ensure the completion of line 10 of Metrovalencia, which will mean a transfer of users from private transport to the PT option. it will also facilitate the transfer of current bus users to the new line, reducing the number of passengers on busses.

Thanks to decreased corruption, investments are optimized, sustainable mobility will benefit, and participatory processes linked to transport policies positively affect policies and their transparency. Higher taxation in favour of sustainable mobility will result in cleaner mobility. Increasing tourism will lead to more mobility, but efficiency of services will increase, and lower cost of mobility. Ease of access to certain areas will increase. Packages will be developed for tourists' mobility that includes sustainable options, which provide new business opportunities.

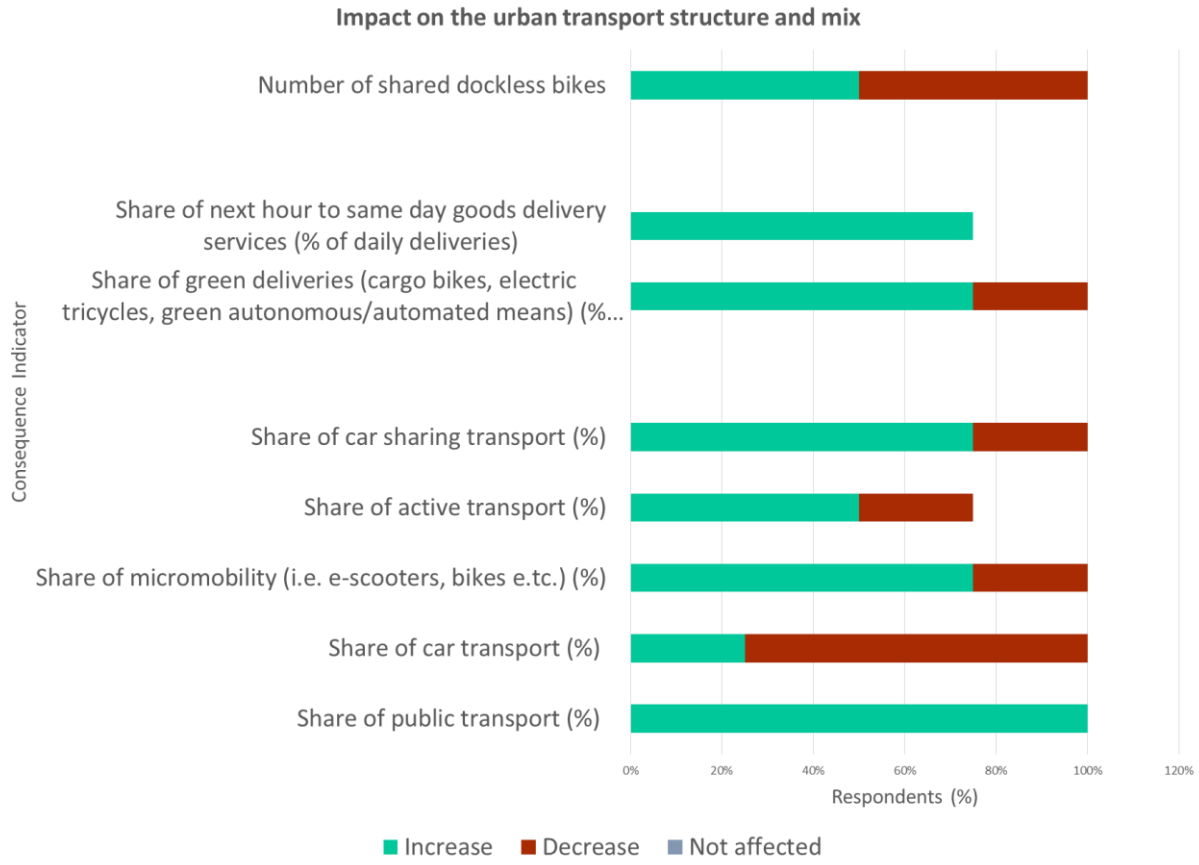
An economic recession will lead to a decline in mobility, but online retail will grow strongly and become more efficient with the use of big data technologies. Increasing densification will lead to lower transport costs. Population increase will generate more opportunities for mobility. Strong growth in the electrification of mobility will lead to improved infrastructure. The growth of consumer and citizen-oriented digitalization will improve real-time information on transport options. More frequent extreme weather due to climate change means that private mobility will grow but personal mobility vehicles will be more difficult to maintain and local air quality will decrease.

- Political support for sustainable mobility, taxation, tourism, immigration, urban density, extreme weather due to climate change, population: increase
- New employment arrangements, new business models, (e.g. collaborative consumption, sharing economy): weak growth
- Corruption, economic growth, people choosing not to own cars, local environmental quality: decrease
- Electrification of mobility, smart-city technology, consumer- and citizen-oriented digitalization: strong growth
- Labour and employment: more regulation

3.1.3.4. Economic Impact Analysis

Econ CA1: The urban transport service structure and mix:

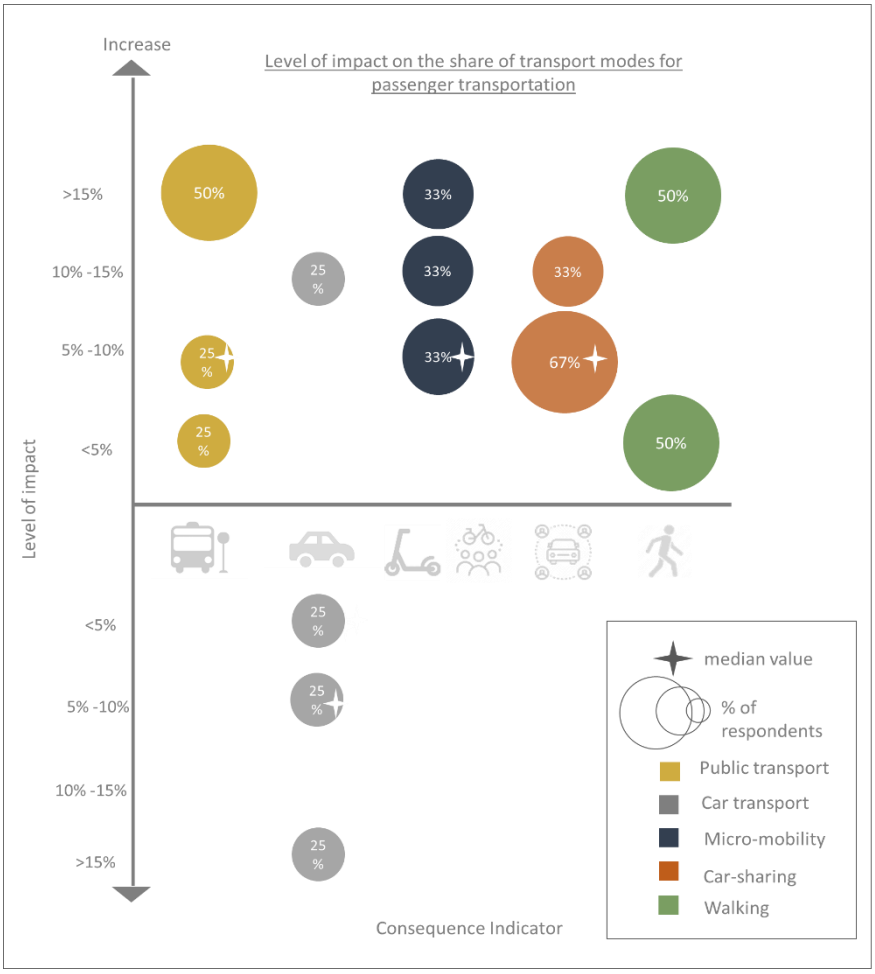
In the framework of the analysis of the first economic consequence area, a common perception on the evolution of this CA can be observed among the respondents. Consensus has been reached on the assessment of the majority of the consequence indicators, with more than 75%, and in many cases even the 100% of the respondents to agree on the impact of the scenario to each indicator (Graph 19).



Graph 19 Impacts on the urban transport structure and mix (Valencia - scenario 3)

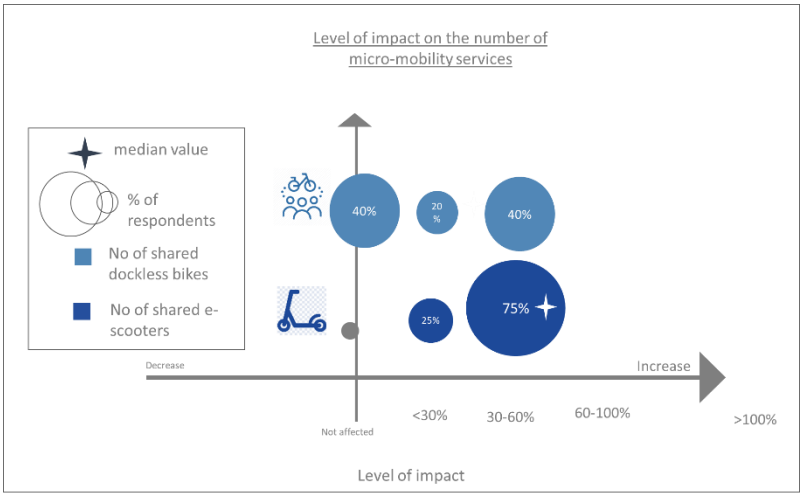
For these indicators, were consensus has been reached and the 70% majority rule can be applied, the following analysis focuses on the opinion of the majority group of respondents while in the rest questions the analysis shows the average opinion among all the respondents.

Following Graph 20, where the participant's different perception on the level of impact to each indicator is presented, a clear trend towards the use of environmental friendly transport modes and preference to the public transportation by the citizens is indicated. With respect to the passenger transport mix, an increase of up to 15% in the share of public transportation , and an up to 10% in both the micro-mobility and car sharing transport is foreseen and a decrease of up to 10% in car transportation respectively. On the other hand, a minor increase, up to 5% to the share of active transportation is foreseen.



Graph 20 Level of impact on the share of transport modes for passenger transportation (Valencia - scenario 3)

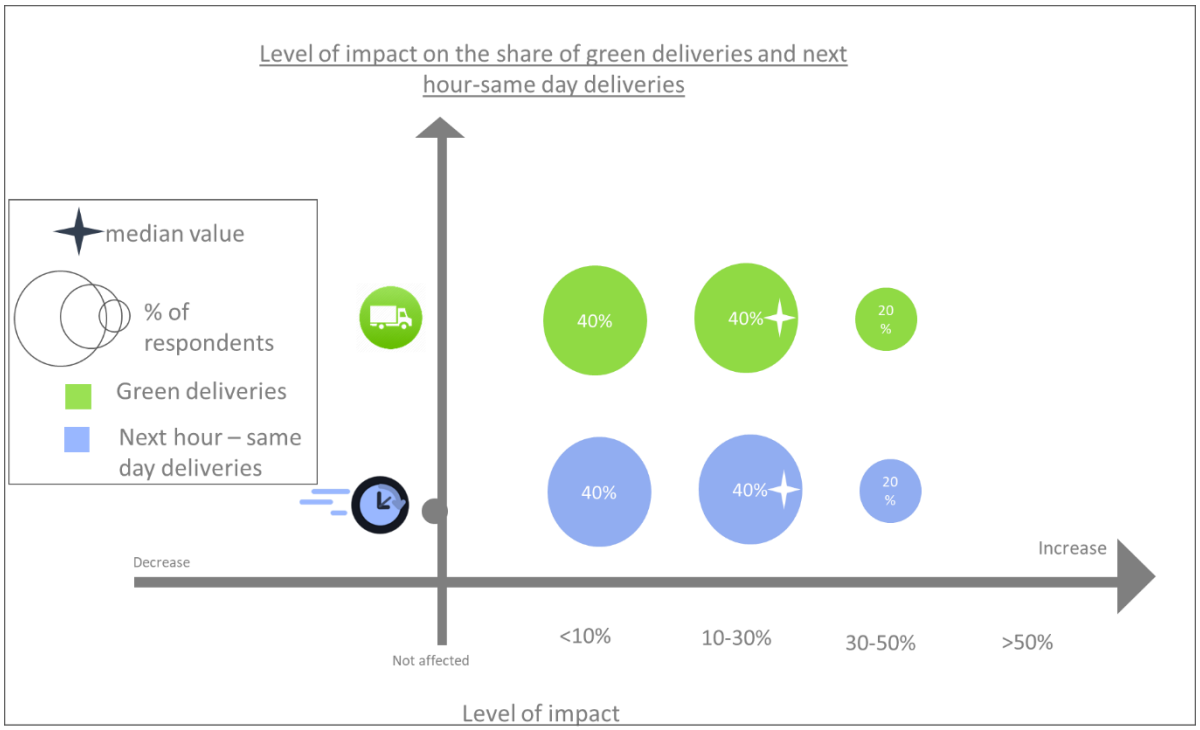
Regarding the application of new mobility services, a stronger tendency towards the use of shared e-scooters rather than the use of dock less bikes is observed (Graph 21). More specifically, according to the following figure, an increase of up to 50% in the number of shared e-scooters is foreseen while no significant changes are expected to the number of shared dock-less bikes.



Graph 21 Level of impact on the number of micro-mobility services (Valencia-scenario 3)

Finally, in terms of urban freight transportation, consensus has been reached and the figures show also a clear trend

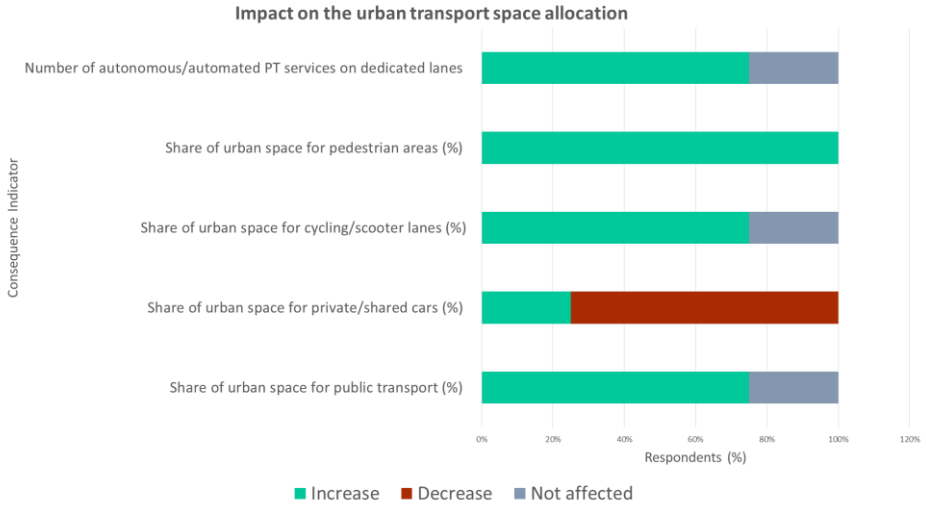
towards more green deliveries, with an increase of up to 30% to the share of green deliveries to be expected. Regarding the share of next hour and next day goods delivery schemes, although the 75% of the participants agree that this figure will increase by 2025-2030, their opinion on the level of impact though varies (Graph 22) The balance among those perceptions can be placed approximately at 30-50% increase of this indicator.



Graph 22 Level of impact on the share of green deliveries and next hour-same day deliveries (Valencia-scenario 3)

Econ CA2: The urban space allocation:

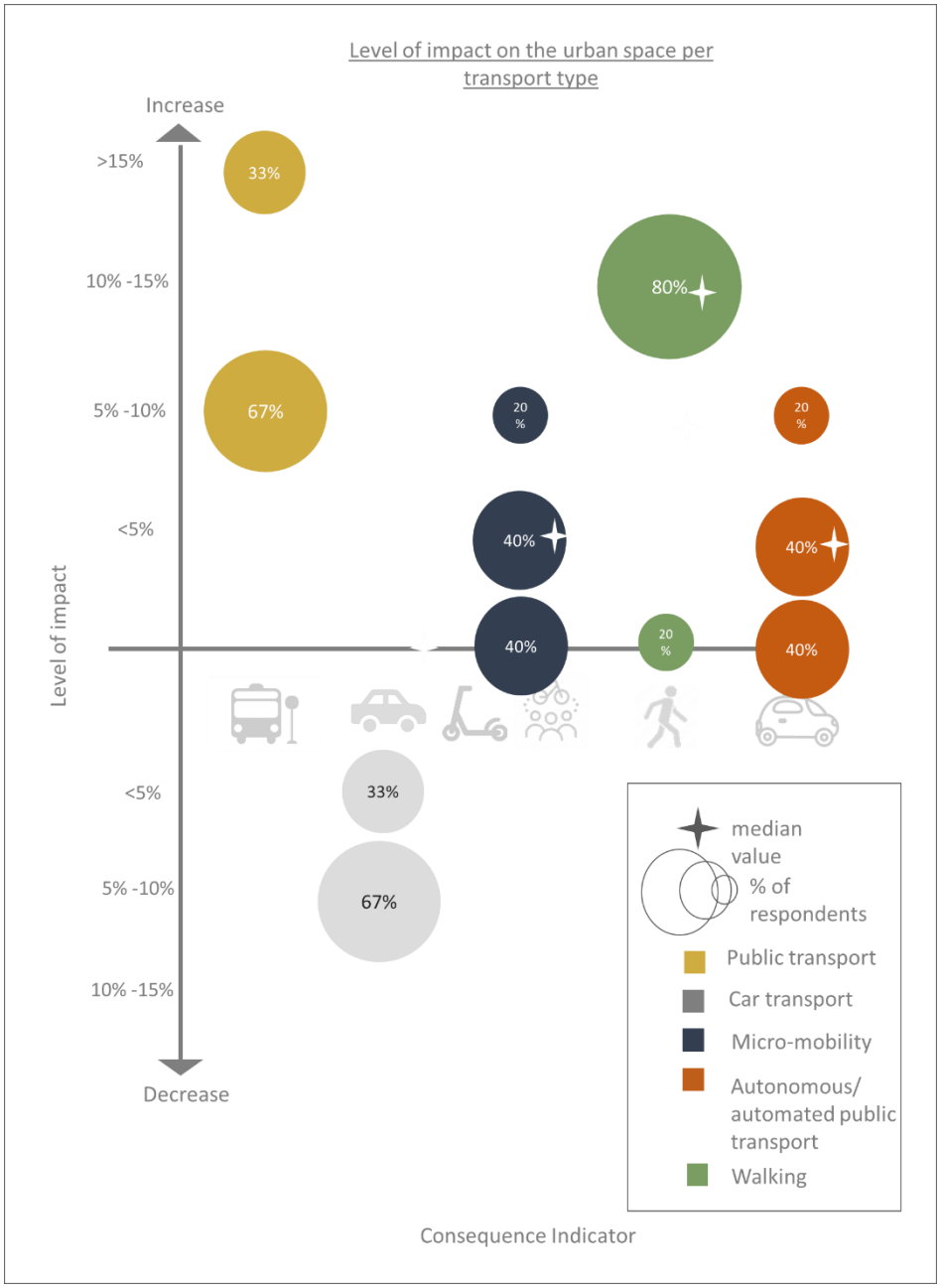
Taking into consideration, the impacts on the urban transport structure and mix, presented above, respective changes in the urban space allocation are also foreseen.



Graph 23 Impact on the urban transport space allocation (Valencia-scenario 3)

More specifically, an increase in the share of urban space for micro-mobility, for pedestrian areas and public transportation is foreseen and a decrease in the space for car transportation.

Consensus has been similarly reached on almost all the CIs analysis besides the CIs related to the urban share for private/shared cars. As presented in Graph 24, a moderate increase, from 5 to 10% to the share of urban space for public transportation as well as for pedestrian areas and a moderate decrease for private and shared cars is foreseen. With respect to space for micro-mobility, a slight increase up to 5% is expected.

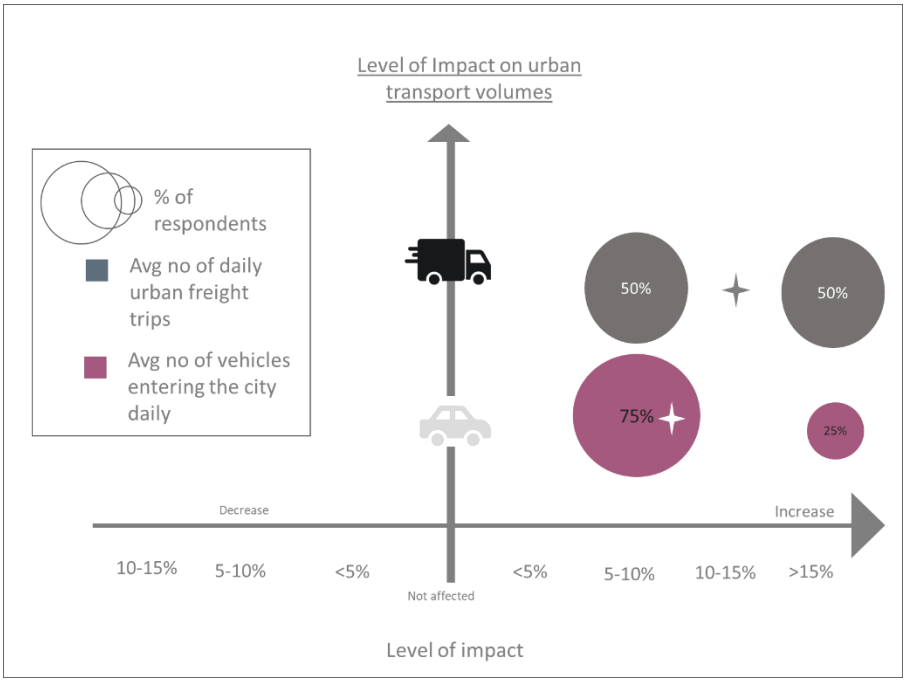


Graph 24 Level of impact on the share of urban space per transport type (Valencia - scenario 3)

Finally and in comparison with the previous scenarios, a moderate transition towards automated and autonomous mobility is observed, with the 75% of respondents to agree on this and expect an average increase from 5 to 10%.

Econ CA3: The urban transport service volumes:

The anticipated increased environmental consciousness of Valencia's citizens, presented in the impact analysis of the previous consequence areas, is not enough though for reducing the daily transport volumes. According to all the participants, a 5 to 10% increase in the average number of vehicles entering the city on a daily basis is expected and an increase of up to 15% in average number of daily urban freight trips.

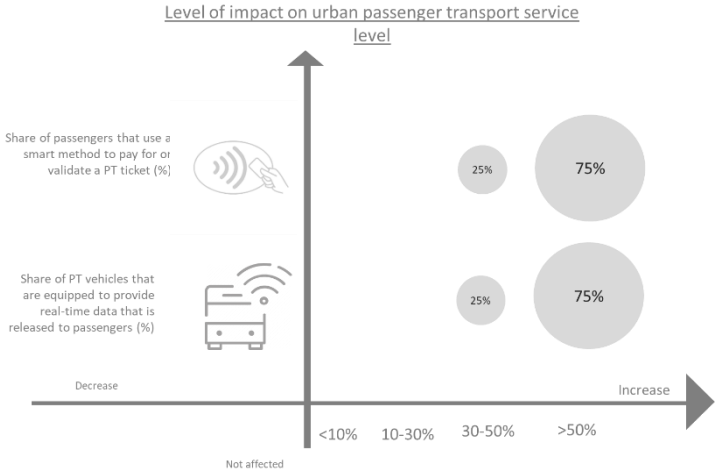


Graph 25 Level of impact on urban transport volumes (Valencia - scenario 3)

Econ CA4: The urban transport service level

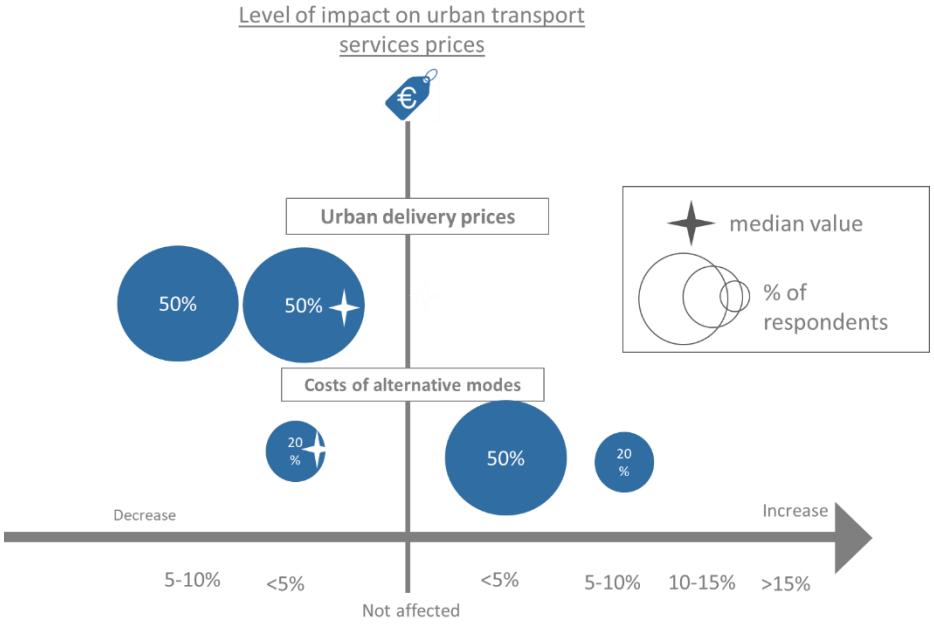
The increased adoption of smart city technologies and automation is strongly justified in the respondent's positive perspectives on the share of the public transport vehicles to be equipped with smart technologies and the passengers that use smart methods to pay by 2025-2030, which according to the majority of the respondents may be more than 50% increased by 2025-2030 (Graph 26 & 27).

Similarly, the growth in delivery requirements and the transformation of retail will result to a better service level with the 100% of the respondents to foresee, at least an increase of up to 20% in the weekly deliveries to consumers.



Graph 26 Level of impact on urban passenger transport service level (Valencia - scenario 3)

Finally, in terms of costs of alternative modes, a slight increase of up to 10% is expected by the majority of the respondents. In terms of urban delivery costs though, the opinions are divided in half among those that foresee a minor or moderate increase of the indicator and those that expect a minor or moderate decrease. Thus, the balance among those controversial views can be found in the “not affected” option.



Graph 27 Level of impact on urban transport service prices (Valencia -scenario 3)

Econ CA5: The urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a strong increase of 8% in the necessary private investments is foreseen for time horizons 2025-2030. Possible explanations for this requirement, is the strong transformation of the retail sector with green transport modes and more delivery frequencies.

3.2.2.6. Environment Impact Analysis

The clear direction to green and public transport modes presented in the previous consequence areas, is a strong arguments for justifying the expected slight decrease -17%- of the CO2 emissions by 2025-2030. On the other hand though, a 23% increase in the Air quality index is foreseen by the city’s stakeholders.

3.2.2.7. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into

consideration the expected increase in the share of next hour and next day deliveries, presented in the framework of the CA1 impact analysis, only a respective 16% increase of the Gig Economy employment is also foreseen, in terms of the percentage of total employees that are occupied in transport sector either as independent contractors or as freelancers.

Consequence Area Soc CA2: Safety & security

With respect to safety and security of the urban mobility sector, the majority of the respondents expect an increase up to 10% in the share of urban accidents involving micro-mobility means as well as to the share of urban mobility accidents involving on-demand bike/scooter deliveries.

Consequence Area Soc CA3: Access to mobility services:

Regarding the level of affordability and accessibility of the city's urban mobility services, a positive impact is foreseen almost unanimously with the 75% of the respondents to indicate an increase by 2025-2030 in both the affordability and accessibility of the mobility sector. More specifically, an increase of up to 5% in the affordability of using mobility services is expected and a minor increase in the accessibility for all types of categories of passengers and for the vulnerable groups to mobility services.

3.1.5 Valencia: Conclusions

Regarding the economic mobility state of Valencia city, the future clearly shows an increase of the citizen's environmental consciousness resulting to the **use of more environmental friendly modes of transport**.

All three scenarios foresee the moderate/ high increase of the share of micro mobility and public transportation, the minor/moderate increase of the share of active transportation, the minor/moderate decrease of the share of car transport and the moderate/high increase of car sharing.

Similar changes are expected also to the city's current urban space allocation. All three scenarios present a future with **more space for public transportation, more cycling and e-scooter lanes, less space for car transport and more space for pedestrian areas**. Finally, in terms of automation in mobility, the city expects the minor/moderate development and operation of dedicated autonomous/automated public transport lanes.

With respect to urban freight transportation, the figures are similar with a moderate increase of the share of green deliveries to be estimated by all three scenarios. Finally, in view of the upcoming on demand economy, the city foresees the moderate/high transformation of the retail sector and the provision of next hour and next day deliveries to the citizens.

Concerning the transport service level, a clear direction towards the use of new technologies and the smart transformation of the public transport is revealed. All three scenarios expect either a moderate or a high increase to the share of PT vehicles that will be equipped with smart technologies and the share of passengers that will use smart methods to pay. With respect to urban freight transportation, a positive impact –ranging among minor to high- to the goods delivery frequency is foreseen by all three scenarios.

In terms of costs for both passenger and freight transportation though, no significant changes are expected by 2025-2030. In two out of three scenarios, a minor decrease of both the urban delivery prices and the costs of alternative modes of urban passenger transport is foreseen. In the worst case scenario, the costs of alternative modes of urban passenger transport will be minor decreased while the urban delivery prices will remain stable.

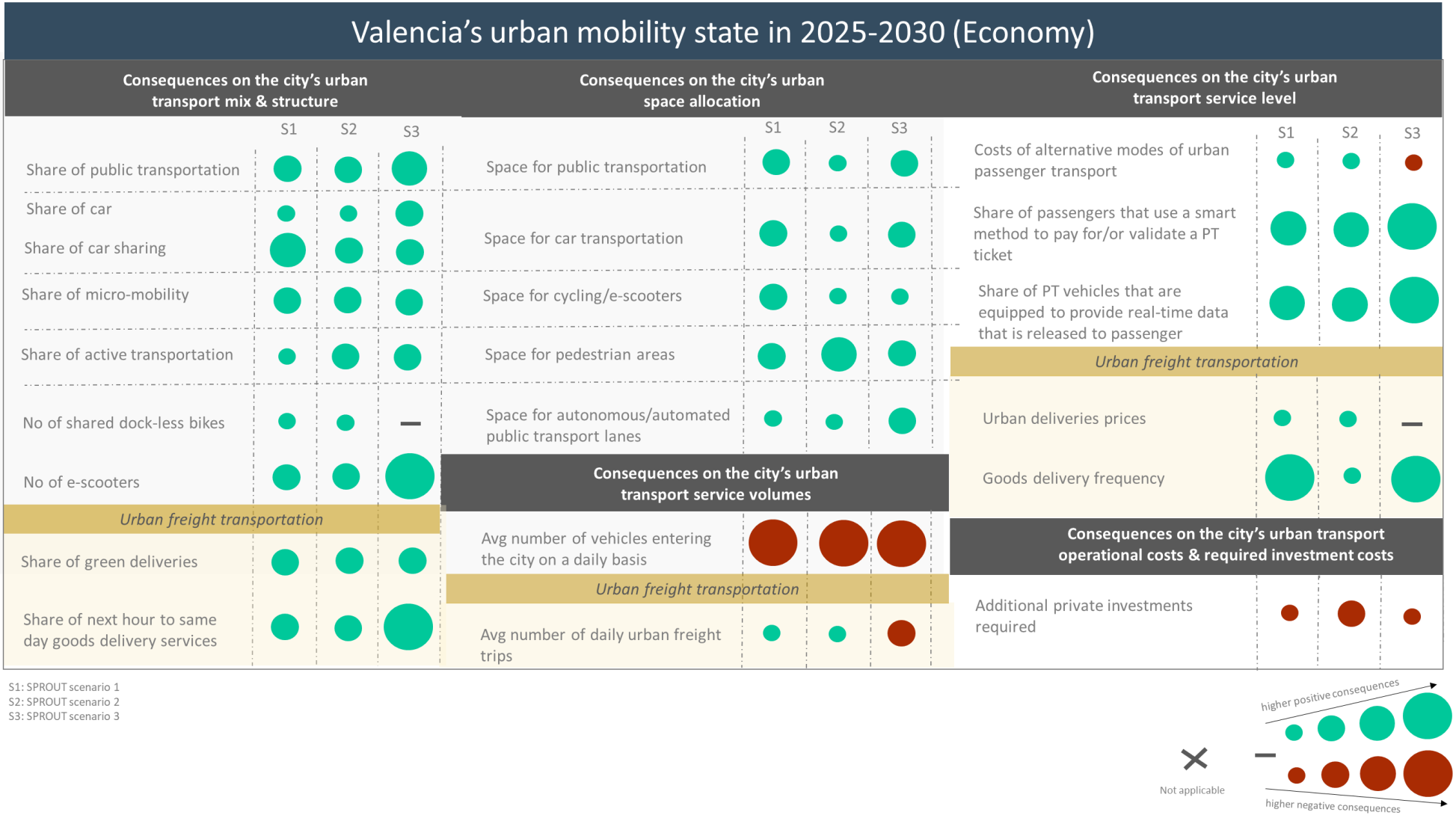
One of the main negative consequences justified by all three scenarios is related to the city's urban freight transport service volumes. The future shows more congested streets, with more daily urban freight trips to be implemented for covering the higher demand due to tourism and e-commerce growth. With respect to vehicles' volumes though, two out of three scenarios expect a minor decrease while the worst case scenario shows a moderate increase of this figure.

This figure of the streets can be considered as the only possible explanation for the expected negative externalities to the city's environment in terms of the air quality index. However, a slight positive direction towards the environmental performance of the city is foreseen. All three scenarios, indicate a minor decrease of the CO2 emissions, strongly justified by the higher environmental consciousness of the citizens.

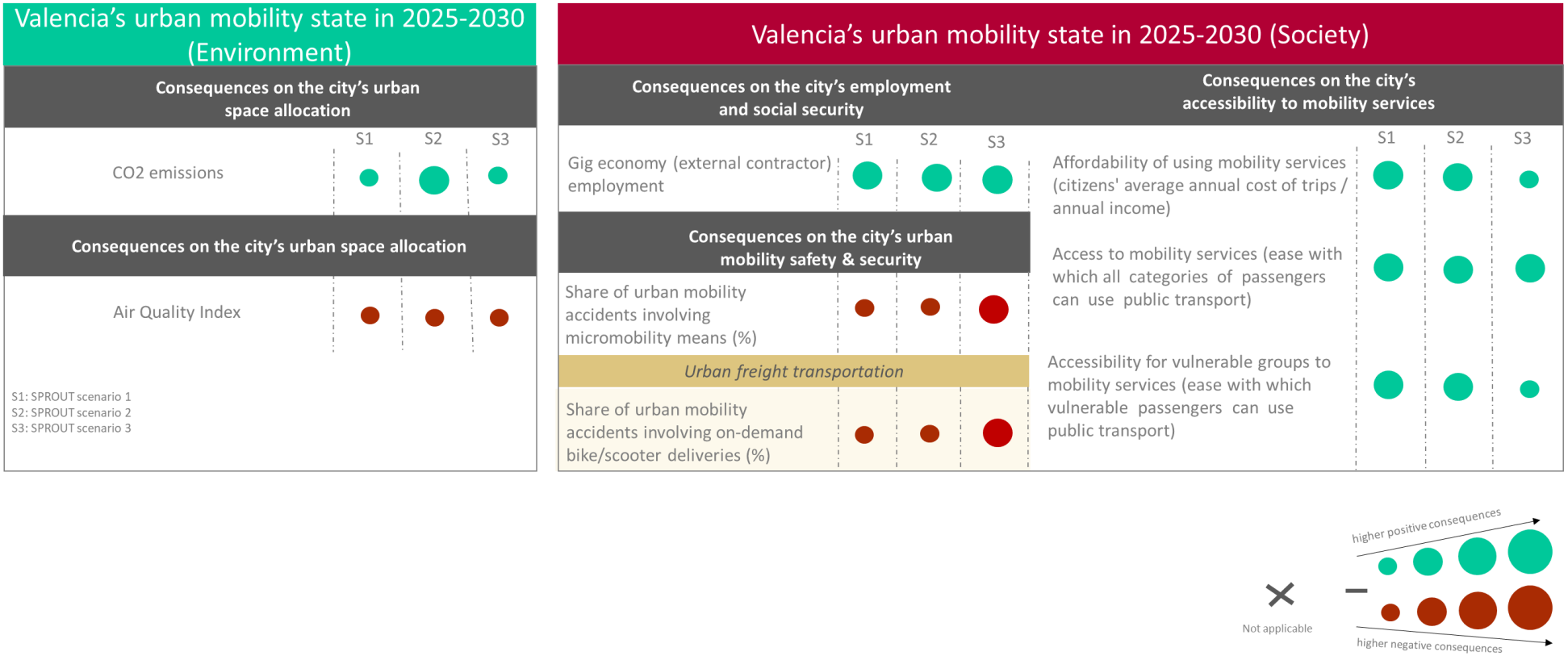
Finally, concerning the social dimension of the city's mobility state, the results are controversial. On the one hand positive figures can be noticed in the accessibility to mobility services. The city expects a minor/moderate increase, verified by all three mobility scenarios, in the affordability of using mobility services based on the citizen's average annual cost of trips and their annual income and a minor/moderate increase in the accessibility to mobility services by all categories of passengers including the vulnerable passengers.

On the other hand, a safety issue is raised by all three scenarios since a significant increase in the share of urban mobility accidents involving micro-mobility means as well as in the share of urban mobility accidents involving on-demand bike/scooter deliveries is foreseen.

The following Figures illustrate the level of positive and negative consequences foreseen for Valencia's' mobility state in each mobility scenario and per each sustainability dimension.



Graph 28 Valencia's urban mobility state in 2025-2030 –Economy (all scenarios)



Graph 29 Valencia's urban mobility state in 2025-2030 –Society & Environment (all scenarios)

3.2 Padua (Italy)

3.2.1 Implementation process: Stakeholders Network, Methods, Data collection

The city of Padua shared the surveys with the local stakeholders and provided clear instructions in written. The survey was completed and returned directly by the stakeholders. The stakeholders that were approached are familiar with the project's main scope and outcomes since they were also involved in the scenario's development process in the framework of Task 3.1. More specifically representatives from the following departments were approached:

- VIU
- BIV (Bus Italia Veneto)
- Cityporto/Interporto
- Padua Municpality – Mobility Sector, Public Works Sector, Environment Sector and Trade Sector
- Padua Local Police

3.2.2 Sustainability Impact Assessment: Padua Scenario 1

3.2.2.8. Padua's first mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

In 2030, a less populated Padua is characterized by an array of changes in urban mobility. Political support for alternative mobility modes helped fuel a modal shift, and reduced urban traffic due to better development of secondary transport networks. These improvements were further helped by increased transparency in the city's government

As a result of increases in its population's environmental consciousness, the majority of its vehicle fleets (both private and public) are now electric, with an increased importance placed on servitization through Mobility-as-a-Service applications. The city's streets are now lined with electric charging stations instead of traditional refuelling stations. This development is further fuelled by increased adoption of smart-city technologies and automation, which boost multimodality and help better manage traffic. These developments also help improve the development of shared mobility systems, which can help counter the strong increase in congestion due to the strong transformation of retail. These developments were partially brought on by the declining quality of Padua's environment, with high particle and noise levels being a part of citizen's lives, leading to negative effect on public health as well.

Whereas personal mobility is now characterized by increased efficiency and servitization, the logistics aspects now make up the bulk of traffic, and are characterized by deteriorating efficiency in freight mobility. However, increasing densification of the city means that a level of efficiency for mobility in general can be guaranteed through concentration and consolidation of traffic flows along major routes connecting relevant facilities. There is also a tendency to step away from public and private transport, making use of couriers instead, which raises the demand for new employment arrangements in favour of the gig-economy. The strong growth in delivery requirements also entails that conflicts arise between physical retail and e-commerce deliveries, who both need public space and drop-off areas for deliveries. For this reason, the urban space allocation is revisited, by transforming parking areas into temporary short-stop areas. This growing demand for space is also characterised by multiple last-mile fulfilment centres and lockers for parcel drop-off.

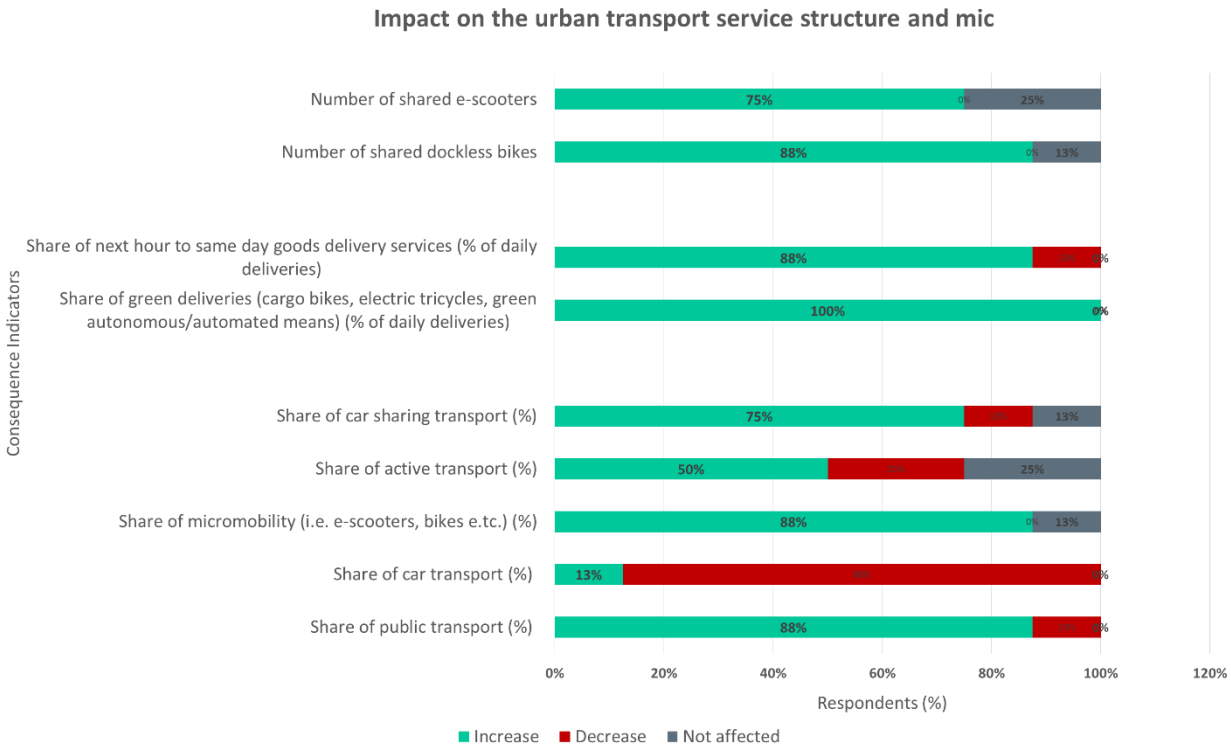
Main take-aways:

- Political agenda and transparency: increase
- New job opportunities, new business models, transformation of retail, environmental consciousness, next-hour to same-day delivery: strong growth
- Urban structure: increasing densification
- Population size and local environmental quality: decrease
- Electrification, smart-city technology, automation: strong growth
- Data and privacy laws, health and safety laws: more regulation

3.2.2.9. Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

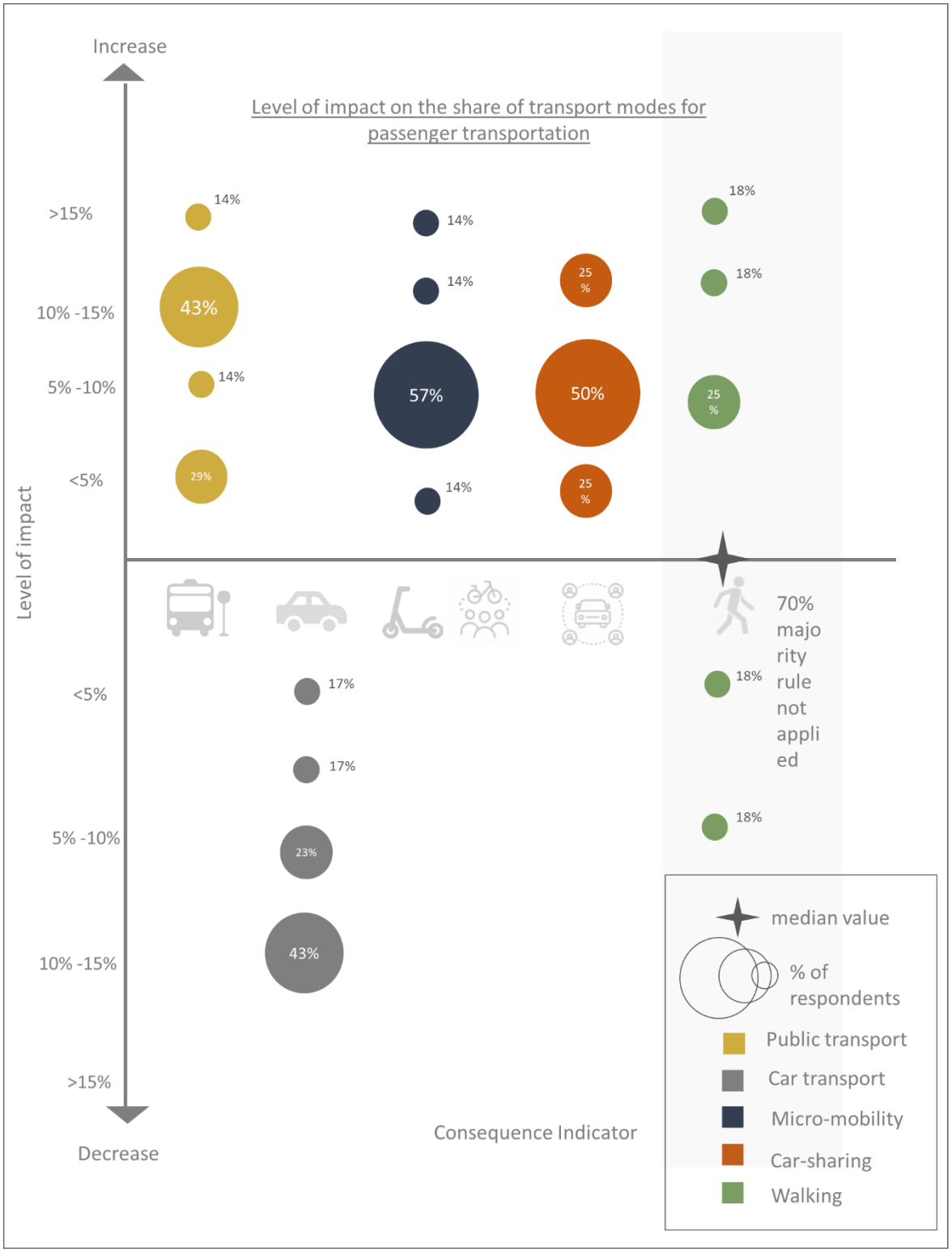
Based on the survey results, a common perception on the evolution of this CA can be observed among the respondents. Consensus has been reached on the assessment of the majority of the consequence indicators, with more than 75%, and in many cases even the 100% of the respondents to agree on the impact of the scenario to each indicator (Graph 30).



Graph 30 Impacts on the urban transport structure and mix (Padua-scenario 1)

For these indicators, were the 70% majority rule can be applied and consensus has been reached, the following analysis focuses on the opinion of the majority group of respondents while in the rest questions the analysis shows the average opinion among all the participants.

Following Graph 31, the respondents' expectations show a clear trend towards the use of environmental friendly transport modes by the citizens of Padua. Regarding passenger transportation, the city expects an increase in the share of public transportation and micro mobility as well as in the number of new mobility services that operate in the city. The increase in the population's environmental consciousness, mentioned in this narrative scenario, is also further justified by the decrease on the share of car transportation and the increase of the car sharing.

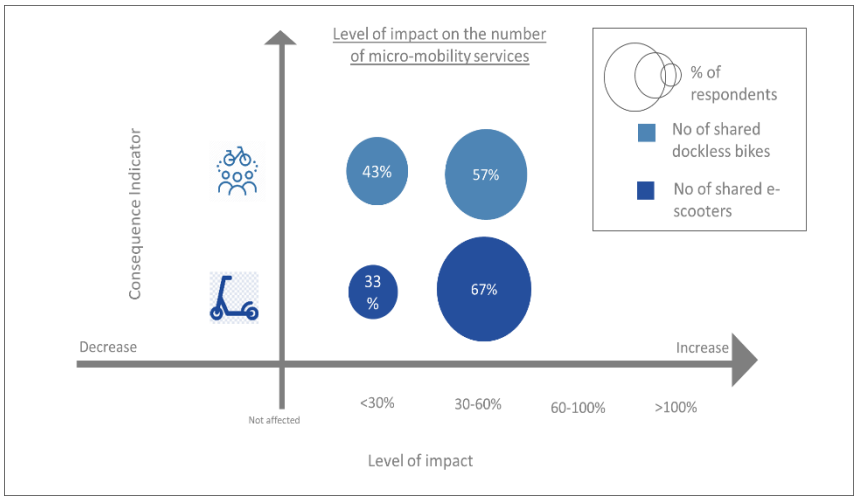


Graph 31 Level of impact on the share of transport modes for passenger transportation (Padua scenario 1)

In terms of active transportation though, the figure is not so optimistic and divergent views can be observed. More specifically, only the 50% of the respondents believe that the share of active transport will increase while the rest of the respondents feel that this share will not be affected if not even slightly decreased.

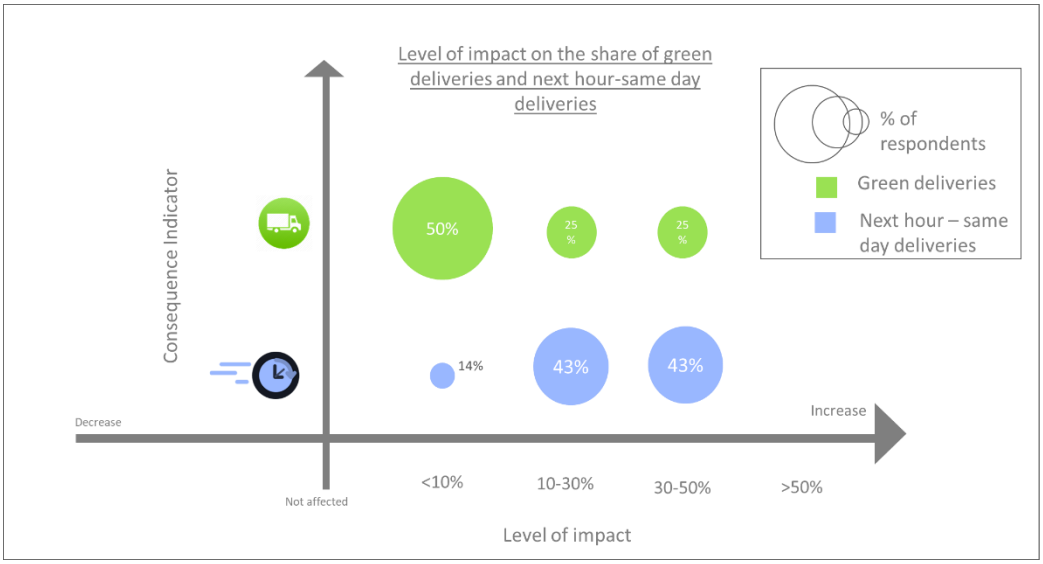
As presented in Graph 31, the majority of the respondents indicated an increase of up to 10% in the share of micro-mobility means and car sharing transportation and a tendency towards an increase of up to 15% of the public transportation share while the level of decrease in the car transportation share can reach up to 15%. In terms of the level of impact on the share of active transportation, a variety of perspectives can be observed though, with the median value to be close to the "Not affected" option.

The figures regarding the application of new mobility services show a strong transition towards this direction, with the majority of respondents to foresee an increase from 30 to 60% to the number of dock less bikes and e-scooters (Graph 32).



Graph 32 Level of impact on the number of micro-mobility services (Padua - scenario 1)

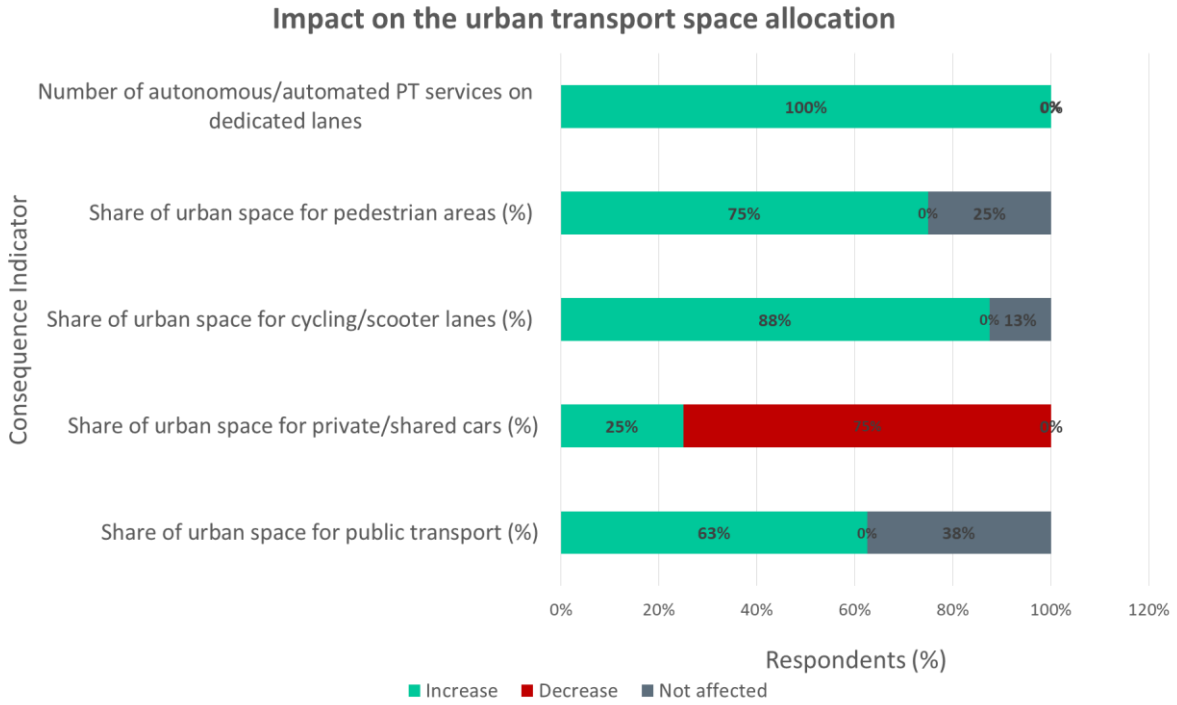
Finally, in terms of urban freight transportation, the figures show also a trend towards an urban freight mix with 10% more green deliveries on the one hand and from 10 to 50% more next day/ next hour deliveries on the other hand. (Graph 33).



Graph 33 Level of impact on the share of green deliveries and next hour-same day deliveries (Padua scenario 1)

Econ CA2: Urban space allocation:

Taking into consideration, the share of the transportation modes presented above, respective changes in the urban space allocation are also foreseen. More specifically, an increase in the share of urban space for micro-mobility and cycling/scooters is anticipated and a decrease in the space for car transportation.



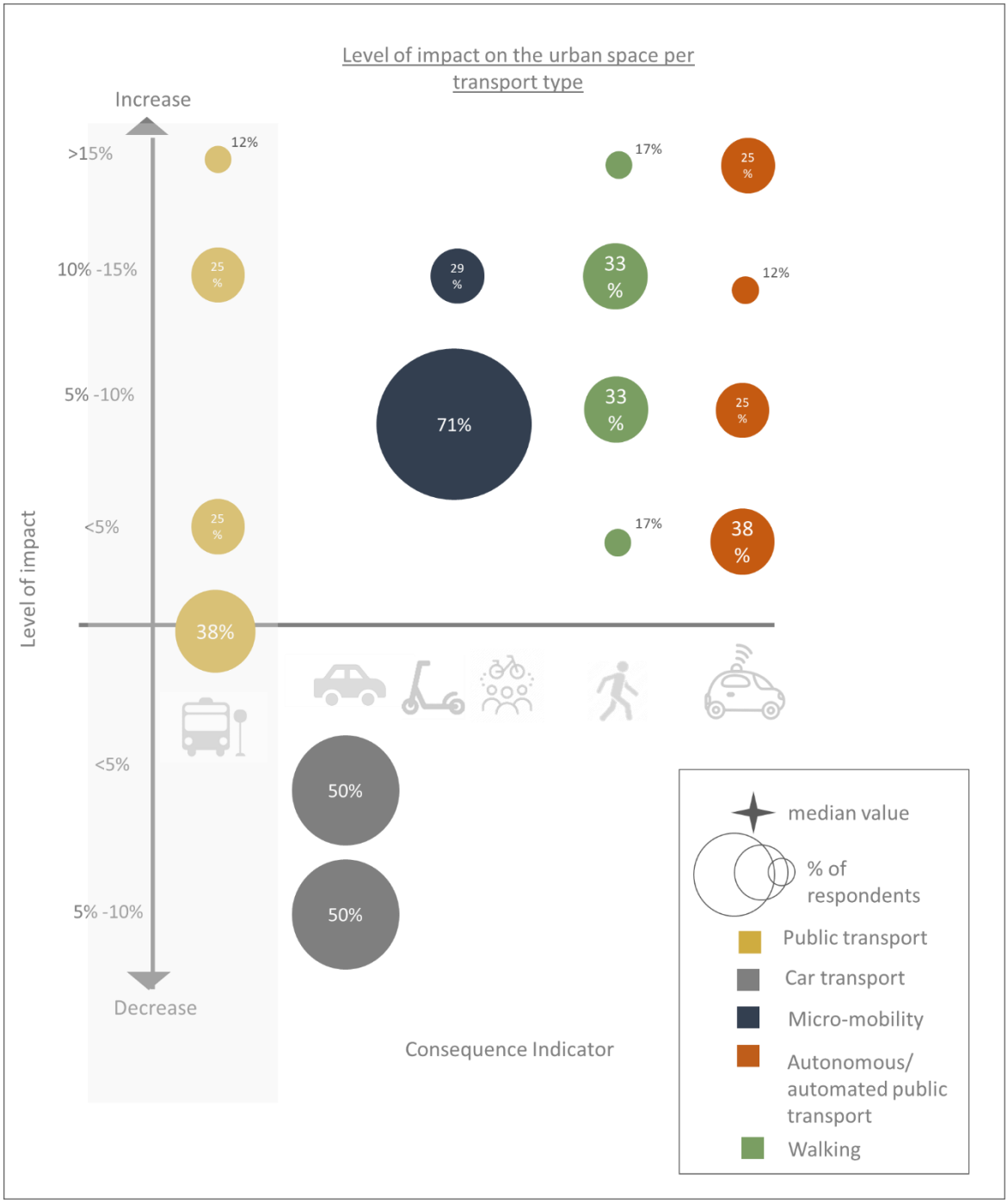
Graph 34 Impact on the urban transport space allocation (Padua scenario 1)

Consensus has been also reached on the assessment of the majority of the consequence indicators besides the CI related to the share of urban transport space for public transportation.

As presented in Graph 35, a strong increase, of up to 10% in the urban space for micro-mobility means is expected and a decrease of up to 10% in the car transportation urban space. With respect to public transportation, the opinions vary, as the 38% of the total respondents do not expect that this indicator will be affected, and only a 25% foresees either an increase of up to 5% or up to 15%.

This figure reveals also, that the level of increase of the share of public transportation, as presented in the previous CA, is not high enough for requiring also changes in the current allocation of the urban space.

On the contrary, controversial outcomes can be observed regarding the share of urban space for pedestrian areas. Although the share of active transportation mode is not expected to highly change, given the variety of perspectives presented above, the 75% of the respondents expect an increase from 5 to 15% in the urban space allocated for the pedestrians.

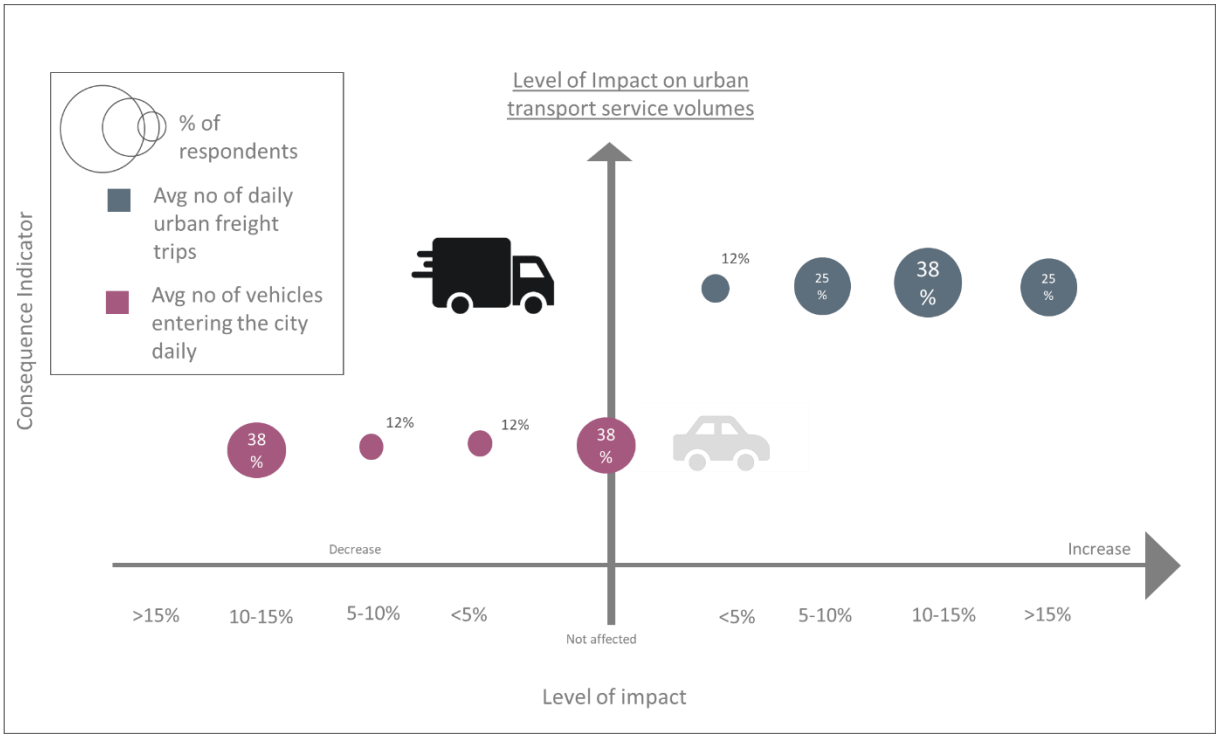


Graph 35 Level of impact on the share of urban space per transport type (Padua-scenario 1)

The city expects also a transition towards automated and autonomous mobility. All the respondents indicated changes in the urban space allocation for satisfying this demand with half of them to support an increase of up to 10 % in the dedicated lanes for autonomous and automated vehicles.

Econ CA3: Urban transport service volumes:

Although Padua is expected to be less populated and its share of car transportation to be decreased, the respondents do not reach on an agreement regarding the potential impact to the average number of vehicles entering the city on a daily basis. Almost the 38% of the respondents do not foreseen that this indicator will be affected by these changes. From the 50% of the respondents which indicate that this indicator will be decreased though, their opinion on the level of impact varies. Thus, taking into account from the abovementioned results the median value, a slight decrease of approximately 5% can be concluded to be expected for this indicator.



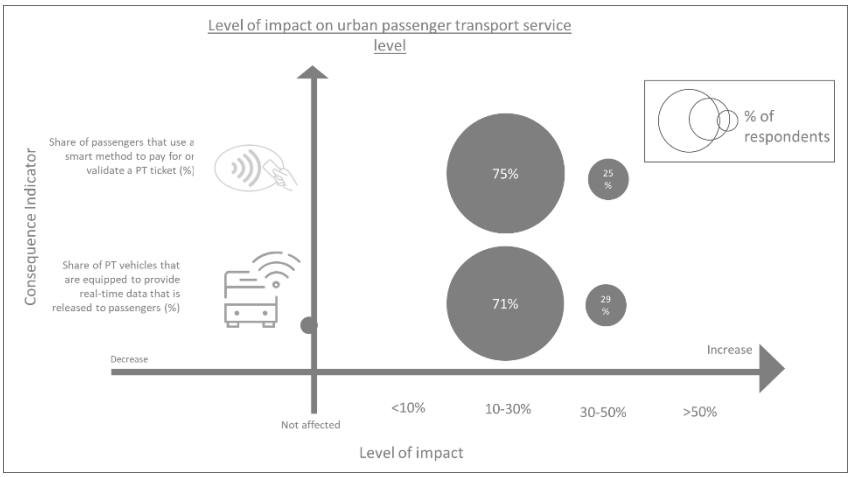
Graph 36 Level of impact on urban transport volumes (Padua-scenario 1)

Regarding urban freight flows though, the figures show a clear increase, with all the respondents to anticipate an increase of up to 15% to the average daily urban freight trips implemented within the city.

Econ CA4: Urban transport service level:

The increased adoption of smart city technologies and automation is strongly justified in the respondent's positive perspectives on the share of the public transport vehicles to be equipped with smart technologies and the passengers that use smart methods to pay by 2025-2030.

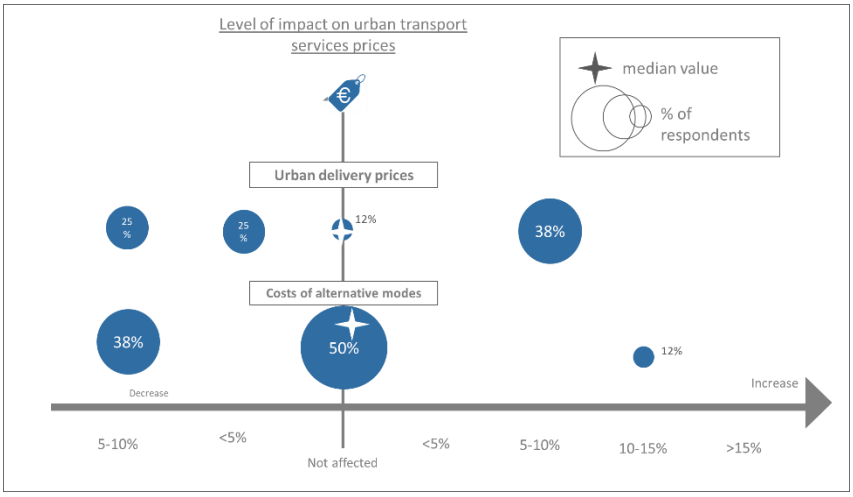
According to the majority of the respondents an increase of up to 30% in share of PT vehicles that are equipped to provide real-time data that is released to passengers is expected and an increase of up to 30% to share of passengers that use a smart method to pay for or validate a PT ticket .



Graph 37 Level of impact on urban passenger transport service level (Padua-scenario 1)

Similarly, the strong growth in delivery requirements and the transformation of retail will result to a better service level with the 75% of the respondents to foresee more weekly deliveries to consumers. With respect to the level of goods frequency increase, the majority of those (67%) indicate a 5-10% increase while the rest an increase of up to 15%.

Finally, in terms of prices and costs for both passenger and freight transportation services, the perspectives vary and thus consensus has not been reached. Graph 38 below, presents the different opinions in terms of the level of impact of urban transport costs. According to this Graph and taking into consideration the median values regarding both indicators no significant changes are expected towards either a positive or a negative direction to the urban delivery prices and the costs of alternative modes of transport.



Graph 38 Level of impact on urban transport service prices (Padua-scenario 1)

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a strong increase of 11% in the necessary private investments is foreseen for time horizons 2025-2030. Possible explanations for this requirement, is the strong transformation of the retail sector with green transport modes and more delivery frequencies.

3.2.2.10. Environment Impact Analysis

Although a clear direction to green and public transport modes is shown in the previous consequence areas, a slight negative impact to the environment is expected, with a minor increase of up to approximately 10% to both the CO2 emissions and the Air quality index.

3.2.2.11. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into consideration the expected increase in the share of next hour and next day deliveries, presented in the framework of the CA1 impact analysis, a respective 44% increase of the Gig Economy employment is also foreseen, in terms of the percentage of total employees that are occupied in transport sector either as independent contractors or as freelancers.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, almost the 75% of the respondents expect an increase up to 5% in the share of urban accidents involving micro-mobility means for both the freight and passenger transportation.

Soc CA3: Access to mobility services:

Regarding the level of affordability of the city's urban mobility services, the respondents opinions are controversial, with only the 63% to support the increase of this indicator with the remaining 38% the decrease of it. Taking into consideration though the balanced response on the level of expected impact to this indicator, the figure shows a tendency towards an among 5 and 10% increase in the affordability of using mobility services.

With respect to accessibility, a quite positive impact is foreseen by the city as the 100% of the respondents expect a moderate increase to both indicators related to this area.

3.2.3 Sustainability Impact Assessment: Padua Scenario 2

3.2.3.1 Padua's second mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

In 2030, Padua is characterized by a lack of transparency and political support for urban mobility projects. There is therefore a deteriorating quality in public transport, and a lack of investments in long-term projects, like data and information networks. This, coupled with concerns around privacy and security, complicates the adoption of smart-city technology, which means that the adoption of it is not widespread. The installation of devices for a wider adoption is complicated and costly. There is, however, a small progress in automation that leads to relative positive impacts on the city's mobility, but there are concerns around privacy and security here as well.

Because of a limited rise in environmental consciousness, citizens are not encouraged to search for alternative modes of transport, which are anyway more difficult to come by because they're ineffective. Private vehicles are therefore still considered the most comfortable mode of transport. As new job opportunities slightly grow however, the demand for public transport is more evenly distributed during the day, which has a small positive impact on mobility. The sharing economy for mobility also does not take off, reducing those services' potential positive impact on mobility and traffic reduction. In addition, electrification remains weak due to a lack of adequate funding, and high acquisition prices. There is also a lack of charging facilities across the city.

There furthermore is an increased demand for space by e-commerce and last-mile logistics operators, who don't cooperate among themselves, as the transformation of retail grows only weakly.

These developments occur against the backdrop of an increasingly dense city with less inhabitants, which fuelled the concentration and consolidation of traffic flows along major routes connecting relevant facilities for more efficiency. However, as delivery requirements by consumers have grown only weakly, the urban logistics network has only moderately densified, and some urban areas are not served by last-mile operators.

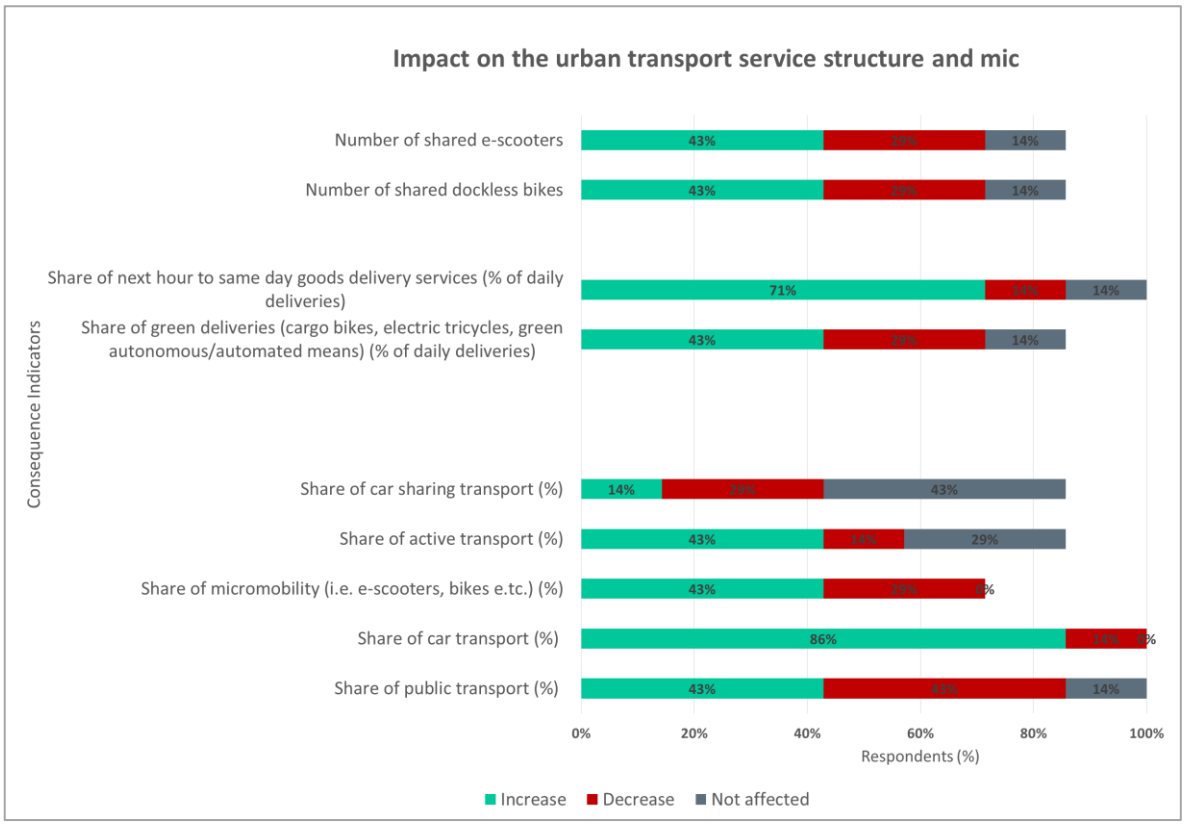
Main take-aways:

- Political support and transparency: decrease
- New job opportunities, new business models, transformation of retail environmental consciousness, next-hour to same-day delivery: weak growth
- Urban structure: increasing densification
- Population size and local environmental quality: decrease
- Electrification, smart-city technology, automation: weak growth
- Data and privacy laws, health and safety laws: less regulation

3.2.3.2 Economic Impact Analysis

Econ CA1: Urban transport service structure and mix

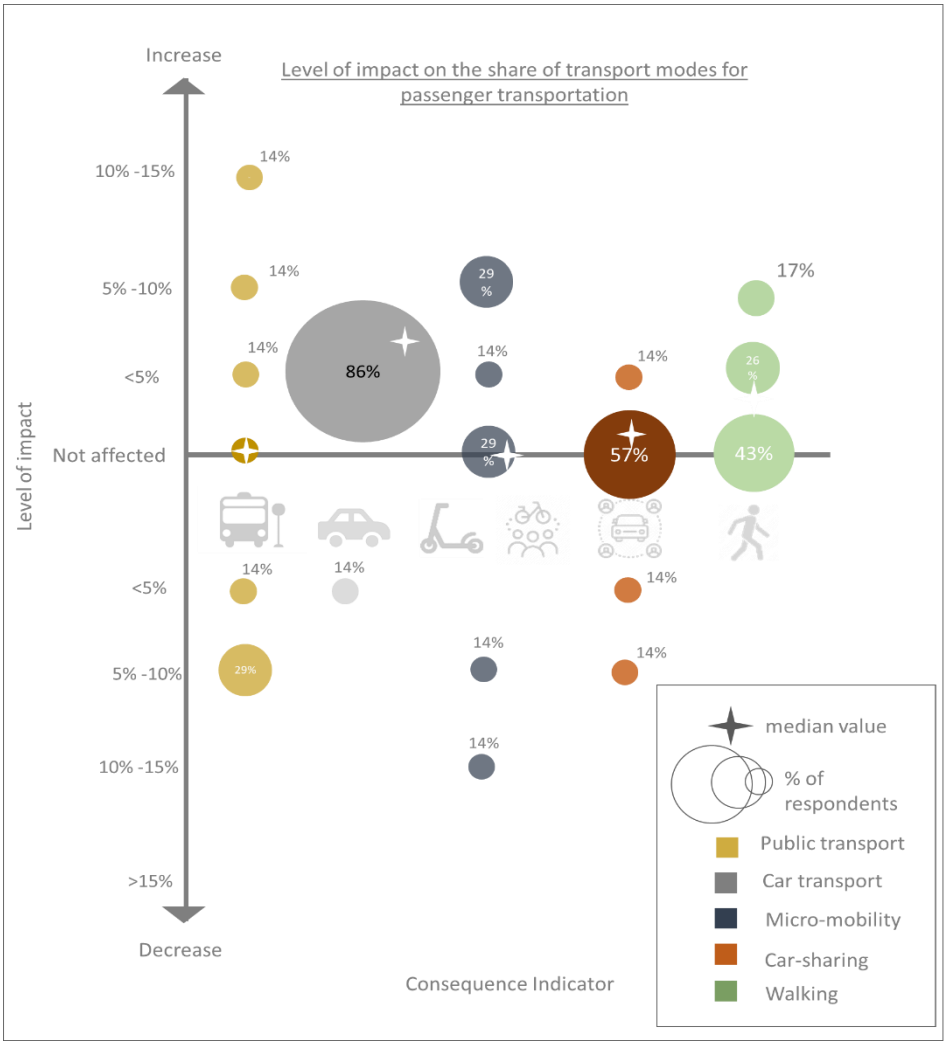
Padua's results regarding the economic impacts of the 2nd scenario, show quite divergent view among the local stakeholders. As presented in the following Graph 39, at the 90% of the CIs impact assessment, consensus cannot be reached towards which direction the city's mobility economic state will change and thus the statistical rule of 70% majority cannot be applied.



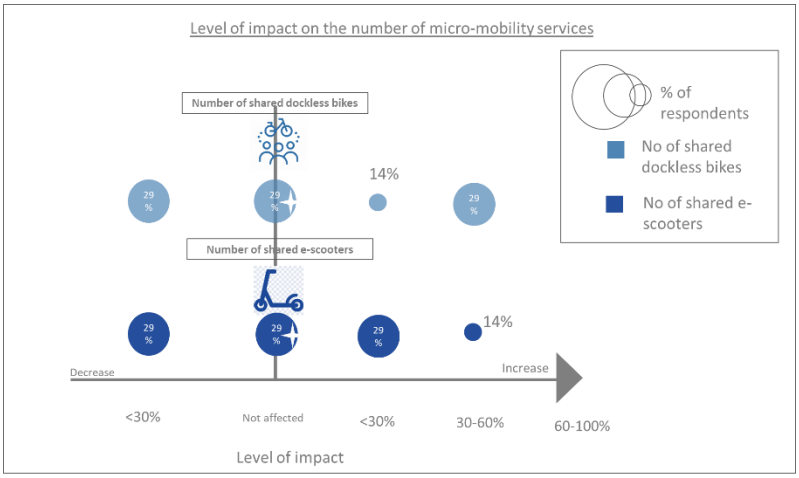
Graph 39 Impacts on the urban transport structure and mix (Padua-scenario 2)

As indicated in Graph 40, the limited rise in environmental consciousness is clearly presented, with the 85% of the respondents to foreseen a slight increase in the share of car transportation and no significant change in the share of car sharing transport. The share of public transportation, micro-mobility means (taking into consideration the mean value) as well as active transportation is expected to remain stable.

More specifically, regarding the introduction of more new mobility services, the opinions are controversial, with the balance to be found among the scale's value: "not affected" and increase of up to 5% (Graph 41)

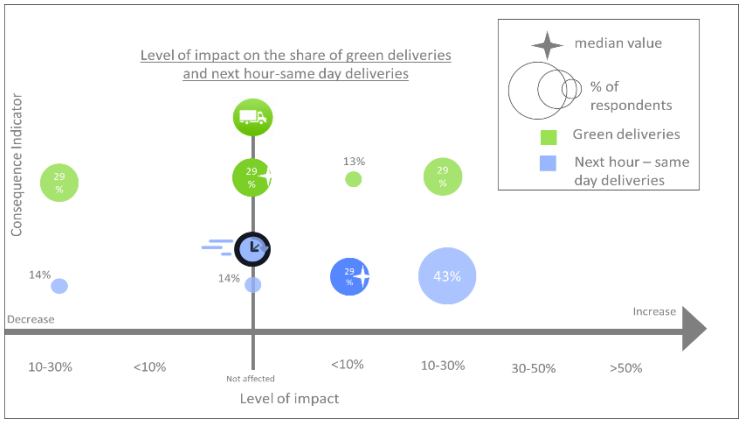


Graph 40 Level of impact on the share of transport modes for passenger transportation (Padua scenario 2)



Graph 41 Level of impact on the number of micro-mobility services (Padua -scenario 2)

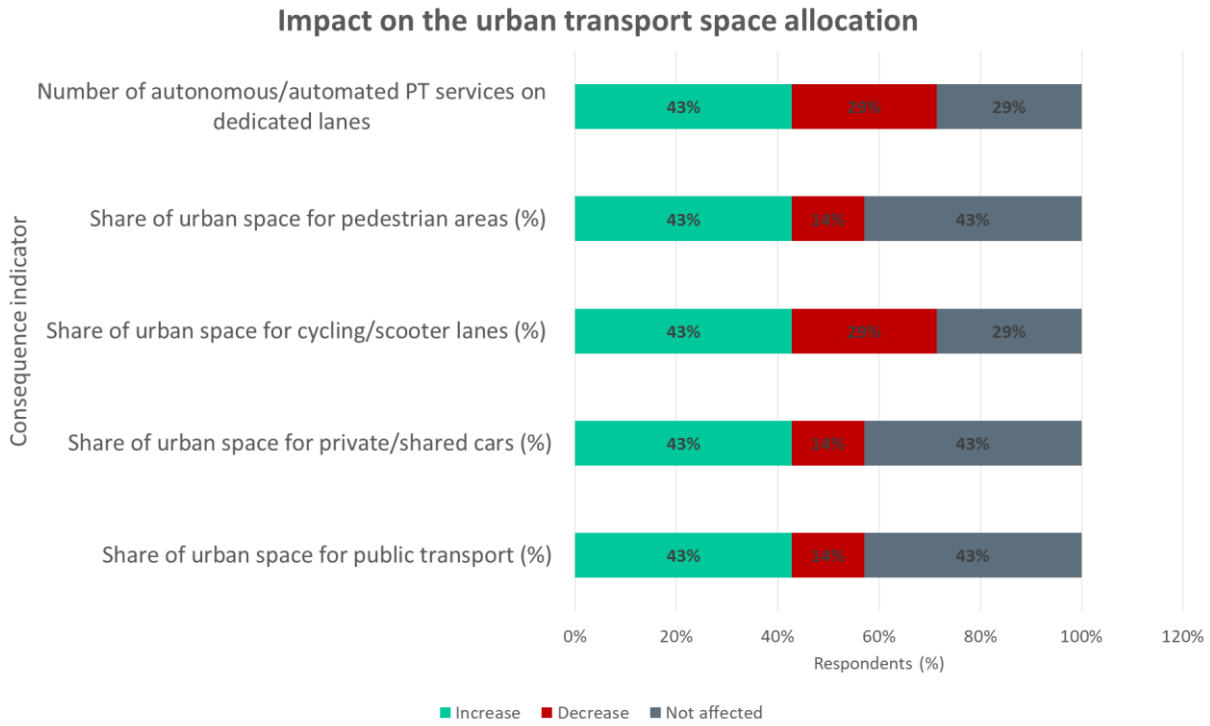
In terms of the level of impact on green deliveries the median value from all the different opinions lies in the slight (<10%) increase. The only clear outcome is related to the share of next hour and next day deliveries. Similarly with the previous scenario, consensus has been reached, and the majority of the respondents expect an increase in this indicator which might range from 10 to 30%.(Gapth 42)



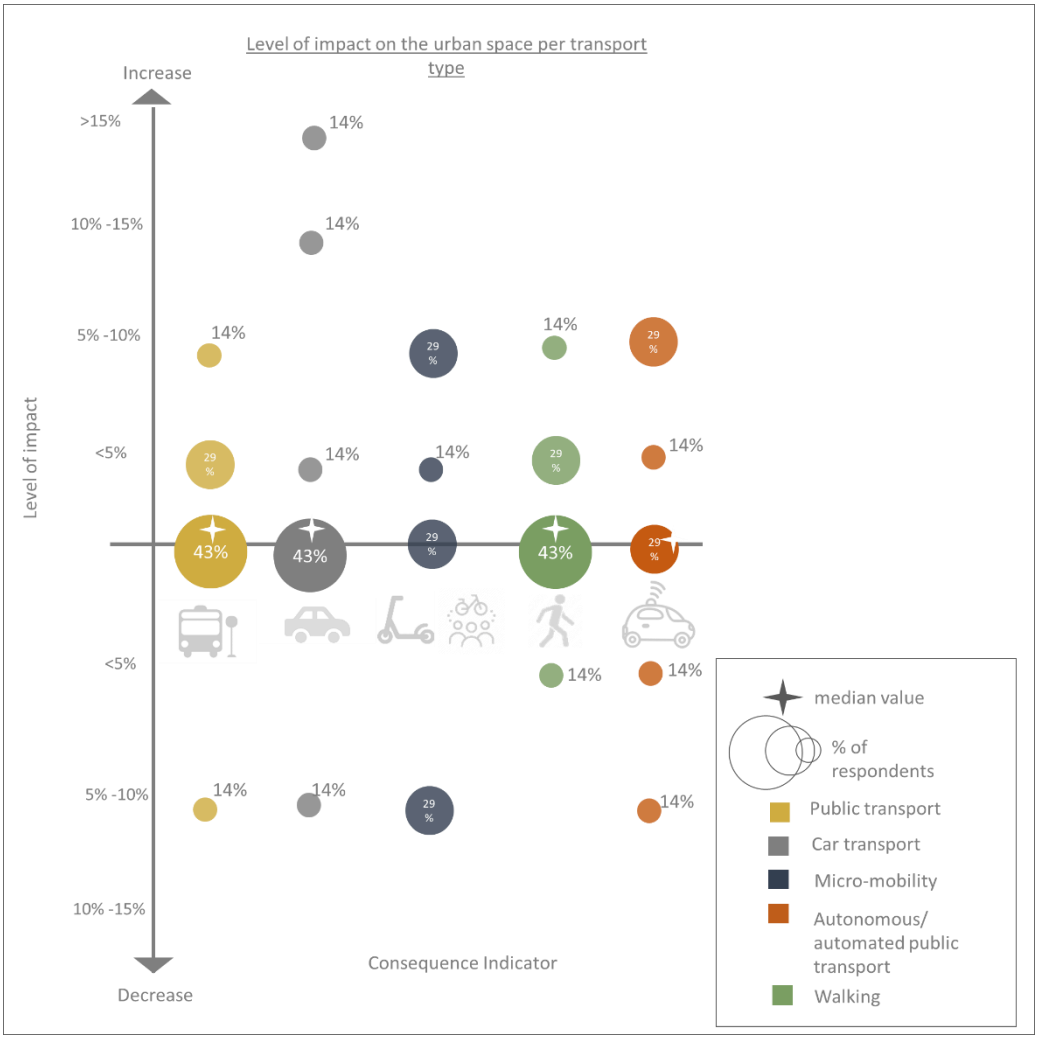
Graph 42 Level of impact on the share of green deliveries and next hour-same day deliveries (Padua-scenario 2)

Econ CA2: Urban space allocation:

Taking into consideration, the figures of the expected impact on the urban transport structure and mix share, presented in the previous CA, the same stabilized figure can be seen also for the urban space allocation per transport mode. The respondent's opinions vary, and a strong proportion of the respondents do not expect any changes towards any direction, either positive or negative.



Graph 43 Impact on the urban transport space allocation (Padua-scenario 2)



Graph 44 Level of impact on the share of urban space per transport type (Padua-scenario 2)

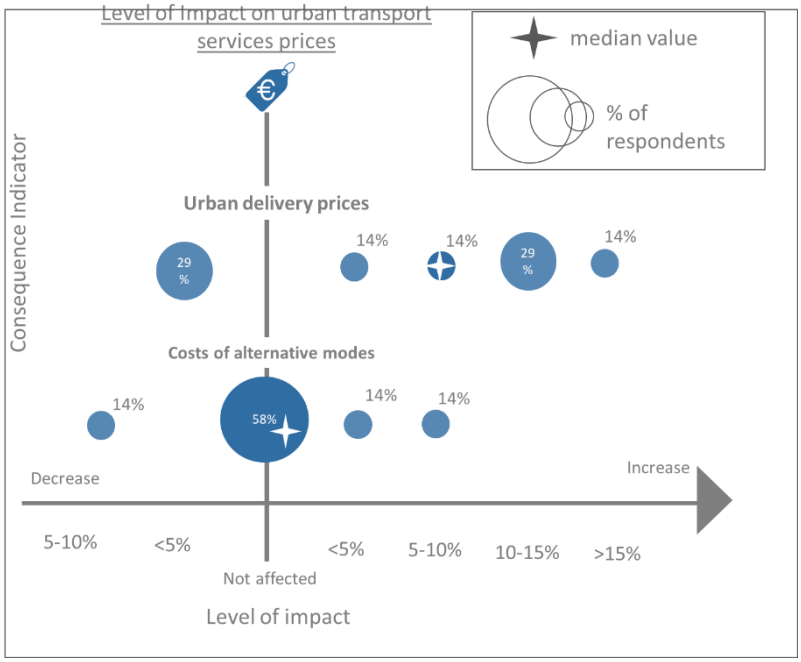
Econ CA3: Urban transport service volumes:

In comparison with the previous consequence areas analysis, a 100% agreement has been reached on how the urban transport service volumes will be evolved by 2025-2030. The survey's results show that all the respondents believe that the volumes for both passenger and freight transportation in time horizons 2025-2030 will be higher than today. More specifically, almost the 57% of the participants expect a range from 5 to 10% increase and almost 30% of the respondents an increase of up to 15% to both the number of daily urban freight trips and the number of vehicles entering the city on a daily basis.

Econ CA4: Urban transport service level:

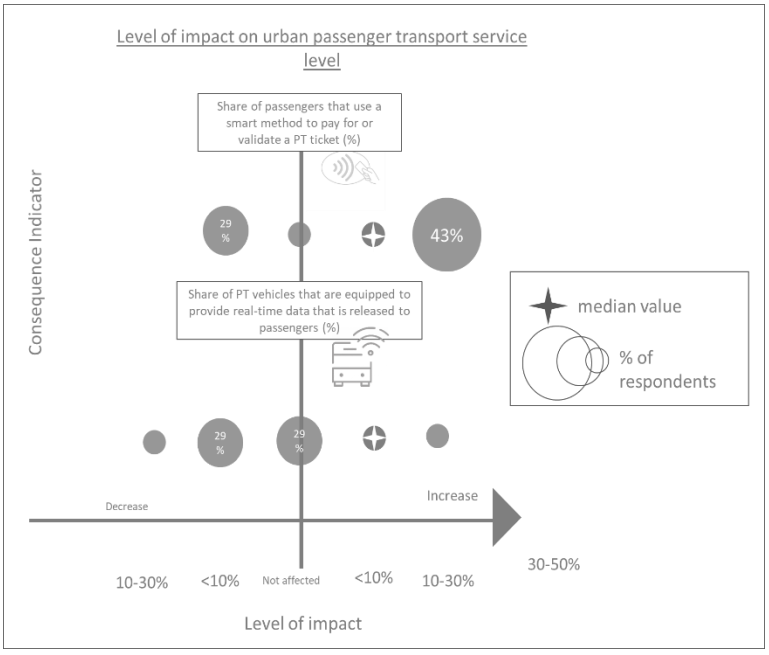
The weak adoption of smart city technologies and automation is clearly shown in the following Graphs, which is logically explained by the expected overall stable situation of the city's future mobility state. Similarly with the previous figures, consensus has not been reached in the analysis of the majority of the CIs. Only in the analysis of the CI related to the expected impact

on urban delivery prices, the majority of the respondents, agree on its slight increase –up to 10%,



Graph 45 Level of impact on urban transport service prices (Padua scenario 2)

In terms of the existence and use of new technologies in public transportation, a slight increase in the share of passengers that use smart method to pay for a PT ticket is foreseen. No changes are expected though, on the share of PT vehicles that are equipped with new technologies.



Graph 46 Level of impact on urban passenger transport service level (Padua scenario 2)

On the other hand, regarding urban freight transportation, a slight positive impact to the service level is foreseen with an increase of up to 5% to the weekly frequency of urban deliveries.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

Surprisingly, in terms of the necessary urban transport operational and capital expenditure costs, a strong increase of 9% in the necessary private investments is foreseen for time horizons 2025-2030. This finding is unexpected taking into consideration the abovementioned figures.

3.2.3.3 Environment Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

In comparison to the previous figures, a 100% consensus has been reached regarding to the potential environmental impact of the second scenario by the time horizons 2025-2030. More specifically, all the respondents foresee a significant increase in both the CO2 emissions and the Air Quality Index, which may reach an increase of up to 50% and 39% respectively.

3.2.3.4 Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into consideration the expected increase in the share of next hour and next day deliveries, presented in the framework of the CA1 impact analysis, a respective 48% increase of the Gig Economy employment is also foreseen, in terms of the percentage of total employees that are occupied in transport sector either as independent contractors or as freelancers.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, almost the 71% of the respondents expect an increase of up to 15% in the share of urban accidents involving micro-mobility means and an increase of up to 10% in the share of urban mobility accidents involving on-demand bike/scooter deliveries.

Soc CA3: Access to mobility services:

Regarding the level of affordability of the city's urban mobility services, the outcomes are controversial with a stronger tendency towards the negative impact on both indicators. More specifically, regarding the affordability of using mobility services, the 57% of the respondents expect a decrease of this indicator fluctuating among 0 and 10%.

With respect to accessibility for either all categories of passengers or especially for the vulnerable groups, the opinions vary. The median values among all the responses shows that the accessibility for all the categories of passenger is expected to be minor decreased and, on the other hand, the accessibility for vulnerable groups to mobility services to not be affected at all.

3.2.4 Sustainability Impact Assessment: Padua Scenario 3

3.2.4.1 Padua's third mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

In 2030, a less populated Padua is characterized by an array of changes in urban mobility. Political support for alternative mobility modes and increased transparency helped fuel a modal shift, and reduced urban traffic due to better development of secondary transport networks. This increase in political support, coupled with a strong growth in new business models, increase in environmental consciousness, and automation, and the adoption of smart city technology further helped fuel a modal shift away from private cars and in favour of public transport. However, there is increased congestion due to increase in freight operations, with an urban logistics network that needs to be reconsidered by placing more logistics nodes, and having them closer to the final customers. In addition, the majority of the city's vehicles are now electric (both private and public ones), which are now more heavily regulated by the city's authorities. There is also a proliferation of new vehicles, like e-scooters, and an increased interest for cycling. There is also an increased interest and demand for the servitization of mobility, which is facilitated by the strong developments in smart-city technology. However, automation is still limited due to concerns regarding privacy and data management.

As local environmental quality has increased, limited traffic areas are extended, and more stringent environmental regulation is adopted.

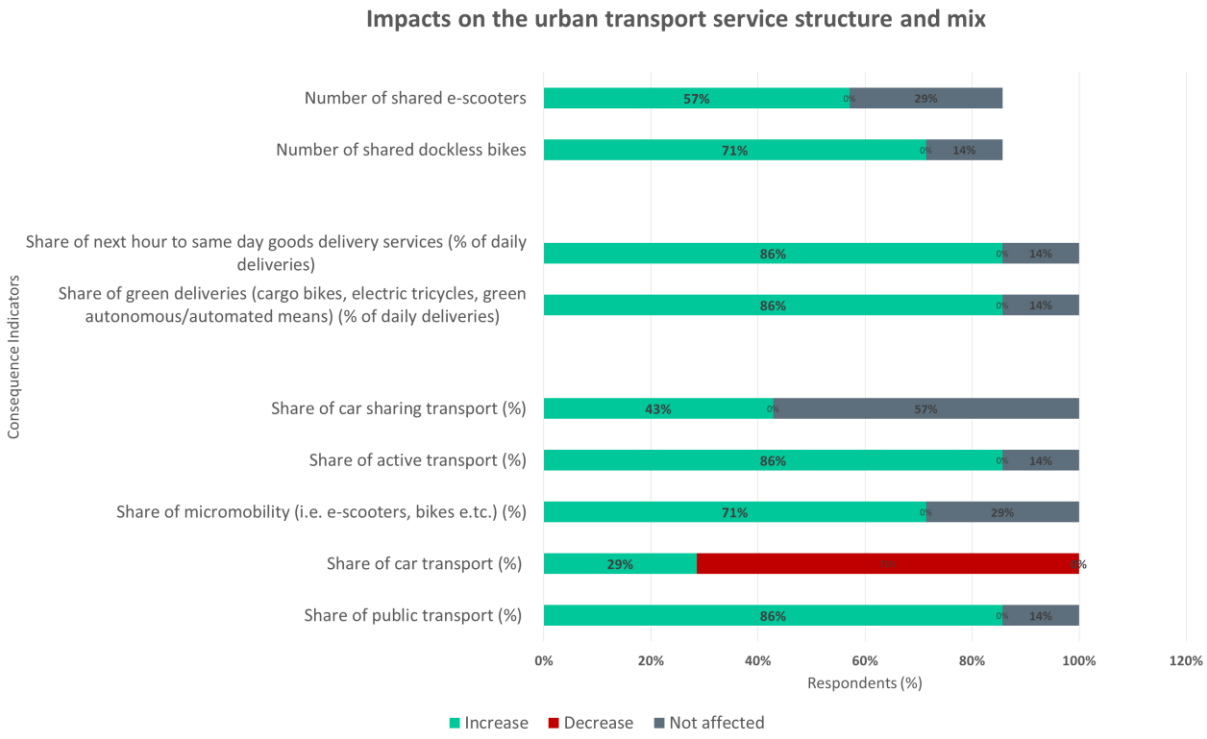
Main take-aways:

- Political support and transparency: increase
- New job opportunities, automation: weak growth
- New business models, transformation of retail, next-hour to same-day delivery, electrification, smart-city technology: strong growth
- Urban structure: increasing sprawl
- Population size and local environmental quality: decrease
- Data and privacy laws, health and safety laws: less regulation

3.2.4.2 Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

Based on the survey results, a common perception on the evolution of this CA can be observed among the respondents. Consensus has been reached on the assessment of the majority of the consequence indicators, with more than 70%, of the respondents to agree on the impact of the scenario to each indicator (Graph 47).



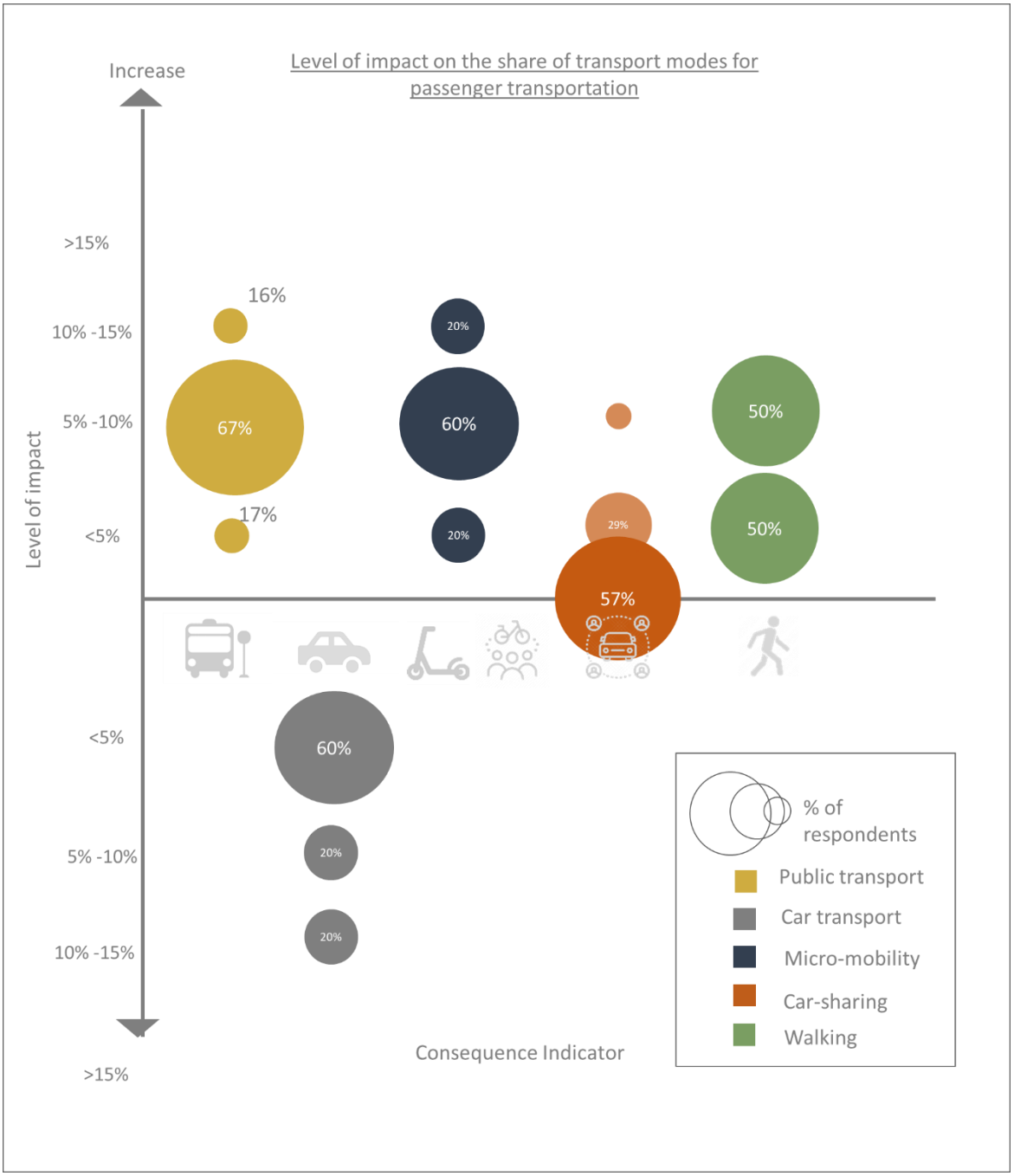
Graph 47 Impacts on the urban transport structure and mix (Padua scenario 3)

For these indicators, were consensus has been reached and the 70% majority rule can be applied, the following analysis focuses on the opinion of the majority group of respondents while in the rest questions the analysis shows the average opinion among all the respondents.

Following Graph 48 the stakeholders' expectations show a clear trend towards the use of environmental friendly transport modes by the citizens. Regarding passenger transportation, the city expects an increase in the share of active transportation, public transportation and micro mobility as well as in the number of new mobility services that will operate in the city. The increase in the population's environmental consciousness, mentioned in this narrative scenario, is also enhanced by the decrease on the share of car transportation. The believes regarding the potential change towards car sharing services are divided in half, among those that forecast an increase in the share of car sharing and those that do not expect that this indicator will be affected.

With respect to the level of impact on each consequence indicator, the graph below shows a tendency towards an increase of up to 10% to the share of both the public transportation and

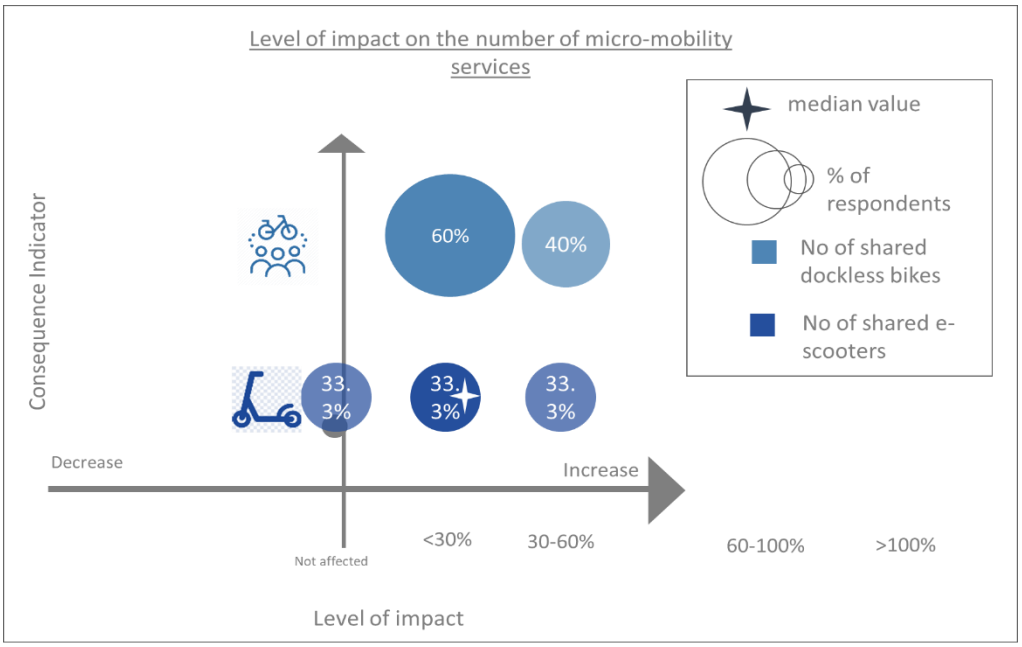
micro-mobility, a lower than 5% decrease of car transportation while the share of car sharing transport is not expected to be affected. With respect to active transportation, the opinions are divided among two close ranges: lower than 5% and from 5 to 10%.



Graph 48 Level of impact on the share of transport modes for passenger transportation (Padua-scenario 3)

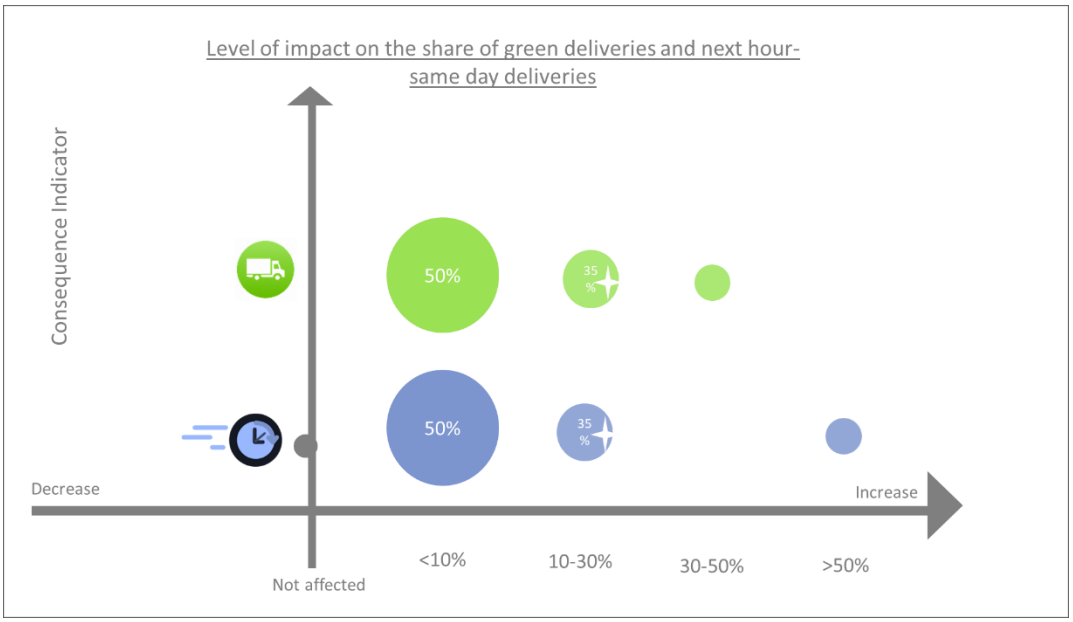
Regarding the application of new mobility services, a stronger tendency towards the use of shared dock less bikes rather than the use of shared e-scooters is observed. More specifically,

an increase of up to 60% in the number of shared dock less bikes is foreseen and an up to 30% increase to the number of shared e-scooters (Graph 49).



Graph 49 Level of impact on the number of micro-mobility services (Padua scenario 3)

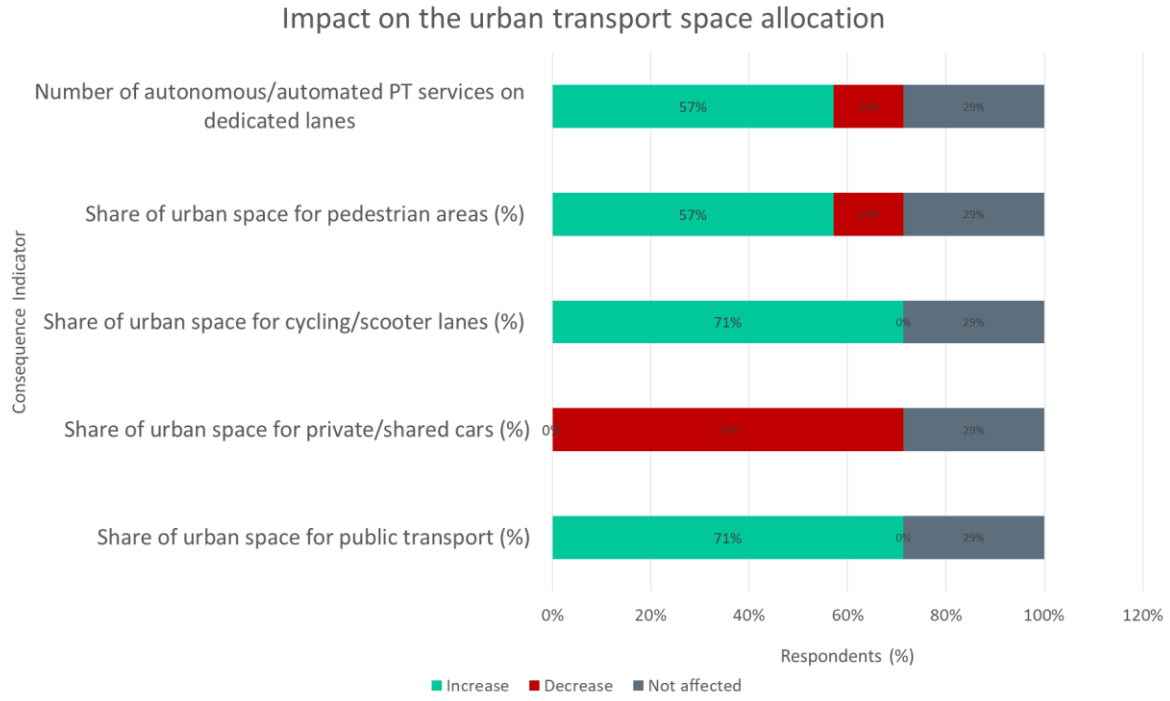
Finally, in terms of urban freight transportation, the graphs show also a trend towards more green deliveries, with half of the respondents -which agree on this- to foresee an up to10% increase in the correspondent share of green deliveries. On the other hand though, a slight increase, up to 10%, on the next hour next day deliveries is also expected (Graph 50).



Graph 50 Level of impact on the share of green deliveries and next hour-same day deliveries (Padua-scenario 3)

Econ CA2: Urban space allocation:

Taking into consideration, the expected impact on the urban transport structure and mix presented above, respective changes in the urban space allocation are also observed. More specifically, an increase in the share of urban space for micro-mobility and cycling/scooters is foreseen and a decrease in the space for car transportation.

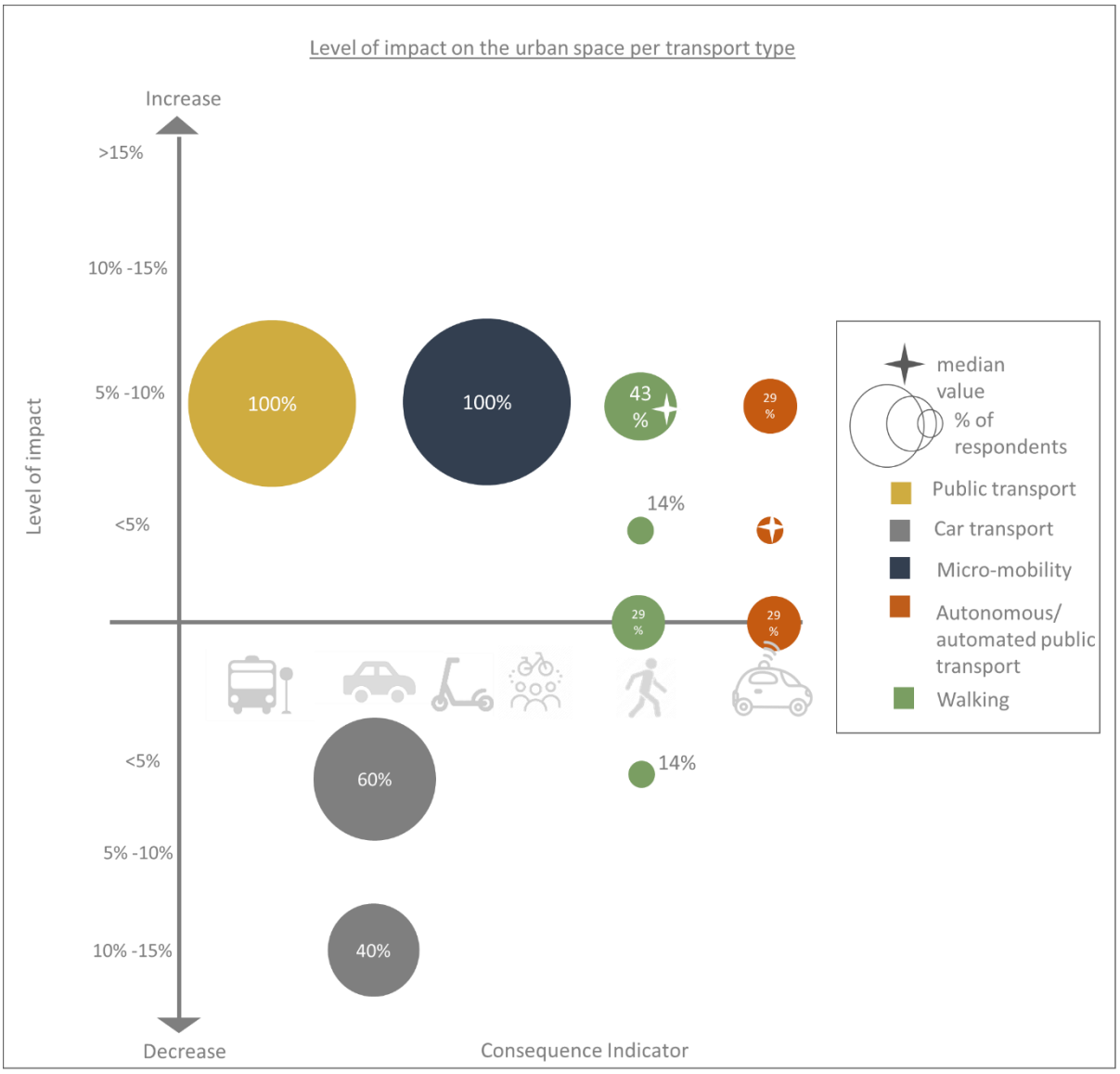


Graph 51 Impact on the urban transport space allocation (Padua scenario 3)

Consensus has been similarly reached on almost all the CIs analysis besides the CIs related to the share of urban space for pedestrian areas and for autonomous and automated vehicles (Graph 51).

As presented in Graph 52, a strong increase, of up to 10% in the urban space for micro-mobility means, public transportation is expected and a decrease of up to 10% in the car transportation urban space. Controversial perceptions can be noticed regarding the share of urban space for pedestrian areas with the 43% of the respondents to support the increase of this indicator by 10% and another 43% to either not expect any change towards any direction or to indicate a slight increase of up to 5%. The median value among those views lies in the slight increase of up to 5% to the share of urban space for pedestrian areas.

Similarly with the other two scenario's analysis a slight transition towards automated and autonomous mobility is also observed. Although, consensus has not been reached, the median value shows a minor increase -an up to 10%- to the lanes dedicated for autonomous and automated transportation.

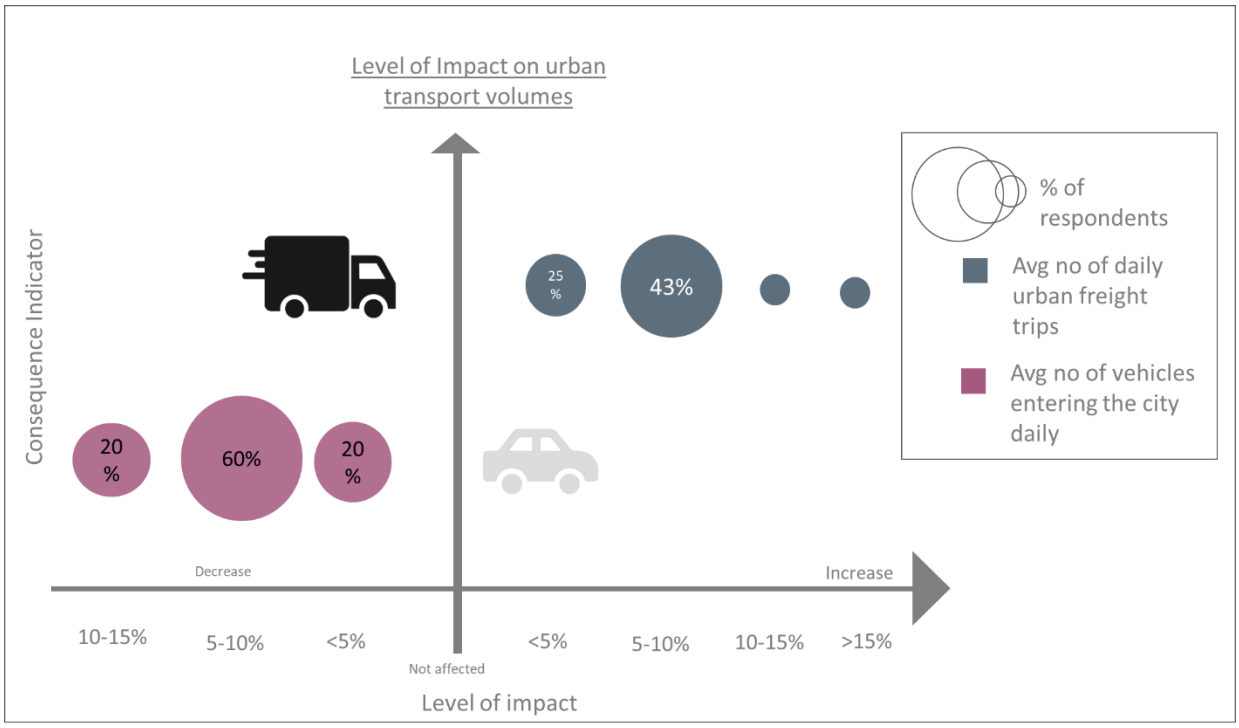


Graph 52 Level of impact on the share of urban space per transport type (Padua-scenario 3)

Econ CA3: Urban transport service volumes:

The less populated Padua, the decrease in car transportation is a possible explanation for the clear tendency, towards the decrease of the average number of vehicles entering the city on a daily basis, which may reach up to 10%.

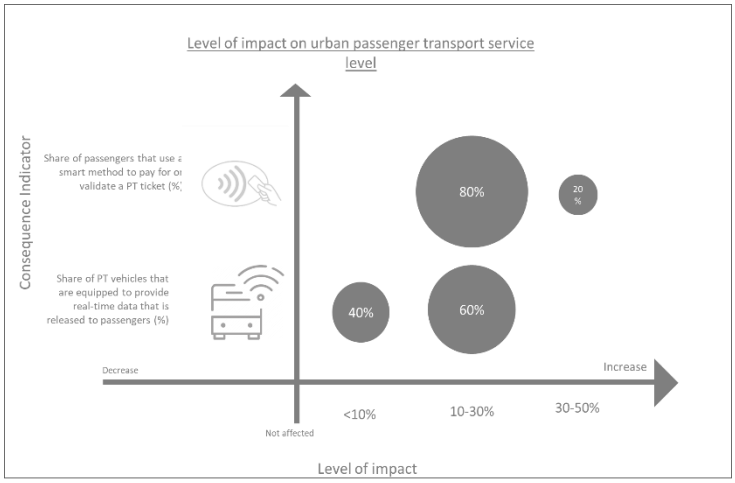
Similarly, the expected increase in the next hour and next day deliveries, presented above, justifies the expected increase -up to 10%- in the average number of daily urban freight trips implemented within the city (Graph 53).



Graph 53 Level of impact on urban transport volumes (Padua-scenario 3)

Econ CA4: Urban transport service level

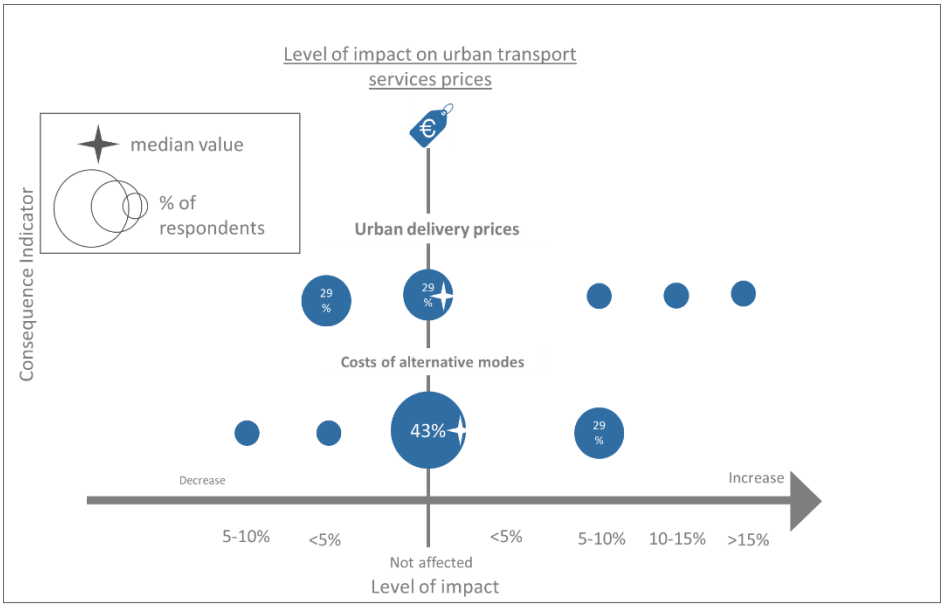
The increased adoption of smart city technologies and automation is strongly justified in the respondent's positive perspectives on the share of the public transport vehicles to be equipped with smart technologies and the passengers that use smart methods to pay by 2025-2030, which according to the majority of the respondents may be more than 30% increased by 2025-2030. (Graph 54)



Graph 54 Level of impact on urban passenger transport service level (Padua-scenario 3)

Similarly, the growth in delivery requirements and the transformation of retail will result to a better service level with the 86% of the respondents to foresee up to 10% more weekly deliveries to consumers.

Finally, in terms of costs for both passenger and freight transportation services, the perspectives vary and thus consensus has not been reached (Graph55). According to the following graph and taking into consideration the most balanced responses, both the urban delivery prices and the costs of alternative modes of transport are not expected to be affected.



Graph 55 Level of impact on urban transport service prices (Padua-scenario 3)

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a moderate increase of 8% in the necessary private investments is foreseen for time horizons 2025-2030. Possible explanations for this requirement, is the strong transformation of the retail sector with green transport modes and more delivery frequencies.

3.2.2.12. Environment Impact Analysis

Although a clear direction to green and public transport modes is shown in the previous consequence areas, a slight negative impact to the environment is expected, with a significant increase of up to approximately 28% to the CO2 emissions and up to 32% to the Air quality index.

3.2.4.3 Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into consideration the expected increase in the share of next hour and next day deliveries, presented in the framework of the CA1 impact analysis, a respective 39% increase of the Gig Economy employment is also foreseen, in terms of the percentage of total employees that are occupied in transport sector either as independent contractors or as freelancers.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, almost the 71% of the respondents expect an increase up to 10% in the share of urban accidents involving micro-mobility means for both the freight and passenger transportation.

Soc CA3: Access to mobility services:

Regarding the level of affordability and accessibility of the city's urban mobility services, the respondent's opinions are controversial, with only the 57% to support the increase of these indicators, a 29% of the respondents to not expect any change towards an either positive or negative direction and the remaining 14% to foresee the slight decrease of these indicators.

Following also the varied and controversial views on the expected level of impact to these indicators, the median values show, a minor increase –up to 5%- in the affordability of using mobility services by the citizens. With respect to the accessibility to mobility services, in a 4 points qualitative scale; Minor, Moderate, High or Extreme, the median values show on the one hand an expectation for a slight increase of the accessibility for vulnerable groups to mobility services and on the other hand no significant changes to the level of accessibility to mobility services by all categories of passengers.

3.2.5 Padua: Conclusions

Regarding the economic mobility state of Padua city, the future shows a high possibility for the citizen's to **use more environmental friendly modes of transport** with two out of three scenarios to foresee the either moderate or high increase of the share of micro mobility and public transportation. Similar changes are expected also to the city's current urban space allocation. Two out of three scenarios show **more space for public transportation, more cycling and e-scooter lanes, less space for car transport and more space for pedestrian areas**, with two out of three scenarios to estimate it. Finally, in terms of automation in mobility, the city expects (justified by two out of three scenarios) the development and operation of dedicated autonomous/automated public transport lanes.

With respect to freight deliveries, a direction towards the provision of green deliveries is also foreseen by two out of three scenarios. On the other hand though, a definite increase of the share of next hour and same day deliveries is expected by all three scenarios.

The worst case scenario – the second scenario in Padua's case- presents a city with neither positive nor negative changes on the current transport mix and structure and the current urban space allocation besides the minor increase in the share of car transport and the share of next hour and next day deliveries.

Concerning the transport service level, a clear direction towards the use of new technologies and the smart transformation of the public transport is revealed. All three scenarios expect either a moderate or a high increase to the share of PT vehicles that will be equipped with smart technologies and the share of passengers that will use smart methods to pay. With respect to urban freight transportation, a positive impact –ranging among minor or high- to the goods delivery frequency is foreseen by all three scenarios.

In terms of costs for both passenger and freight transportation though, no significant changes towards any positive direction, are expected by 2025-2030, justified by all three scenarios. The worst case scenario even shows a moderate increase of the urban delivery prices.

One of the main negative consequences justified by all three scenarios is related to the city's urban freight transport service volumes. The future shows more congested streets, with more daily urban freight trips to be implemented for covering the higher demand due to tourism and e-commerce growth. With respect to vehicles' volumes though, two out of three scenarios expect a moderate or high decrease. In the worst case scenario, the streets will be more congested with both passenger and freight vehicles.

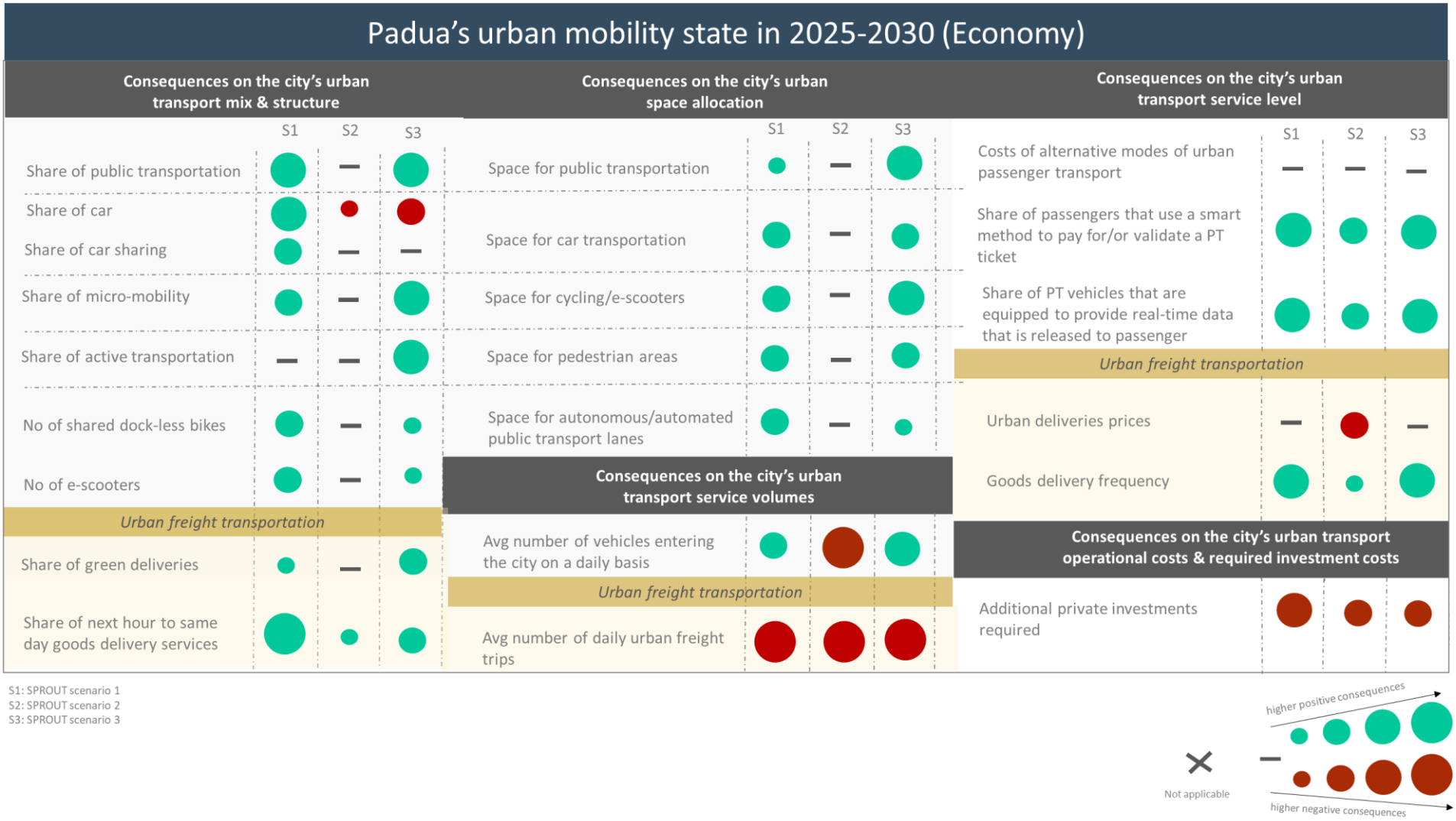
This figure of the streets can be considered the only possible explanation for the expected negative externalities to the city's environment, ranging from minor to high increase of the CO2 emissions and the Air quality index. This figure clearly shows that the expected level of increase in the use of environmental friendly modes of transport is not enough for achieving a less pollutant city.

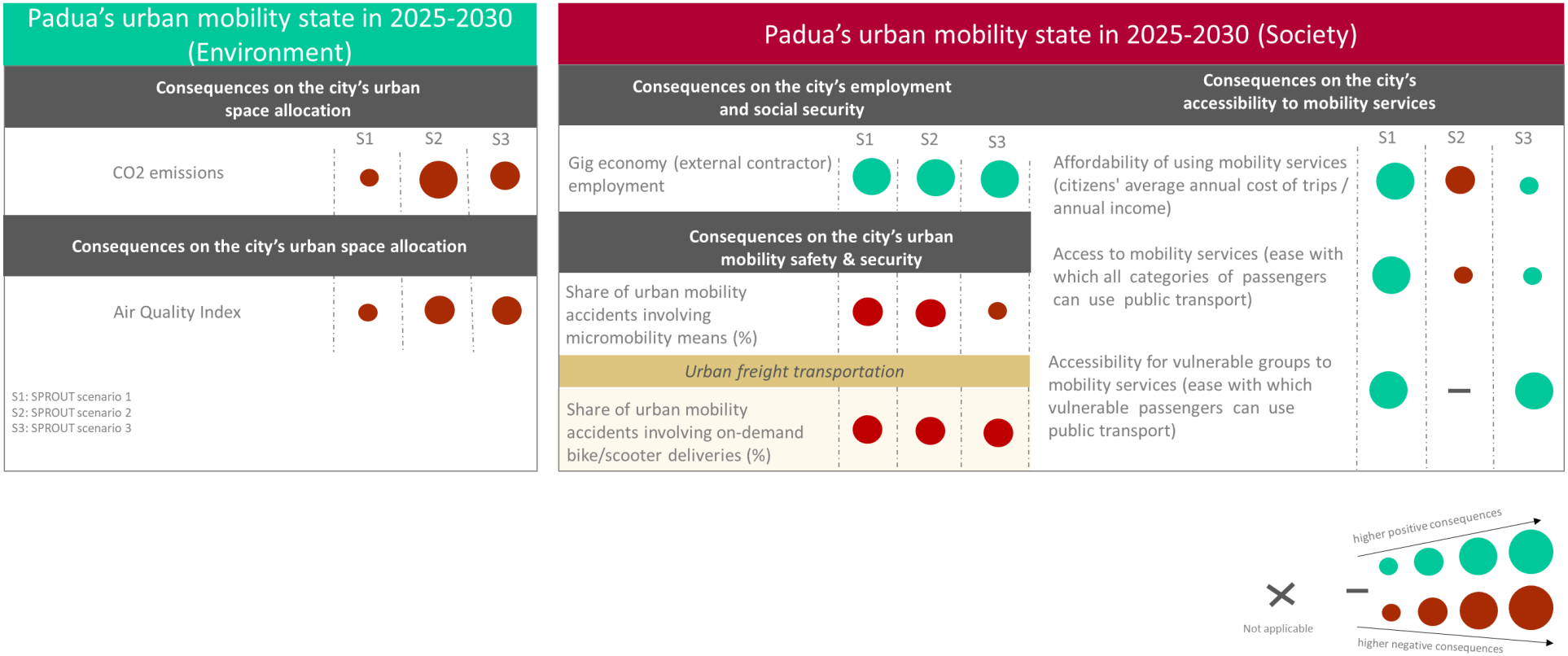
Finally, concerning the social dimension of the city's mobility state, the results are controversial. On the one hand positive figures can be noticed in the accessibility to mobility services. The city expects an increase, verified by two out of three mobility scenarios, in the affordability and of using mobility services based on the citizen's average annual cost of trips and their annual income and either a minor to high increase in the accessibility to mobility services by all categories of passengers including the vulnerable passengers. The worst case scenario presents a quite negative picture of the city's accessibility to mobility services, foreseeing a moderate decrease in the affordability and a minor decrease in the accessibility by all types of passengers' categories.

On the other hand, a safety issue is raised by all three scenarios since a significant increase in the share of urban mobility accidents involving micro-mobility means as well as in the share of urban mobility accidents involving on-demand bike/scooter deliveries is foreseen.

The following Figures illustrate the level of positive and negative consequences foreseen for Padua's' mobility state in each mobility scenario and per each sustainability dimension.

Graph 56 Paduas' future mobility state in 2025-2030 - Economy (all scenarios)





Graph 57 Padua's future mobility state in 2025-2030 –Society & Environment (all scenarios)

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3.3 Kalisz (Poland)

3.3.1 Implementation process: Stakeholders Network, Methods, Data collection

Kalisz followed a consensus building approach for filling in the survey. Kalisz city organized web-workshops (due to the COVID-19 pandemic) with the local stakeholders for discussing the content of this survey, clarifying any potential questions and concerns and finally reaching consensus among the participants for each survey's questions. For facilitating this process, the survey and all related SPROUT material was translated in the local language.

In the survey, the stakeholders that participated were representatives of the following organizations:

- Kalisz City Hall,
- Kalisz Business Incubator,
- Regional Chamber of Commerce,
- Food Cluster of Southern Greater Poland,
- Logistics company operating in Kalisz,
- ŁUKASIEWICZ Research Network – Institute of Logistics and Warehousing.

In comparison with the city of Padua and Valencia where consensus has not been reached and the questionnaires were distributed to each local stakeholder individually, in the analysis of the data collected by Kalisz city it is assumed that the stakeholders reached a 100% agreement on each question.

3.3.2 Sustainability Impact Assessment: Kalisz Scenario 1

3.3.3.1. Kalisz's first mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

In 2030, a range of drivers influences the traffic situation in Kalisz city centre. A tax policy in favour of alternative transport modes has been introduced, including the increase of parking fees, taxes on vehicles with high emissions, tax breaks for renewable energy installations, and the introduction of free public transport. Coupled **with its growing population**, **growing immigration, growing tourism,** a weak growth in safety concerns, and changing behaviour towards car ownership the demand for public transport has strongly increased. To accommodate for its citizens' move to the suburbs, the public transport network has also been extended. While changing behaviour towards car ownership has also notably reduced the private car ownership, a strong growth in new business models has increased carpooling by around 25%, as well as the use of other alternative modes of mobility by 15%. **This increases the amount of parking spots** available in the centre of the city, especially since parking fees have been increased. Due to the **strong economic growth, low-emission vehicles and electric vehicles have strongly increased**, which has increased the demand for charging stations. However, this puts increased pressure on the number of parking spots in the centre, as electric vehicles are mostly sold as private vehicles. The rise in demand for private vehicles is linked to Kalisz' younger demographic composition, since families with young children purchase them.

As the city is characterized by increasing densification, there is a 20% increase in traffic during rush hour. This dissuades city-centre residents to buy a private car, which is further

fuelled by the city's strong digitalization. This development increases the total number of trips, but the strong growth in digitalization distributes traffic more evenly. As the city's smart-city technology grows, there is also a 30% decrease in traffic, because apps make it possible to monitor available parking spots in real-time, decreasing the number of cars driving around looking for a spot. The smart-city apps, as well as infrastructure and information for public transport, are provided in multiple languages to accommodate for the city's growth in both tourism and immigration.

One of the developments putting strong upwards pressure on traffic, however, is the strong transformation of retail. There is a 25-35% increase in online shopping, which increases both congestion and the demand for parking spaces. Due to insufficient parking spots, there are problems with loading and delivery, increasing the demand for short-term parking spaces. The growth in tourism also increases this demand for unloading spaces, as commercial and service industry activities increase.

In the summer, due to an increase in climate change, there is a decrease in the use of active modes, and the total number of trips decreases, as people avoid going outside in the heat. This also means that citizens turn to air-conditioned passenger cars for everyday travels, but as local environmental quality decreases, people turn to hybrids and electric vehicles, which reduce noise and emissions.

Main Key drivers:

- **Tax policy, tourism, immigration, population size, changing behaviour towards car ownership**: increase
- **New business models, transformation of retail, environmental consciousness:** strong growth
- **Demographic composition:** decrease
- **Safety concerns:** weak growth
- **Urban structure:** increasing densification
- **Electrification, smart-city technology:** strong growth
- **Climate change:** slight increase
- **Local environmental quality:** decrease

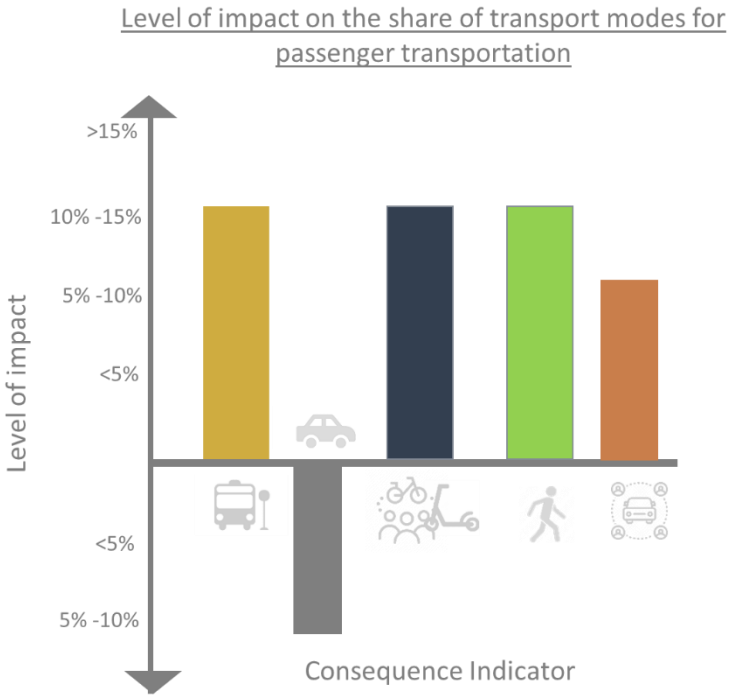
3.3.3.2. Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

A change in the inhabitants' behaviour towards more sustainability modes is strongly justified by the analysis of the first consequence area. More specifically, an increase from 10 to 15% to the share of public transportation as well as micro mobility and active transportation is foreseen. (Graph 58, 59).

Especially, regarding the use of new mobility services by the city's inhabitants, a further development of the existing bike sharing system is expected and the provision of up to 30 to 60% more shared dock-less bikes to the citizens. Furthermore, the introduction of e-scooter services is also awaited by 2025-2030.

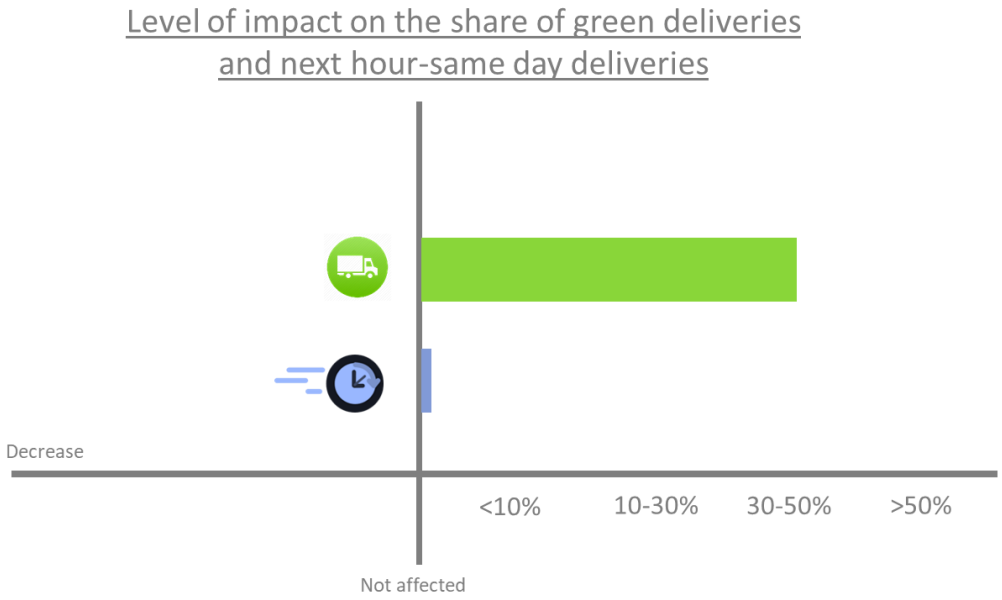
On the other hand, although an increase of up to 5% in the share of car transport is also awaited, a preference to car sharing services is foreseen by the local stakeholders. This development might result eventually to the decrease of the car ownership rate, which at this point stands to approximately 64.8% [6](Graph 58)



Graph 58 Level of impact on the share of transport modes for passenger transportation (Kalisz - scenario 1)

In terms of urban freight transportation, an increase from 10 to 30% in the share of green deliveries is foreseen while the provision of on demand and next hour deliveries is not expected to affect the city's mobility state. (Graph 59)

[6] SPROUT (2019) Del.2.2. "Current State of Urban Mobility (KPIs), HORIZON 2020 EU programme



Graph 59 Level of impact on the share of green deliveries and next hour-same day deliveries (Kalisz - scenario 1)

Econ CA2: Urban space allocation:

Taking into consideration the impact on the urban transport structure and mix presented above, respective changes in the urban space allocation are also foreseen. More specifically, a 5 to 10% increase in the share of urban space for public transportation is estimated and higher than 10% and up to 15% in the share of urban space for cycling and scooter lanes while the urban space for cars won't be affected.

However, controversial outcomes can be noticed regarding the share of urban space for pedestrian areas. Although a 15% increase in the active transportation mode is expected, a 5 to 10% decrease in the correspondent urban space is estimated for the time horizons 2025-2030. A possible explanation for that, would be the local stakeholders to have considered as active transportation mode mainly the activity of cycling and not walking.

With respect to automated and autonomous mobility, the city of Kalisz does not expect a transition towards the development of dedicated lanes for the provision of autonomous and automated public transportation services.

Econ CA3: Urban transport service volumes:

The population and tourism growth of Kalisz city will result to an increase from **5 to10% to the total average number of vehicles that enter the city** on a daily basis while a higher demand for last mile logistics is also expected which will follow to a **10-15% increase of the average number of urban freight trips implemented daily within the city.**

Econ CA4: Urban transport service level:

A **quite positive impact to the transport service level is foreseen**, since at one end, a decrease to the costs for passenger transportation services is expected (5 to 10% decrease)

and on the other hand, more public transportation vehicles will be equipped with new technologies (a 10 to 30% increase is expected to the correspondent share of PTs is estimated) and even more passengers will be able to use smart methods in public transportation (from 30 to 50% increase).

In terms of urban freight transportation, the picture is quite similar, even though a lower to 5% decrease in the urban deliveries prices is foreseen while an increase of up to 20% in the goods delivery frequency is expected.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a slight increase of 3% in the necessary private investments is foreseen for time horizons 2025-2030. A possible explanation for this requirement, is the increase of the share of green deliveries which presupposes a private investment in equipment and infrastructure (i.e. replacing the conventional fleet with the new environment friendly fleet).

3.3.3.3. Environmental Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

Although a clear direction to green and public transport modes is shown in the previous consequence areas, a slight negative impact on the environment is expected, with a significant increase of up to 35% to both the CO2 emissions and the Air quality index. A potential explanation for this figure is the significant increase in the expected traffic flows for both passenger and freight transportation. This negative outcome clearly shows that the turn towards more environmental friendly modes of transport, presented above, is not enough for preventing such negative environmental impacts.

3.3.3.4. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (*independent contractors and freelancers).* Although these areas would be expected to not being affected, taking into consideration that the city logistics sector won't provide in the recent future on demand and next hour logistics services, a 10% increase to the Gig employment is foreseen by the Kalisz city.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, the city of Kalisz expects an increase between 10 to 15% in the share of the accidents involving micro-mobility means as well as an increase of up to 5% in the accidents related to on demand bike/scooter urban deliveries.

Soc CA3: Access to mobility services:

Regarding the level of accessibility and affordability of the city's urban mobility services, a quite positive impact is foreseen by the city. More specifically, a 5 to 10% increase in the affordability of using the mobility services based on the citizens' average annual cost of trips and per their annual income, is expected while a high increase of the accessibility to mobility services by all categories of passengers.

3.3.3 Sustainability Impact Assessment: Kalisz Scenario 2

3.3.3.1. Kalisz's second mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

In 2030, a range of drivers influences the traffic situation in Kalisz city centre. A tax policy in favor of alternative transport modes has been introduced, including the increase of parking fees, taxes on vehicles with high emissions, tax breaks for renewable energy installations, and the introduction of free public transport. Coupled with its growing immigration, growing tourism, and a small growth in environmental consciousness, the demand for public transport has strongly increased. However, an economic crisis, a weak growth in new business models, and a lack of changing behavior towards car ownership have not reduced the number of private cars, which has increased congestion. However, as not all citizens will be able to afford a car, the number of trips involving active modes will increase, but not as much in the summer. This is due to a strong increase in climate change and declining environmental quality, which entail an increase in the number of extreme weather events. Citizens then feel more comfortable in their own cars, as they do not know what type of weather they will find during their trip. The demand for public transport also decreases because of this, but the fleets have been adapter to operate in these new conditions. However, a small growth in smart-city technology and digitalization fuels the adoption of apps popular in other Polish cities like JakDojade, somewhat increasing the popularity of public transport. The limited increase in digitalization also allows for the diversification of transport modes, and the integration of services more evenly distributes traffic. Kalisz' older population also increases the demand for public transport, for taxis, and for better walking infrastructure. As the city is characterized by increasing densification, centre-city residents will turn away from private car ownership somewhat, but there is an increase in traffic during rush hour. This increase in congestion is also brought upon by the weak growth in new business models, which does not help decease car ownership. These new business models also remain relatively expensive, and are therefore only occasionally used by wealthy citizens, which is a small part of the population in times of an economic crisis.

In the city centre, the increase in tourism increases the demand for parking spaces for coach buses, as well as the demand for parking spaces outside the centre. This increase in tourism also increases the commercial and service industry, increasing the demand for delivery services and unloading spaces in the centre. The weak transformation of retail also increases the demand for parking spaces due to the activities of courier companies. A strong increase in safety concerns has helped take steps to calm down traffic, resulting in the implementation of a 30 kilometre-an-hour zone. This increases the demand for public transport and active travel modes.

A weak increase in electrification increases the demand for charging stations somewhat, but their limited availability slows down the electrification process. The introduction of free apps to localize charging stations tries to counter this effect.

Main take-aways:

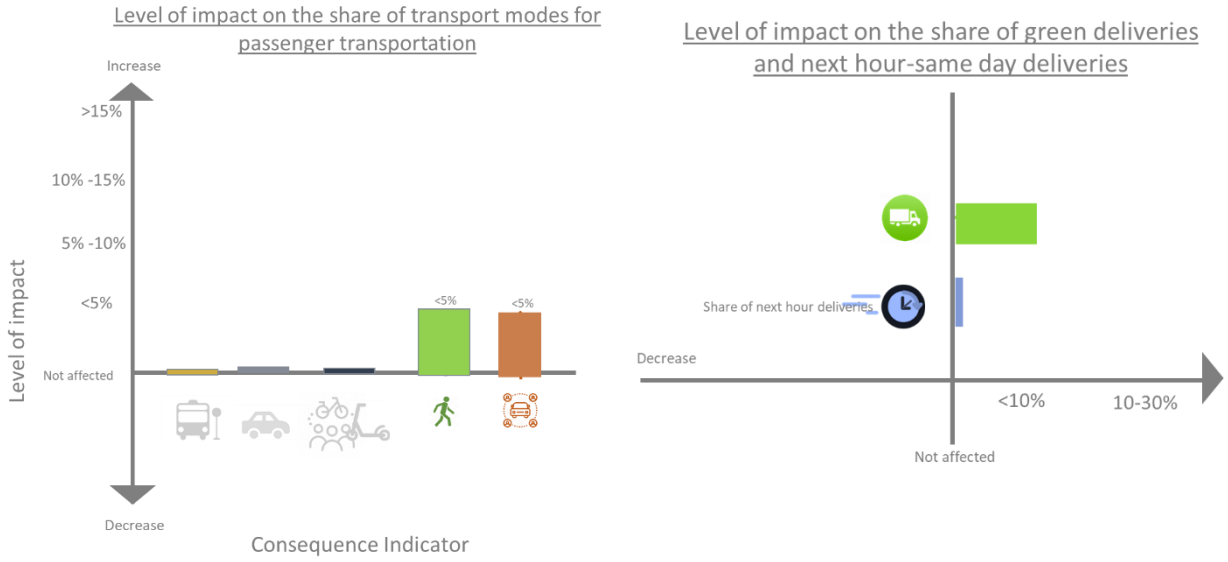
- Demographic composition, immigration, tourism, tax policy: increase
- Economic crisis
- Environmental consciousness, new business models, transformation of retail, electrification, smart-city technology, digitalization: weak growth
- Safety concerns: strong growth
- Population size, changing behaviour towards car ownership: decrease
- Urban structure: increasing densification
- Climate change: strong increase
- Local environmental quality: decrease

3.3.3.2. Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

In terms of passenger transportation, no special changes are expected to the current transport service structure and mix. A slight change in the inhabitants' behaviour towards more active transport modes or car sharing modes is only foreseen which won't exceed the 5% .

The same figure can be seen also for the urban freight transportation with a slight increase to the share of green deliveries (less than 10%). Finally the city does not expect the introduction of next hour / same day delivery services.



Graph 60 Level of impact on the share of transport modes for passenger and freight transportation (Kalisz-scenario 2)

Econ CA2: Urban space allocation:

Taking into consideration the limited impacts on the transport structure and mix and the trend towards more active ways of transport or car sharing services, a correspondent increase of 10-15% to the share of the urban space for pedestrian areas is foreseen and a 5 to 10% to the urban space for private and shared cars respectively.

Econ CA3: Urban transport service volumes:

The small increase of the citizen's environmental consciousness on the one hand and the growth in the tourism and densification on the other, will result the passenger transport volumes to remain stable for the time horizons 2025-2030.

In terms of urban freight transportation though, the higher demand for transferring products within the city due to tourism, will affect the average number of daily urban freight trips where an increase of up to 10% is foreseen.

Econ CA4: Urban transport service level:

Similar to the figures in the previous consequence areas, no severe changes are expected to the level of transportation service. More specifically, due to the economic crisis which is clearly mentioned in the scenario 2, no improvements in the current public infrastructure with the inclusion of new technologies will be made as well as no change in the costs of alternative modes of urban passenger transport is expected. However, possible due to the tourism growth, an increase of up to 10% in the share of passengers at that use smart payment methods while using public transportation is foreseen.

In terms of urban freight transportation, the results are quite controversial. On the one hand we notice a higher demand for transferring products within the city which will result to an increase in the urban freight transport volumes (CA3) and on the other hand, Kalisz city expects a decrease of up to 10% in the average number of weekly deliveries to consumers and no change in the urban delivery prices.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

Kalisz estimates a high increase, of up to 7,5%, in the costs for urban transport private investment (% of existing annual investment costs).

3.3.3.3. Environmental Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

An increase of 15% to both the CO2 emissions and the Air quality index is expected. A lower increase in both environmental indicators from the first scenario can be noticed. A potential explanation for that would be that in the second scenario, the share of active transport will be increased as less citizens will be able to afford a car which can be

The increase is lower than in the first scenario, because, according to Scenario 2, not all citizens will be able to afford a car, so the number of trips involving active modes will increase (that is a more eco-friendly choice). Also, the activity of delivery companies will be less intensive (weak transformation of retail and crisis) than in Scenario 1.

3.3.3.4. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (*independent contractors and freelancers).* Although this areas would be expected to not being affected, taking into consideration that the city logistics sector won't provide in the recent future on demand and next hour logistics services, an approximately 10% increase to the Gig employment is foreseen by the Kalisz city.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, the city of Kalisz doesn't expect any change in the share of accidents involving either micro-mobility means or in the accidents related to on demand bike/scooter urban deliveries. This outcome is quite reasonable, taking into account that the city's current transport mix won't be affected by new mobility services (i.e. micro mobility)

Soc CA3: Access to mobility services:

Regarding the level of accessibility and affordability of the city's urban mobility services, a slight positive impact is foreseen by the city. More specifically, a 5 to 10% increase in the affordability of using the mobility services based on the citizens' average annual cost of trips and per their annual income, is expected. In terms of accessibility, a minor increase of the accessibility to mobility services by all categories of passengers and a moderate increase of the accessibility to public transportation by vulnerable groups.

3.3.4 Sustainability Impact Assessment: Kalisz Scenario 3

3.3.4.1. Kalisz's third mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

In 2030, a range of drivers influences the traffic situation in Kalisz city centre. A tax policy in favour of alternative transport modes has been introduced, including the increase of parking fees, taxes on vehicles with high emissions, tax breaks for renewable energy installations, and the introduction of free public transport. Coupled with its growing immigration, growing tourism, an older population and a strong growth in environmental consciousness, the demand for public transport has strongly increased. The network has also been extended, with the addition of new, long-range bus routes. Strong growth in safety concerns have helped introduce a 30 kilometre-an-hour zone, to help calm down traffic, further increasing the demand for public transport and active travel modes. The increase in the population's environmental consciousness and changing behaviour towards car ownership decrease the amount of people

owning a private car, additionally stimulating the demand for walking and biking infrastructure. As the local environmental quality has increased, the number of trips making use of active modes has followed suit. The share of trips using active modes however decreases in the summer, as a slight increase in climate change produces heat waves in the summer. This decreases the total number of trips as well, as people avoid travels, and increases the number of trips taken in cars, which have air-conditioning.

As new business models have only weakly grown, there is no decrease in private cars as a result of it, and congestion increases. This increase, especially in rush-hour, is also accommodated by increasing densification, but this last evolution also encourages the use of active modes, as facilities are now more accessible.

As there is a strong growth in electrification, there is an increased demand for charging stations, and for parking spots as well. As the economy booms, citizens now acquire electric and low-emission vehicles, adding pressure on the number of parking spaces. Growing tourism has a similar effect, as there is now increased demand for coach parking spaces in the city centre, and for additional parking outside of it. However, a strong growth in smart-city technology helps regulate the amount of traffic in the centre, as cars looking for a spot can easily check for availability, and so avoid driving around looking for parking. This development also reduces travel time; while increasing the total number of trips, and more evenly distributing traffic. The total number of trips also increases due to the strong digitalization, which further reduces the number of passenger cars and therefore helps free up parking spaces. However, all apps, as well as other public transport information and infrastructure, need to now be provided in multiple languages, to accommodate the growing immigration and tourism.

One of the developments putting strong upwards pressure on traffic, however, is the strong transformation of retail. There is a 25-35% increase in online shopping, which increases both congestion and the demand for parking spaces. Due to insufficient parking spots, there are problems with loading and delivery, increasing the demand for short-term parking spaces. The growth in tourism also increases this demand for unloading spaces, as commercial and service industry activities increase.

Main take-aways:

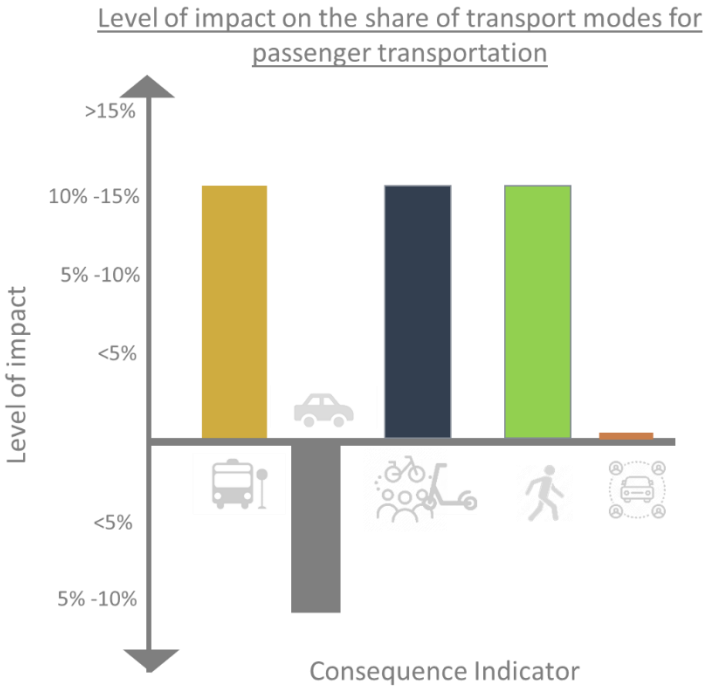
- Tax policy, tourism, immigration, demographic composition, changing behaviour towards car ownership, local environmental quality: increase
- New business models: weak growth
- Economic growth, transformation of retail, environmental consciousness, safety concerns: strong growth
- Urban structure: increasing sprawl
- Population size: decrease
- Electrification, smart-city technology, digitalization: strong growth
- Climate change: slight increase

3.3.4.2.Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

The strong growth of Kalisz's citizens' environmental consciousness and changing behaviour towards car ownership, clearly changes the picture on the current share of transport modes for passenger transportation.

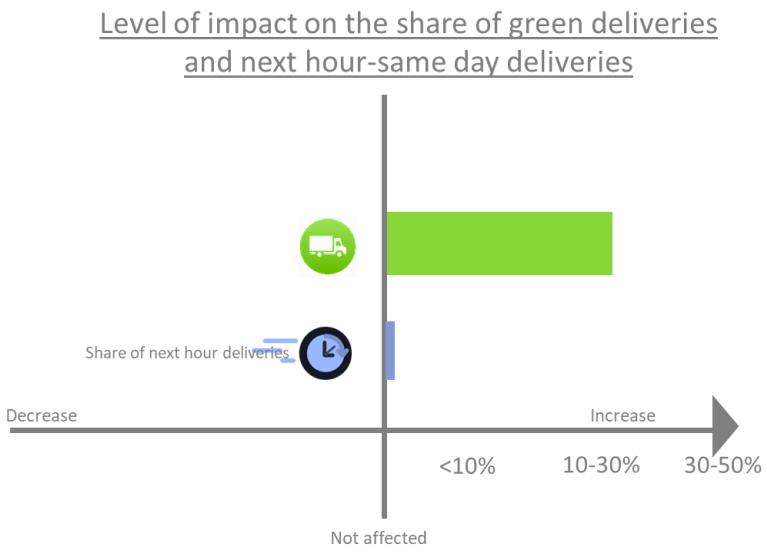
Based on the outcomes of the survey, the city expects foresee an increase of approximately 10 to 15% in the share of both the public transportation, micro mobility and active transportation. In terms of car transportation, a decrease in the correspondent share up to 10% is foreseen, while in comparison with the scenario 1, the share of car sharing transportation is not expected to be affected. (Graph 61)



Graph 61 Level of impact on the share of transport modes for passenger transportation (Kalisz-scenario 3)

Especially, regarding the use of new mobility services, a further development of the existing bike sharing system is expected and the provision of up to 30 more shared dock-less bikes to the citizens. Furthermore, the introduction of e-scooter services is also awaited by 2025-2030.

In terms of urban freight transportation, an increase from 10 to 30% in the share of green deliveries is foreseen while the provision of on demand and next hour deliveries is not expected to affect the city's mobility state (Graph 62).



Graph 62 Level of impact on the share of green deliveries and next hour-same day deliveries (Kalisz-scenario 3)

Econ CA2: Urban space allocation:

Taking into consideration the turn towards more environmentally friendly modes than car transportation, an increase in the respective urban allocation shares is expected. More specifically, **a 10 to 15% increase in the share of urban space for both public transportation and cycling/scooter lanes** is foreseen and up to **10% in the share of urban space for pedestrian areas.** The share for private and shared cars won't be affected and regarding the existence of autonomous and automated public transport services on dedicated lanes, such a measure is not applicable for Kalisz city.

Econ CA3: Urban transport service volumes:

The growing immigration and tourism of Kalisz city, in the framework of the third mobility scenario, will result to an increase from **10 to15% to the total average number of vehicles that enter the city** on a daily basis and although the expected higher demand for last mile logistics and the strong increase in online shopping, only a 5 to10**% increase of the average number of urban freight trips implemented daily within the city is foreseen.**

Econ CA4: Urban transport service level:

A **quite positive impact to the transport service level is foreseen** for the time horizons 2025-2030, since at one end, a decrease to the costs for passenger transportation services is expected (5 to 10% decrease) and on the other hand, a strong growth in smart-city technology is expected with 30-50% increase in the share of public transportation vehicles that are equipped with new technologies and the same increase in the share of passengers that use smart method to pay for/or validate a public transportation ticket.

In terms of urban freight transportation, the figures are quite similar, even though a lower to 5% decrease in the urban deliveries prices is foreseen while an increase of up to 20% in the goods delivery frequency is expected.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, an increase of up to 12% in the necessary private investments is foreseen for time horizons 2025-2030. Similarly with the previous scenarios, the turn towards green deliveries, which require private investments in equipment and infrastructure, is a good explanation for this figure.

3.3.4.3.Environmental Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

The clear direction to green and public transport modes shown in the previous consequence areas, justifies significantly the expected decrease of up to 50% to both the CO2 emissions and the Air quality index.

3.3.4.4.Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (*independent contractors and freelancers).* Taking into consideration that the operation of next hour and next day deliveries won't affect the city's mobility state, no change in the current types of employments is expected.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, the city of Kalisz expects an increase between 5 to 10% in the share of the accidents involving micro-mobility means as well as an increase of up to 5% in the accidents related to on demand bike/scooter urban deliveries.

Soc CA3: Access to mobility services:

Regarding the level of accessibility and affordability of the city's urban mobility services, a quite positive impact is foreseen by the city. More specifically, a higher to 15% increase in the affordability of using the mobility services based on the citizens average annual cost of trips and per their annual income, is expected while a high increase of the accessibility to mobility services by all categories of passengers.

3.3.5 Kalisz: Conclusions

Regarding the Economic mobility state of Kalisz city, the future shows a high possibility for an increase of the citizen's environmental consciousness resulting to the use of more environmental friendly modes of transport. Especially, regarding urban freight deliveries, a clear direction towards the provision of green deliveries is foreseen in all three possible mobility scenarios. In terms of on demand deliveries though, which constitutes one of the latest trends worldwide, the city does not expect any change in the current way of last mile operations towards the provision of next hour and next day deliveries.

Regarding the potential consequences in the city's urban space allocation, the results show a future with more space for public transportation, more cycling and e-scooter lanes and more space for pedestrian areas, with two out of three scenarios to estimate it. On the other hand though, no significant reduction to the urban space allocation for car transportation space which is controversial. Finally, the time horizon 2025-2030 looks to be quite soon for the development and operation of dedicated autonomous/automated public transport lanes.

Concerning the transport service level, two out of three scenarios show clearly a positive evolution, with lower costs for both passenger and freight transportation, more smart mobility and higher goods delivery frequency.

One of the main negative consequences presented by all three scenarios is related to the city's urban transport service volumes. **The future shows more congested streets, with more vehicles entering the city on a daily basis and more daily urban freight trips to be implemented for covering the higher demand due to tourism and e-commerce growth.**

This figure of the streets in the future can be considered also the only possible explanation for the expected negative externalities to the city's environment. More specifically, in each possible mobility scenario, the city's local stakeholders estimate either a minor or a moderate increase in the CO2 emissions and the Air Quality Index of the city which **clearly shows that the estimated level of increase in the use of environmental friendly modes of transport is not enough for achieving a less pollutant city.**

Finally, concerning the social dimension of the city's mobility state, the results are controversial. On the one hand positive figures can be noticed in the accessibility to mobility services. The city expects an increase, verified by all mobility scenarios, in the affordability of using mobility services based on the citizen's average annual cost of trips and their annual income and either a minor or a moderate increase in the accessibility to mobility services by all categories of passengers including the vulnerable passengers.

On the other hand, **a safety issue is raised by two out of three scenarios since an increase in the share of urban mobility accidents involving micromobility means as well as in the share of urban mobility accidents involving on-demand bike/scooter deliveries is foreseen.**

The following Graphs illustrate the level of positive and negative consequences foreseen for Kalisz' mobility state in each mobility scenario and per each sustainability dimension.

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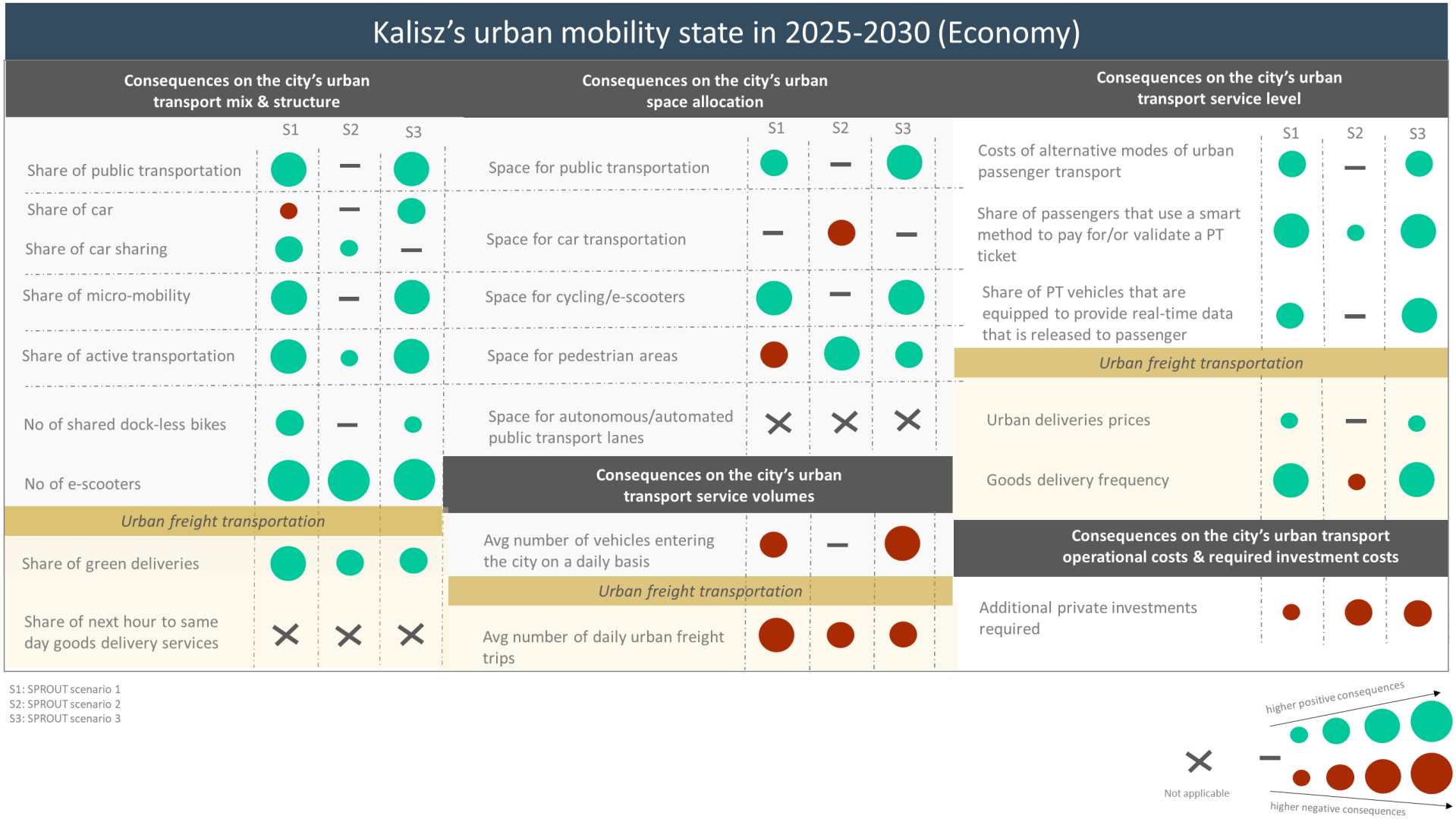
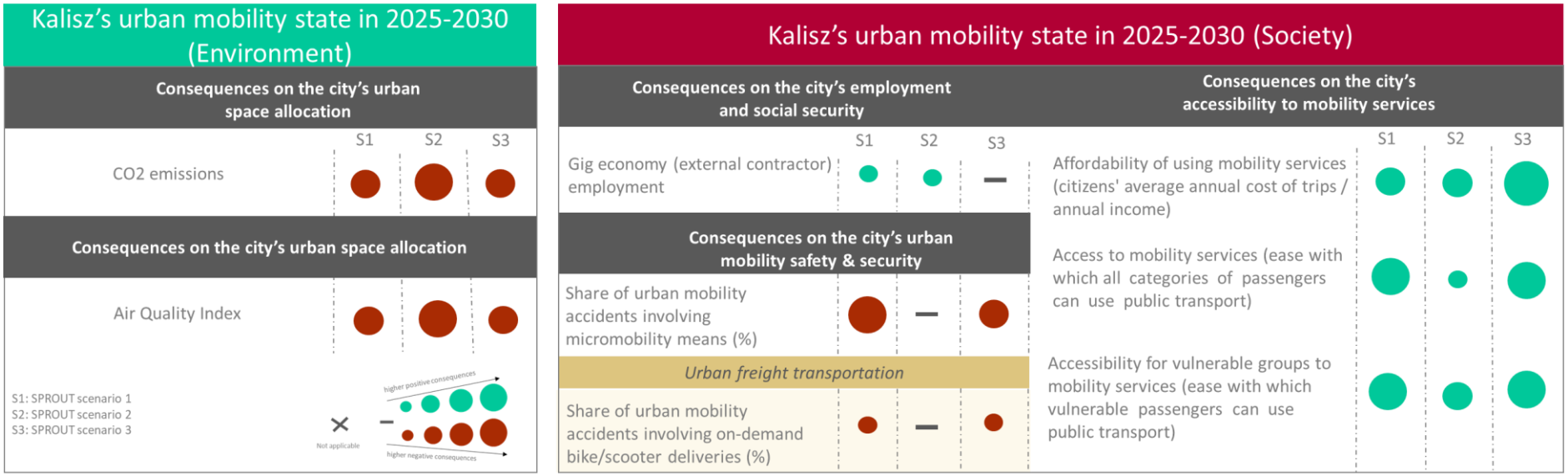


Graph 63 Kalisz-Economic mobility state in 2025-2030 (all scenarios)



Graph 64 Kalisz' Environmental & Social mobility state in 2025-2030 (all scenarios)

3.4 Budapest (Hungary)

3.4.1 Implementation process: Stakeholders Network, Methods, Data collection

Budapest followed a consensus building approach for filling in the survey. Budapest city organized web-workshops (due to the COVID-19 pandemic) with the local stakeholders for discussing the content of this survey, clarifying any potential questions and concerns and finally reaching consensus among the participants for each survey's questions.

In the survey, the stakeholders that participated were representatives of the following organizations:

- Donkey Republic
- Hungarian Cyclists' Club
- Budapest University of Technology and Economics – Department of Transport Technology and Economics
- Közlekedés Tudományi Intézet (Institute of Transport Sciences)
- Lime (e-scooter sharing operator)
- Budapest Közút (Road Operator of Budapest)
- Blinkee (E-scooter operator)

In the analysis of the data collected by Budapest city it is assumed that the stakeholders reached a 100% agreement on each question.

3.4.2 Sustainability Impact Assessment: Budapest Scenario 1

3.3.4.2. Budapest's first mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

Increasing tourism will lead to **more micromobility**, a reorganisation of public space and more public transport. The urban structure will become denser, reducing travel distances and stimulating micromobilty. Due to a **strong growth of environmental consciousness**, people will lead to more usage of micromobility and active travel modes but **fewer parking spaces and congestion**.

Population growth will put a strain on existing transport. **Strong growth in digitalisation** and connectivity increases the importance of shared mobility, leading to a better usage of public space. **Extreme weather events due to climate change** will restrict micro-mobility usage but increasing air pollution will encourage people to use micro-mobility. Stricter data and privacy laws lead to more regulation of travellers' data and stricter health and safety laws lead to the need to regulate micro-mobility, which increases its usage, and will encourage people to give up cars.

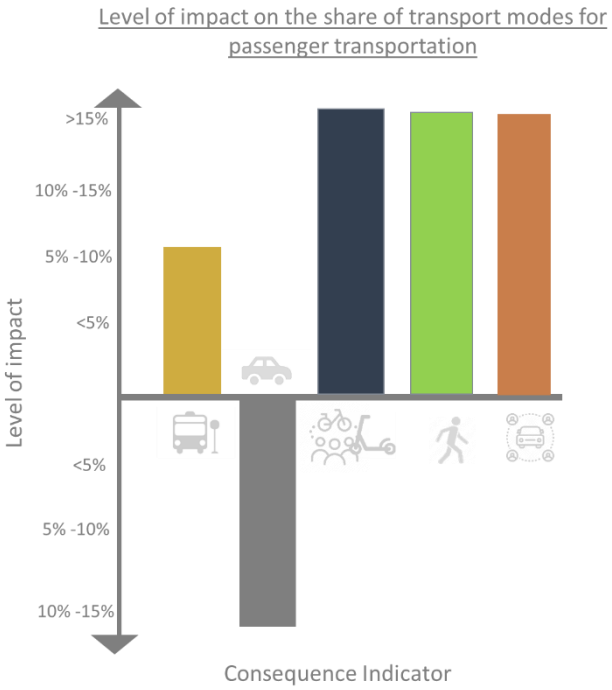
Main take-aways:

- Population size, tourism, urban densification: increase
- Environmental consciousness, electrification of mobility, consumer- and citizen-oriented digitalization: strong growth
- Overall stricter regulation

3.3.3.5. Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

A strong change in the inhabitants' behaviour towards more sustainability modes is observed The city foresees a moderate –from 5 to 10%- increase of the share of public transport, a major increase -more than 15%- to the share of micro-mobility as well as active transportation.

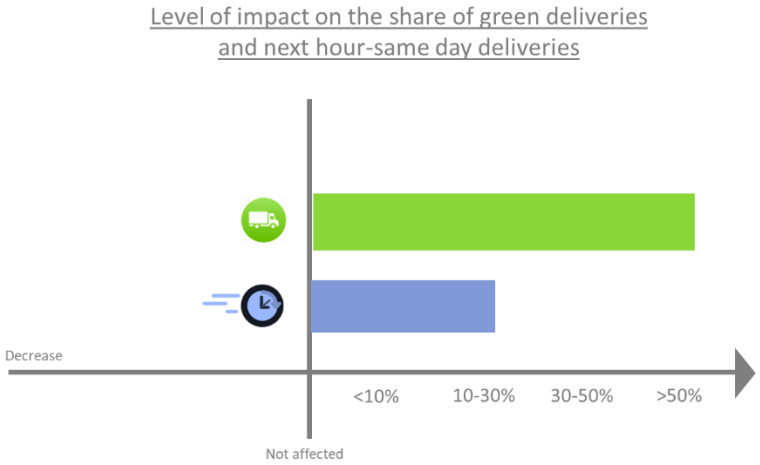


Graph 65 Level of impact on the share of transport modes for passenger transportation (Budapest - scenario 1)

The use of new mobility services by the city's inhabitants will be strongly enhanced by the provision of up to 30 to 60% more shared e-scooters. The number of shared dock-less bikes on the other hand is not expected to be affected by this scenario.

Regarding car transportation, a major increase in the share of car sharing transport and a high decrease -from 10 to 15%- of the total share for car transport strongly justifies the green transformation of Budapest.

Finally, in terms of urban freight transportation, a major increase (more than 50%) to the share of green deliveries is expected and a moderate –from 10 to 30%- increase in the share of next hour and same day deliveries.



Graph 66 Level of impact on the share of green deliveries and next hour-same day deliveries (Budapest scenario 1)

Econ CA2: Urban space allocation:

Taking into consideration the quite positive impact on the urban transport structure and mix presented above, respective changes in the urban space allocation are also foreseen. More specifically, a more than 15% increase in the share of urban space dedicated to micro mobility means together with **a 5 to 10% increase in the share of pedestrian areas as well as a slight increase (lower than 5%) in the space dedicated to public transportation is foreseen.** The important decrease in the share of car transport, presented above, will be followed by **the 10 to 15% decrease in the space for car transportation.**

In terms of the share of dedicated lanes for autonomous and automated public transportation services, Budapest does not expect any change towards any positive or negative direction on that matter.

Econ CA3: Urban transport service volumes:

The transition towards a less car mobility and a more active/micro-mobility is strongly justified on one end by the 10-15% decrease in the average number of vehicles entering the city on a daily basis.

On the other hand though, the streets will be crowded by the higher number (more than 15%) of urban freight trips, implemented daily for capturing the higher e-commerce demand.

This figure shows that the growing population and tourism which may lead to higher demand for urban freight deliveries together with the retail's transformation towards the provision of next hour-same day deliveries might cause a quite a negative impact to the urban freight transport service volumes.

Econ CA4: Urban transport service level:

The expected impact on the urban transport level is controversial for both passenger and freight transportation. More specifically, at one end, even more passengers is expected to use smart methods in public transportation (from 10 to 30% increase) however the public vehicles won't be further equipped with smart technologies for providing real-time data to the users.

In terms of urban freight transportation, the city expects a strong increase in the goods frequency, which would be expected following also the abovementioned outcomes regarding the increase of the volumes, however no further changes to the urban delivery prices are foreseen.

Finally, regarding the potential impact to the costs of alternative mode, although the share will be significantly increases, no changes are expected towards that direction.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a slight increase of 5% to the necessary private investments is foreseen for time horizons 2025-2030.

3.3.3.6. Environmental Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

The strong transition towards green and public transport modes presented in the previous consequence areas, constitute a great argument for justifying the expected up to 27% of the CO2 emissions and an up to 25% decrease to the Air quality index respectively is foreseen by the city's stakeholders.

3.3.3.7. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into consideration the expected increase in the share of next hour and next day deliveries, a respective 26% increase of the Gig Economy employment is also foreseen, in terms of the percentage of total employees that are occupied in transport sector either as independent contractors or as freelancers.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, the city of Budapest expects a more than 15% decrease in both the share of the accidents involving micro-mobility means as well the accidents related to on demand bike/scooter urban deliveries.

Soc CA3: Access to mobility services:

Regarding the level of accessibility and affordability of the city's urban mobility services, a quite positive impact is foreseen by the city. More specifically, a more than 15% increase in the affordability of using the mobility services based on the citizens average annual cost of trips and per their annual income, is expected while a high increase of the accessibility to mobility services by all categories of passengers.

3.4.3 Sustainability Impact Assessment: Budapest Scenario 2

3.3.4.3. Budapest's second mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

Decreasing tourism will lead to a **decreased demand for micro-mobility** and less transport-related conflicts. Increasing urban sprawl will mean that **the role of micro-mobility will be enhanced in combination with public transport**.

Environmental consciousness will only grow weakly, but **strong growth of safety concerns** will lead to an overall improved mobility situation and older generations will start using micro-mobility**. Extreme weather events due to climate change** will restrict micro-mobility usage, but also to restrictions on the use of combustion engines, but increasing local air quality will encourage people to use micro-mobility. Consumer protection, data and privacy

legislation decreases, and as health and safety regulation only weakly increase, unequal use of public space will remain and conflicts caused by the unregulated environment.

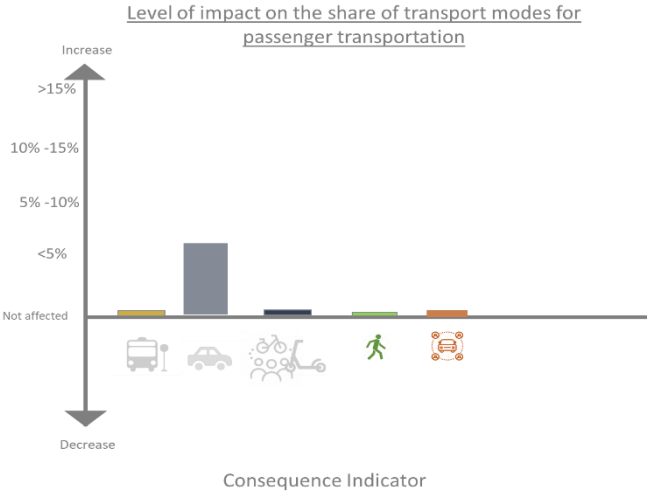
Main take-aways:

- Tourism, population size, consumer protection, urban densification: decrease
- Local environmental quality: increase
- Environmental consciousness, health and safety legislation: weak increase
- Consumer protection, data and privacy legislation: less regulation
- Health and safety laws: weak increase in regulation

3.3.3.8. Economic Impact Analysis

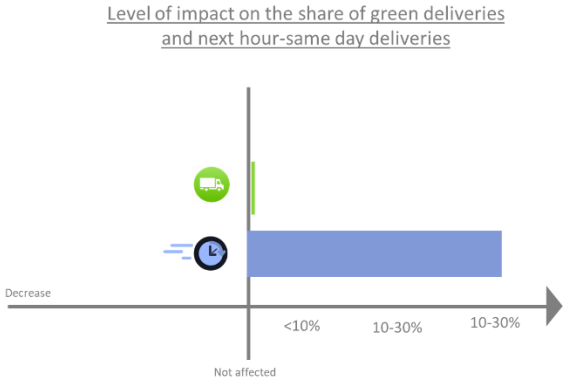
Econ CA1: Urban transport service structure and mix:

As indicated in Graph 67, the limited rise in environmental consciousness is clearly presented, with the city to foresee a slight increase in the share of car transportation and no further changes in the transport structure and mix. The share of environmental friendly transport modes i.e. micro-mobility, active transportation, car sharing and public transportation will remain stable. The transition towards micro-mobility won't be supported following the expected 30 to 60% decrease in the number of shared e-scooters that would be provided to the citizens.



Graph 67 Level of impact on the share of transport modes for passenger transportation (Budapest scenario 2)

In terms of urban freight transportation, similarly no significant changes towards the implementation of green deliveries is expected. However, the future shows a transformed e-commerce sector which will provide by 30 to 50% more next hour-same day deliveries.(Graph 68)



Graph 68 Level of impact on the share of green deliveries and next hour-same day deliveries (Budapest - scenario 2)

Econ CA2: Urban space allocation:

Taking into consideration the quite negative figures regarding the future state of the urban transport structure and mix, similar figures can be seen for the future share of urban space per transport mode. More specifically, a slight increase in the share of space for car transportation and a slight decrease in the share of space for pedestrian areas is expected. The remaining indicators won't be affected by the mobility scenario.

Econ CA3: Urban transport service volumes:

Although the city will be less populated and with decreased tourism, the city's stakeholders believe that the average number of daily urban freight trips will be major increased (more than 15%) probably due to the transition towards more on-demand deliveries and the average number of vehicles entering the city on a daily basis will be increase from 10 to 15%

Econ CA4: Urban transport service level:

The expected impact on the urban transport level is controversial for both passenger and freight transportation. More specifically, at one end, a slight increase (up to 5%) is expected to the share of passengers that use smart methods in public transportation (from 10 to 30% increase) however the public vehicles won't be further equipped with smart technologies for providing real-time data to the users.

In terms of urban freight transportation, the city expects a strong increase, higher than 20%, in the goods frequency, which would be expected following also the abovementioned outcomes regarding the increase of the volumes, however no further changes to the urban delivery prices are foreseen.

Finally, regarding the potential impact to the costs of alternative mode, no changes are expected towards that direction, which is logically explained taking into consideration that the share of micro-mobility transport will be decreased.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a slight increase of 5% increase in the necessary private investments is foreseen for time horizons 2025-2030.

3.3.3.9. Environmental Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

Although the city won't experience a positive transition towards more environmental friendly modes of transport and the streets will be more crowded by 2025-2030, the respondent's opinion on the impact to the climate change is controversial. More specifically, the city expects a decrease of up to 7% to the CO2 emissions and a to 9% decrease to the city's Air quality index.

3.3.3.10. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into consideration the expected increase in the share of next hour and next day deliveries, presented in the framework of the CA1 impact analysis, a respective 14% increase of the Gig Economy employment is also foreseen, in terms of the percentage of total employees that are occupied in transport sector either as independent contractors or as freelancers.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, the city of Budapest doesn't expect any changes towards an either positive or negative direction.

Soc CA3: Access to mobility services:

In terms of accessibility to mobility sector, the city of Budapest doesn't expect any changes towards an either positive or negative direction.

3.4.4 Sustainability Impact Assessment: Budapest Scenario 3

3.3.4.4. Budapest's third mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

Increasing tourism will lead to more micro-mobility, a reorganisation of public space and more public transport. Increasing urban sprawl will mean that the role of micro-mobility will be enhanced in combination with public transport. **Environmental consciousness** will only grow weakly, but **strong growth of safety concerns** will lead to an overall improved mobility situation and older generations will start using micro-mobility. **Population growth** will put a strain on existing transport. Extreme weather events due to climate change will restrict micro-mobility usage, but also to restrictions on the use of combustion engines. Consumer protection legislation increases but data and privacy legislation decrease. Stricter health and safety laws lead to the need to regulate micro-mobility, which increases its usage, and will encourage people to give up cars.

- Tourism, population size, local environmental quality, consumer protection legislation: increase
- Environmental consciousness, electrification of mobility, consumer- and citizen-oriented digitalization: weak growth
- Safety concerns, health and safety legislation: strong increase

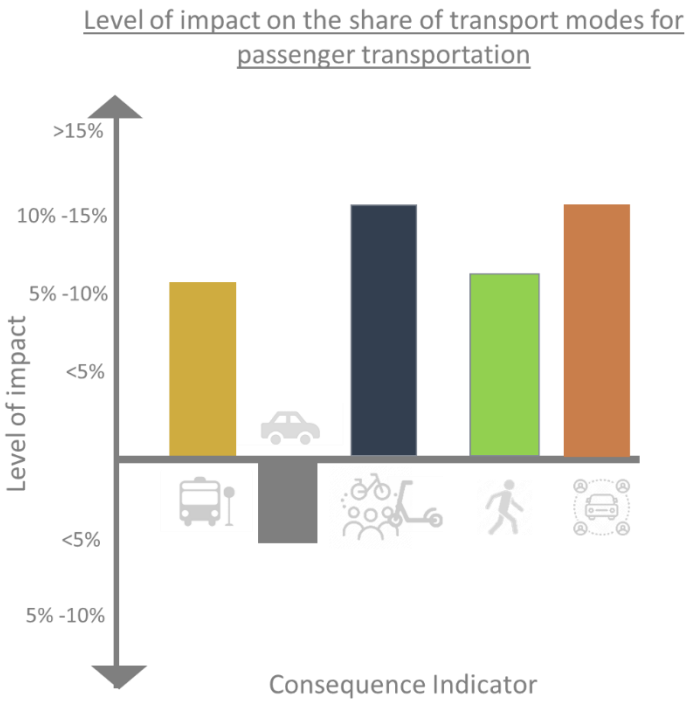
3.3.4.5. Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

A strong change in the inhabitants' behaviour towards more sustainability modes is observed. The city foresees a moderate –from 5 to 10%- increase of the share of public transport as well active transportation and a high increase -from 10 to 15%- to the share of micro-mobility.

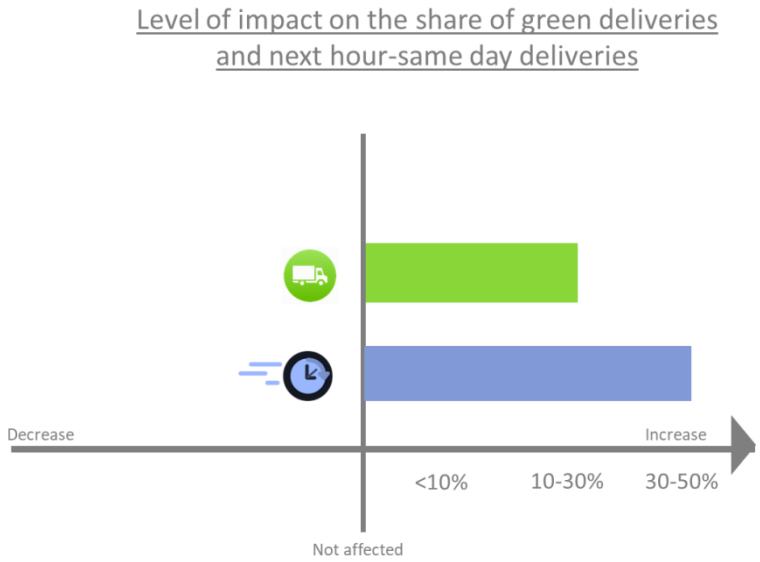
The use of new mobility services by the city's inhabitants will be strongly enhanced by the provision of up to 30% more shared e-scooter and shared dock-less bikes to the citizens is foreseen is expected.

Regarding car transportation, a high increase in the share of car sharing transport and a slight decrease –up to 5%- of the total share for car transport strongly justifies the green transformation of Budapest.



Graph 69 Level of impact on the share of transport modes for passenger transportation (Budapest - scenario 3)

In terms of urban freight transportation, an increase, from 10 to 30%, to the share of green deliveries is foreseen and a high –from 30 to 50%- increase in the share of next hour and same day deliveries.



Graph 70 Level of impact on the share of green deliveries and next hour-same day deliveries (Budapest – scenario 3)

Econ CA2: Urban space allocation:

Taking into consideration the impact on the urban transport structure and mix presented above, respective changes in the urban space allocation are also foreseen. More specifically, an increase of up to 5% in the share of urban space for public transportation, a from 5 to 10% increase in the share for micro mobility means and a major increase , from 10 to 15% to the share of space dedicated to pedestrian areas is foreseen. In terms of car transportation, a moderate decrease from 5 to 10% in the correspondent share of urban space is expected.

Finally, similarly with the previous scenarios, no significant changes towards the provision of dedicated lanes for autonomous and automated public transportation services are foreseen.

Econ CA3: Urban transport service volumes:

Although the previous analysis shows a clear transition towards a less car oriented mobility and a more active/micro-mobility, the increased tourism and population of Budapest may be the possible explanations on why the city expects an increase in the urban transport volumes. More specifically, the streets are expected to be more congested mainly due to the 15% more daily urban freight trips, for covering the higher next hour and same day demand while with respect to passenger transportation, a slight increase –lower than 5%- to the average number of vehicles entering the city on a daily basis is expected.

Econ CA4: Urban transport service level:

The expected impact on the urban transport level is controversial for both passenger and freight transportation. More specifically, at one end, even more passengers is expected to use smart methods in public transportation (from 30 to 50% increase) however the public vehicles won't be further equipped with smart technologies for providing real-time data to the users.

In terms of urban freight transportation, the city expects a strong increase –more than 20%-in the goods frequency, which would be expected following also the abovementioned outcomes regarding the increase of the volumes, however no further changes to the urban delivery prices are foreseen.

Finally, regarding the potential impact to the costs of alternative mode, a moderate increase from 5 to 10% is foreseen. A possible explanation for this figure is the provision of more next hour-same day delivery services.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, the city does not expect that the private investment costs will be strongly affected, since the respondents concluded on an average 1% increase of this indicator.

Environmental Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

The strong transition towards green and public transport modes presented in the previous consequence areas, constitute a great argument for justifying the expected decrease of up to -23% of the CO2 emissions and the 13% increases Air quality index.

Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into consideration the expected increase in the share of next hour and next day deliveries, presented in the previous analysis, a respective 30% increase to the Gig Economy employment is also foreseen, in terms of the percentage of total employees that are occupied in transport sector either as independent contractors or as freelancers.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, the city of Budapest expects a decrease of up to 15% in both the share of the accidents involving micro-mobility means as well the accidents related to on demand bike/scooter urban deliveries.

Soc CA3: Access to mobility services:

Regarding the level of accessibility and affordability of the city's urban mobility services, a quite positive impact is foreseen by the city. More specifically, an increase of up to 10% in the affordability of using the mobility services based on the citizens average annual cost of trips and per their annual income, is expected while a moderate increase of the accessibility to mobility services by all categories of passengers.

3.4.5 Budapest: Conclusions

Regarding the economic mobility state of Budapest city, the future shows an increase of the citizen's environmental consciousness with two out of three scenarios to foresee the either moderate or high increase of the share of micro mobility, active transportation as well as public transportation.

Similar changes are expected also to the city's current urban space allocation. Two out of three scenarios show more space for public transportation, more cycling and e-scooter lanes, less space for car transport and more space for pedestrian areas, with two out of three scenarios to estimate it.

Finally, the city does not expect any transition towards autonomous and automated mobility, with all scenarios to justify it.

With respect to freight deliveries, a direction towards the provision of green deliveries is also foreseen by two out of three scenarios. On the other hand though, a definite increase of on demand logistics and in the share of next hour and same day deliveries is expected by all three scenarios.

The worst case scenario – the second scenario in Budapest's case- presents a slight negative impact on the current transport mix and structure, justified by the moderate increase of the car transportation share. The remaining consequence indicators related to the urban transport mix and structure won't be affected by this scenario. With respect to the future urban space allocation, a slight increase of the space for car transportation and a slight decrease of the space dedicated to cycling/e-scooters transportation is foreseen. Finally, regarding urban freight transportation, no transition towards the provision of green deliveries is foreseen. On the other hand though, the city expects a transformation of the e-commerce sector towards the provision of next hour-same day deliveries.

Concerning the transport service level, the results from the analysis of all the scenarios show controversial results. At one end, a moderate/high increase to the share of passengers that use smart methods in public transportation is expected but on the other hand the public vehicles won't be further equipped with smart technologies for providing real-time data to the users. Regarding the potential impact to the costs of alternative transport modes, neither positive not negative changes are expected, which is logically explained taking into consideration that the share of micro-mobility transport will be decreased.

Regarding urban freight transportation, the city expects a definite increase, higher than 20%, in the goods frequency. However no further changes to the urban delivery prices are foreseen by two out of three scenarios while the worst case scenario foresees a moderate decrease to this consequence indicator.

One of the main negative consequences justified by all three scenarios is related to the city's urban freight transport service volumes. The future shows more congested streets, with more daily urban freight trips to be implemented for covering the higher demand for next hour – same day last mile deliveries. Even, the less populated Budapest, which is presented in the

framework of the second scenario, the same high increase in the urban freight volumes is expected.

With respect to vehicles' volumes, only the first scenario which presents a quite important transition towards more environmental friendly vehicles, expects a moderate decrease in this consequence indicator. Thus, a quite high possibility for increased passenger volumes is foreseen by the remaining two out of three scenarios.

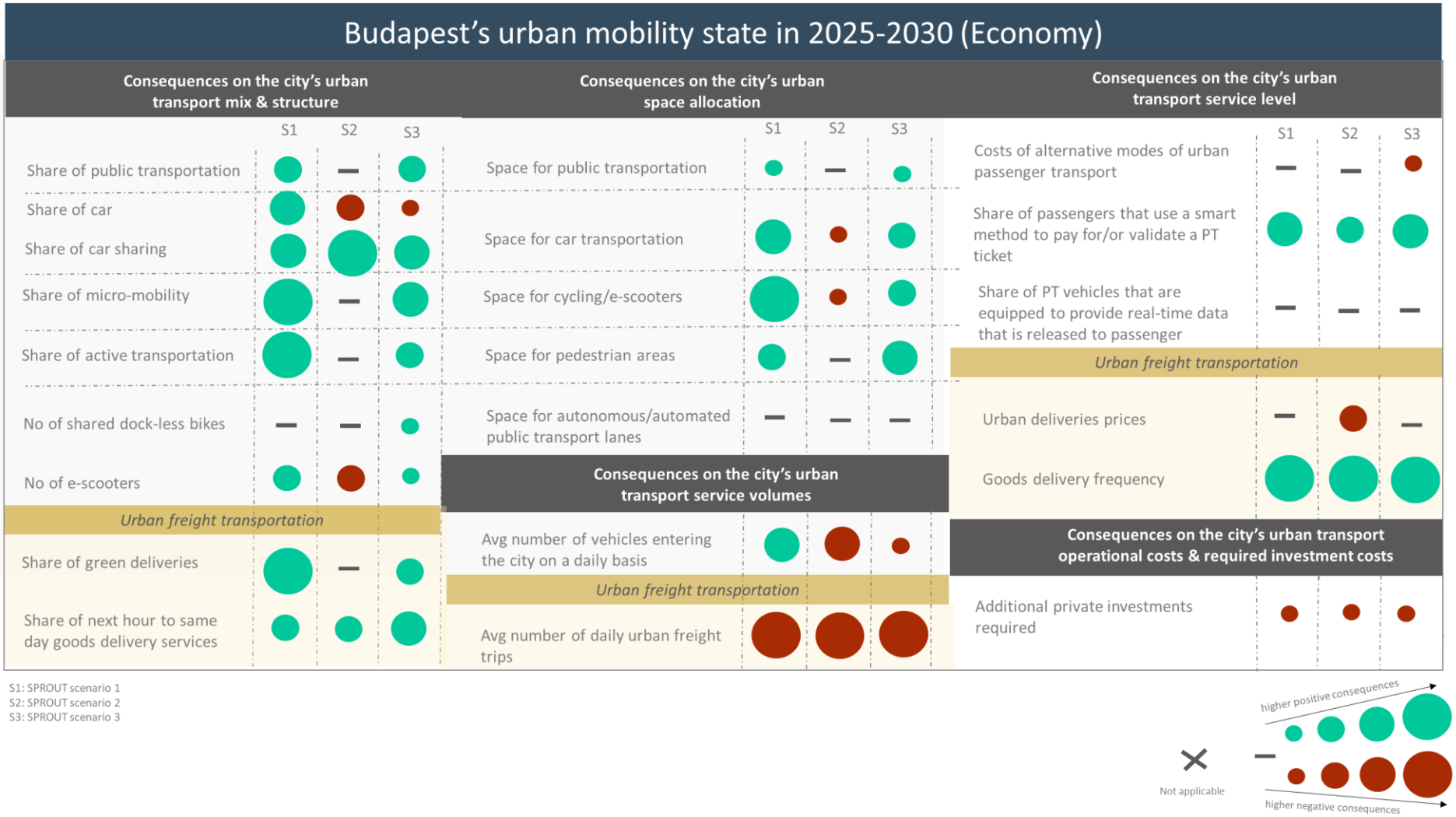
This figure of the streets can be considered also the only possible explanation for the expected negative externalities to the city's environment, ranging from minor to high increase of the CO2 emissions and the Air quality index. This figure clearly shows that the expected level of increase in the use of environmental friendly modes of transport is not enough for achieving a less pollutant city.

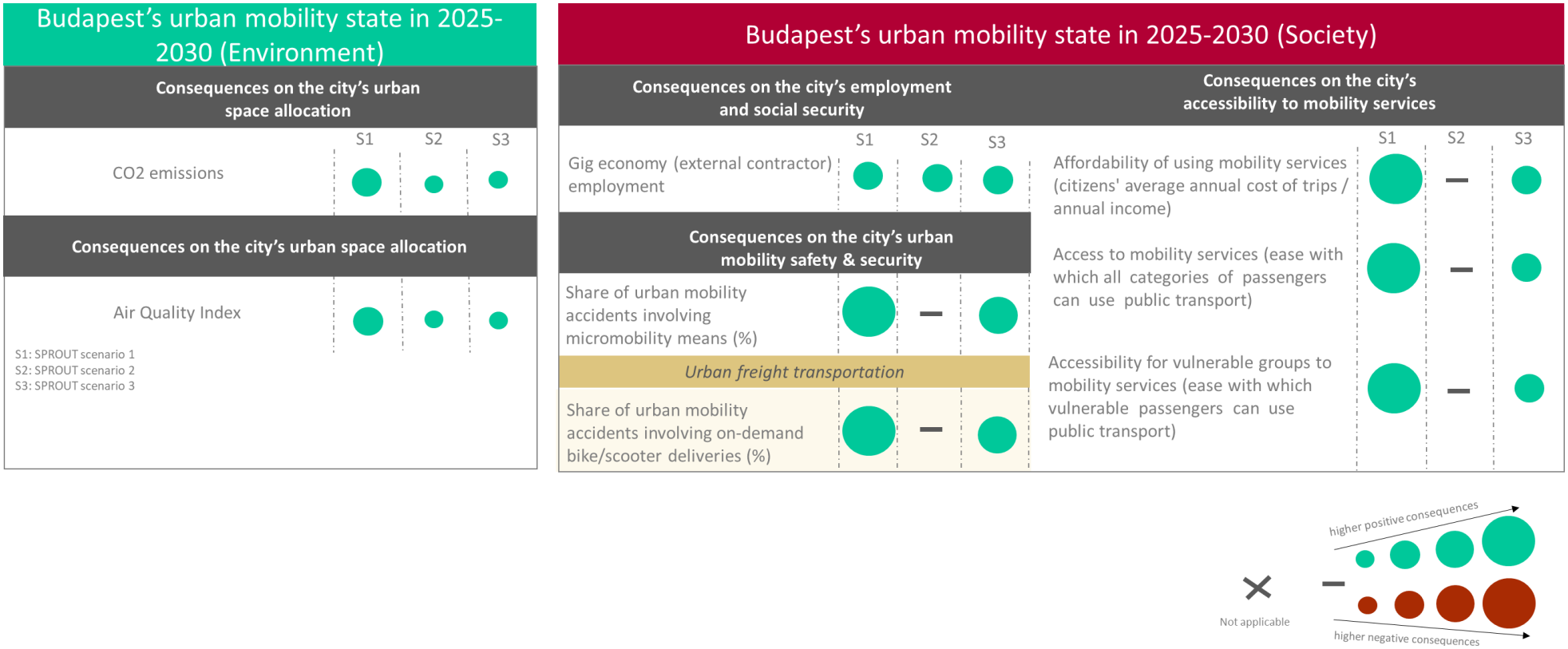
Finally, concerning the social dimension of the city's mobility state, the results are quite positive with two out of three scenarios to justify it. The city expects an urban mobility with less accidents in both passenger and freight transport services, higher affordability of using mobility services and higher accessibility by all categories of passengers. The worst case scenario presents a stable situation with neither the urban transport safety and security indicators nor the accessibility indicators to be affected.

Finally, in terms of employment, the city will experience a moderate increase to the Gig employment.

The following Graphs illustrate the level of positive and negative consequences foreseen for Budapest's' mobility state in each mobility scenario and per each sustainability dimension.

Graph 71 Budapest's future mobility state in 2025-2030 –Economy (all scenarios)





Graph 72 Budapest's future mobility state in 2025-2030 - Society & Environment (all scenarios)

3.5 Tel Aviv (Israel)

3.5.1 Implementation process: Stakeholders Network, Methods, Data collection

Tel Aviv followed a consensus building approach for filling in the survey. The survey was initially shared to the local stakeholders via email and with three stakeholders phone interviews were conducted. The stakeholders that were approached were:

- representatives of Ministry of Transport and Road Safety
- policymakers in the municipality of TLV
- employees from the strategic planning division, traffic division, and light rail administration

- independent consultants, and professors from the faculty of Civil and Environmental Engineering and the Faculty of Architecture and Town Planning in the Technion

Building upon the feedbacks from the personal interviews, a virtual workshop was organized, where representatives from Municipality of Tel viv and Technion discussed the three scenarios and reached an agreement upon the answers.

3.5.2 Sustainability Impact Assessment: Tel Aviv Scenario 1

3.3.4.6. Tel Aviv's first mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

The political agenda and tax policy increasingly supports new mobility developments, leading to an accelerated approval of the metro system, and parking policy to decrease private car ownership. Electrical vehicles are also be promoted this way, and congestion fees help reduce the number of private cars. Increases in tourism increase the demand for public transport and micro-mobility services, and encourage open space allocation to promote walkability. These developments are further fuelled by a younger population, coupled with increased environmental consciousness and increased densification, who demand more active modes, for on-demand mobility, and for electric vehicles.

On the other hand, increased economic growth increases the demand for private cars from a wealthier social class, while the working class demands more public transport and cycling infrastructure. Due to increased safety concerns, better infrastructure is demanded for active modes, and for better separation between road users. However, stronger health and safety regulations also deter some from using bikes and other micro-mobility modes, but it further helps the city's preparedness for electric transportation. The increases in regulation also mean better management of logistics within the city to reduce pollution, and help restrict heavy vehicle traffic.

Increases in smart-city technology and digitalization fuel the rise of car-sharing initiatives, further fuelling a decline in demand for private car ownership. It also entails better logistics and parking management, as well enhancing the quality of public transport by exposing connectivity problems.

Main take-aways:

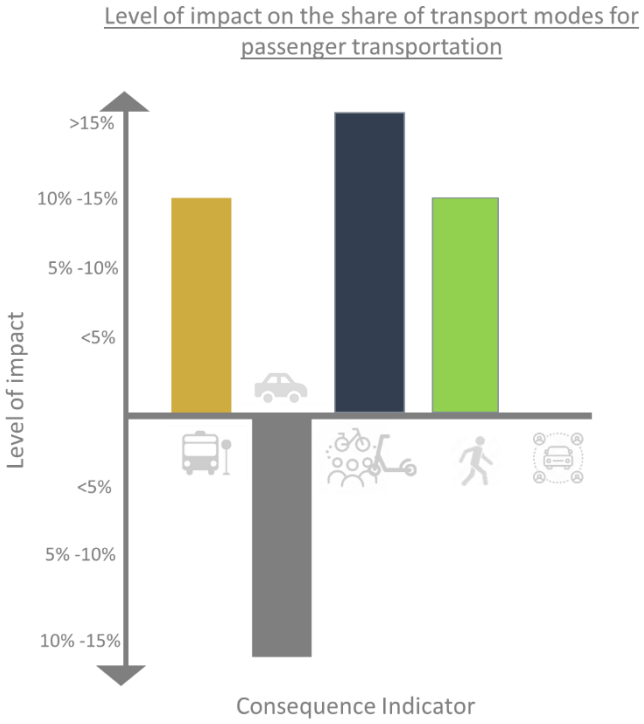
- Political agenda, tax policy: increase
- Tourism, economic growth, environmental consciousness, safety concerns and population size : increase
- Urban structure: increasing densification
- Demographic composition: decrease
- Smart-city technology and digitalization: strong growth
- Health and safety regulation: strong increase

3.3.3.11. Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

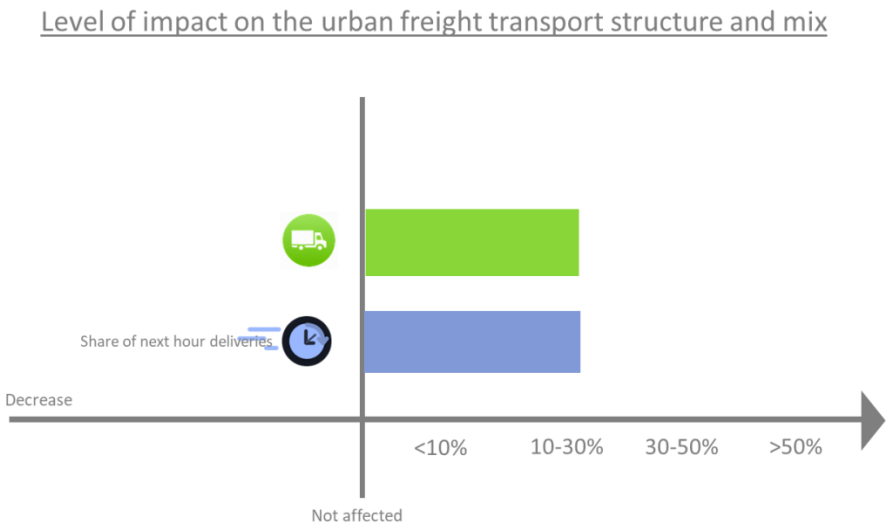
A change in the inhabitants' behaviour towards more sustainability modes is strongly justified by the analysis of the first consequence area. More specifically, an increase from 10 to 15% to the share of public transportation and active transportation as well as a decrease from 10 to 15% to the share of car transportation is foreseen. (Graph 73)

Especially, regarding the use of new mobility services by the city's inhabitants, an increase of more than 15% to the share of micro-mobility is foreseen while a further development of the existing bike sharing system is expected and the provision of up to 30 to 60% more shared dock-less bikes to the citizens. Furthermore, the introduction of e-scooter services is also awaited by 2025-2030.



Graph 73 Level of impact on the share of transport modes for passenger transportation (Tel Aviv scenario 1)

In terms of urban freight transportation, an increase from 10 to 30% in the share of green deliveries as well as to the share of next hour-same day deliveries is foreseen.(Graph 74)



Graph 74 Level of impact on the share of green deliveries and next hour-same day deliveries (Tel Aviv-scenario 1)

Econ CA2: Urban space allocation:

Taking into consideration the impact on the urban transport structure and mix presented above, great changes to the urban space allocation are also expected. The city expects a major increase –more than 15% to the space allocated for both public transportation, micro mobility means and pedestrian areas and a major decrease -more than 15%- to the urban space for private/shared cars.

With respect to automated and autonomous mobility, Tel Aviv does not expect a transition towards the development of dedicated lanes for the provision of autonomous and automated public transportation services.

Econ CA3: Urban transport service volumes:

An increase from **5 to10% to both the total average number of vehicles that enter the city** on a daily basis as well as to the **average number of daily urban freight trips** is expected.

Econ CA4: Urban transport service level:

A positive impact to the transport service level is foreseen, since at one end, a decrease to the costs for passenger transportation services is expected (5 to 10% decrease) and on the other hand, more public transportation vehicles will be equipped with new technologies (an increase of up to 10% to the correspondent share of PTs is estimated) and even more passengers will be able to use smart methods in public transportation (an increase of 10 to 30%).

In terms of urban freight transportation, the picture is quite similar, with the urban delivery prices to be decreased by 10 to 15% and the goods delivery frequency to be increased by 10-15% respectively.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a slight increase of 9% increase in the necessary private investments is foreseen for time horizons 2025-2030. A possible explanation for this requirement, is the increase of the share of green deliveries which presupposes a private investment in equipment and infrastructure (i.e. replacing the conventional fleet with the new environmental friendly fleet).

3.3.3.12. Environmental Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

The clear direction towards green and public transport modes -shown in the previous consequence areas- is the most possible explanation for the expected moderate decrease – up to 30%- to the CO2/GHG emissions and the decrease of up to 25% to the Air Quality Index.

3.3.3.13. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (*independent contractors and freelancers).* Although the share of next-hour same day urban deliveries is expected to be major increased – presented above- a slight increase of up to 2% to the Gig employment is foreseen by Tel Aviv.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, the city of Tel Aviv expects a decrease between 5 to 10% of both the share of the accidents involving micro-mobility means as well as the accidents involving on demand bike/scooter urban deliveries.

Soc CA3: Access to mobility services:

Regarding the level of accessibility and affordability of the city's urban mobility services, a quite positive impact is foreseen by the city. More specifically, a 5 to 10% increase in the affordability of using the mobility services based on the citizens average annual cost of trips and per their annual income, is expected while a high increase of the accessibility to mobility services by all categories of passengers.

3.5.3 Sustainability Impact Assessment: Tel Aviv Scenario 2

3.3.4.7. Tel Aviv's second mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

The political agenda does not support new ambitious mobility projects, cancelling or re-sizing the plans for larger bus terminals. The development of the metro system has also been called to a halt. The economic crisis has reduced the demand for public transport, but the number of trips in private vehicles as well, due to an overall decrease in trips by the city's population. However, the city's ageing population demands more accessible public transport, on demand services, and deliveries.

Due to a lack of digitalization among consumers, multimodality is at a minimum, and micro-mobility and carsharing initiatives don't grow to their full potential.

Main take-aways:

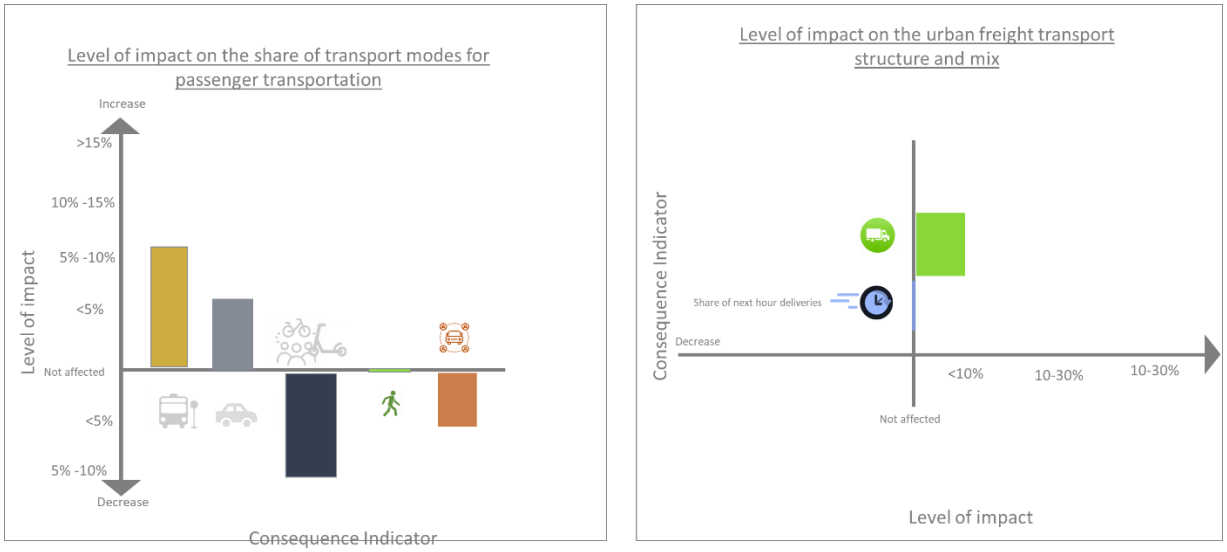
- Political agenda, tax policy: decrease
- Tourism, economic growth, environmental consciousness, safety concerns and population size : decrease
- Urban structure: increasing sprawl
- Demographic composition: increase
- Smart-city technology and digitalization: weak growth
- Health and safety regulation: weak increase

3.3.3.14. Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

As indicated in Graph 75, the limited rise in environmental consciousness is clearly presented, with the city to foresee a slight increase –from 5 to 10%- to the share of public transportation, a slight decrease in the share micro mobility and no further changes in the transport structure and mix. The transition towards micro-mobility won't be supported and the number of shared dock-less bikes and e-scooters that are available by the city will remain as they are.

In terms of urban freight transportation, similarly no significant changes towards the implementation of green deliveries is expected with the share of green deliveries to be decreased by 10%



Graph 75 Level of impact on the share of transport modes for passenger/freight transportation (Tel Aviv – scenario 2)

Econ CA2: Urban space allocation:

Taking into consideration the quite negative figures regarding the future state of the urban transport structure and mix, similar figures can be seen for the future share of urban space per

transport mode. More specifically, a slight decrease in the share of space for car transportation is expected while the urban space allocated for the rest transport modes won't be affected.

Econ CA3: Urban transport service volumes:

With regards to urban transport service volumes, the city does not expect any change either to the average number of daily urban freight trips or the average number of vehicles entering the city on a daily basis.

Econ CA4: Urban transport service level:

The expected impact on the urban transport level is controversial for freight transportation. More specifically, at one end, a decrease from 5 to 10% to the urban delivery prices is expected while on the other hand the goods delivery frequency wont be affected. Regarding passenger transportation, the future doesn't show any direction towards using new technologies in public transportation.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a slight decrease of 3% in the necessary private investments is foreseen for time horizons 2025-2030.

3.3.3.15. Environmental Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

Although the city wont experience a positive transition towards more environmental friendly modes of transport, the city expects a minor decrease –up to 11%- to the CO2/GHG emissions and up to 5% to the Air Quality Index.

3.3.3.16. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into consideration the quite stable figures presented above, no significant changes towards the Gig employments are expected as the city foresees only a slight increase –up to 2%- of this indicator.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, although the share of micro mobility is expected to be increased, Tel Aviv foresees an increase from 10 to 15% to the accidents involving these means both in passenger or freight transportation.

Soc CA3: Access to mobility services:

In terms of accessibility to mobility sector, Tel Aviv foresees a slight increase (lower than 5%) to the affordability of using mobility services and a moderate increase in the accessibility to mobility services.

3.5.4 Sustainability Impact Assessment: Tel Aviv Scenario 3

3.3.4.8. Tel Aviv's third mobility scenario for the time horizons 2025-2030 and main key drivers that shape the future

The political agenda and tax policy increasingly supports new mobility developments, leading to an accelerated approval of the metro system, and parking policy to decrease private car ownership. Electrical vehicles are also be promoted this way, and congestion fees help reduce the number of private cars. Increases in tourism increase the demand for public transport and micro-mobility services, and encourage open space allocation to promote walkability. These developments are further fuelled by increased environmental consciousness and increased densification, which make the population demand more active modes, for on-demand mobility, and for electric vehicles. An ageing population also requires more accessible public transport, and makes more use of delivery services.

Due to a lack of digitalization among consumers, multimodality is at a minimum, and micro-mobility and carsharing initiatives don't grow to their full potential.

Stronger health and safety regulations also deter some from using bikes and other micro-mobility modes, but it further helps the city's preparedness for electric transportation. The increases in regulation also mean better management of logistics within the city to reduce pollution, and help restrict heavy vehicle traffic.

Main take-aways:

- Political agenda, tax policy: increase
- Tourism, economic growth, environmental consciousness, and population size : increase
- Safety concerns: weak growth
- Urban structure: increasing densification
- Demographic composition: increase
- Smart-city technology and digitalization: weak growth
- Health and safety regulation: strong increase

3.3.3.17. Economic Impact Analysis

Econ CA1: Urban transport service structure and mix:

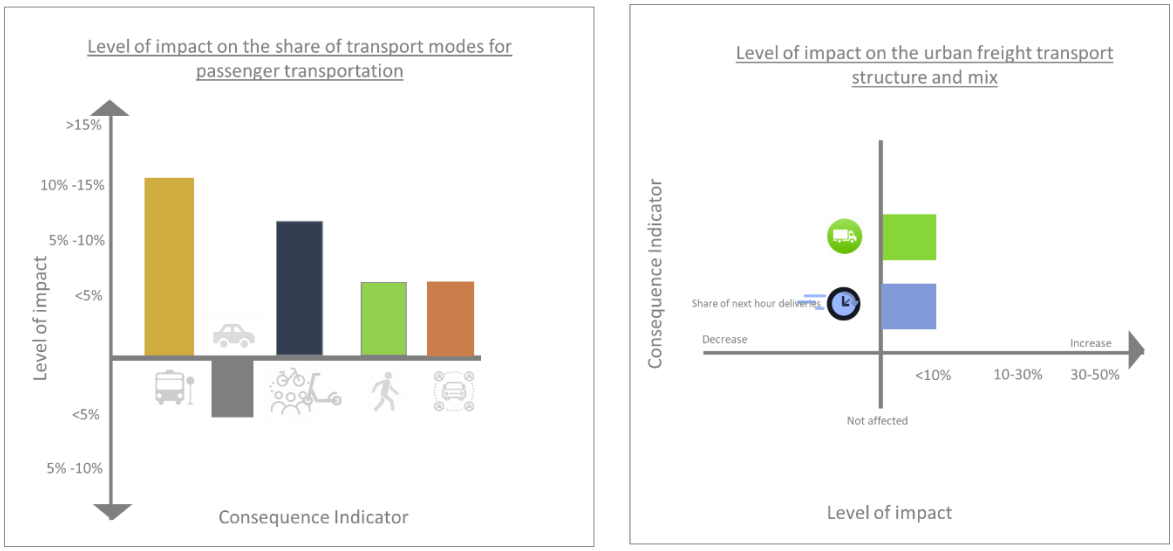
A change in the inhabitants' behaviour towards more sustainability modes is justified by the expected increase from 10 to 15% to the share of public transportation and the slight decrease (up to 5%) to the share of car transportation.

With regards to the use of new mobility services by the city's inhabitants the survey shows quite positive outcomes, with an increase from 5 to 10% to the share of micro-mobility to be

foreseen. With regards to the existing bike sharing and e-scooter system services that operate in the city a provision of up to 30 % more shared dock-less bikes and e-scooters to the citizens is expected.

On the other hand, no significant changes in the share of active transportation are foreseen (Graph 76)

In terms of urban freight transportation, an increase of up to 10% in the share of green deliveries as well as to the share of next hour-same day deliveries is foreseen.



Graph 76 Level of impact on the share of transport modes for passenger/freight transportation

Econ CA2: Urban space allocation:

Taking into consideration the impact on the urban transport structure and mix presented above, great changes to the urban space allocation are also expected. The city expects a major increase –more than 15% to the space allocated for both public transportation, micro mobility means and pedestrian areas –athough the share of active transportation is not expected to be affected- and a high decrease –from 10 to 15%- to the urban space for private/shared cars.

With respect to automated and autonomous mobility, Tel Aviv does not expect a transition towards the development of dedicated lanes for the provision of autonomous and automated public transportation services.

Econ CA3: Urban transport service volumes:

An increase from 5 to10% to both the total average number of vehicles that enter the city on a daily basis as well as to the average number of daily urban freight trips is expected.

Econ CA4: Urban transport service level:

A slight positive impact to the passenger transport service level is foreseen. On the one hand a decrease to the costs for alternative modes of urban passenger transportat is expected (up to 5% decrease) and a slight increase of the share of passengers that use smart methods to

pay in public transportation services. On the other hand though, no significant changes towards the equipment of more public transportation vehicles with new technologies is foreseen.

With regards to urban freight transportation, the figures are better, with a higher decrease from 5 to 10% to the urban delivery costs to be expected and an increase from 10 to 15% to the goods delivery frequency.

Econ CA5: Urban transport operational and capital expenditure costs (OpEx & CapEx):

In terms of the necessary urban transport operational and capital expenditure costs, a slight increase of 5% increase in the necessary private investments is foreseen for time horizons 2025-2030.

3.3.3.18. Environmental Impact Analysis

Env CA 1: Climate change & Env CA2: Air quality index

The clear direction towards green and public transport modes -shown in the previous consequence areas- is the most possible explanation for the expected moderate decrease –up to 23%- to the CO2/GHG emissions and the decrease of up to 25% to the Air Quality Index.

3.3.3.19. Social Impact Analysis

Soc CA1: Employment & social security

In terms of employment and social security in the transport sector, the local stakeholders were asked to estimate the change in the current types of employment and the possible transition towards the Gig economy employment (independent contractors and freelancers). Taking into consideration the quite stable figures presented above, no significant changes towards the Gig employments are expected as the city foresees only a slight increase –up to 2%- of this indicator.

Soc CA2: Safety & security

In terms of safety and security of the urban mobility sector, although the share of micro mobility is expected to be increased, Tel Aviv foresees an increase from 10 to 15% to the accidents involving these means both in passenger or freight transportation.

Soc CA3: Access to mobility services:

Regarding the level of accessibility and affordability of the city's urban mobility services, a quite positive impact is foreseen by the city. More specifically, a 10 to 15% increase in the affordability of using the mobility services based on the citizens average annual cost of trips and per their annual income, is expected while a high increase of the accessibility to mobility services by all categories of passengers.

3.5.5 Tel Aviv: Conclusions

Regarding the economic mobility state of Tel Aviv's city, the future shows a high possibility for an increase of the citizen's environmental consciousness resulting to the use of more environmental friendly modes of transport with two out of three scenarios to foresee the either moderate or high increase of the share of micro mobility, active transportation as well as public transportation.

Similar changes are expected also to the city's current urban space allocation. Two out of three scenarios show more space for public transportation, more cycling and e-scooter lanes, less space for car transport and more space for pedestrian areas, with two out of three scenarios to estimate it.

Finally, the city does not expect any transition towards autonomous and automated mobility, with all scenarios to justify it.

With respect to freight deliveries, a direction towards the provision of green deliveries as well as next hour and same day deliveries is also foreseen in two out of three scenarios.

The worst case scenario – the second scenario in Tel Aviv's case- presents a slight negative impact on the current transport mix and structure, justified by the moderate decrease of the micro-mobility share. The remaining consequence indicators related to the urban transport mix and structure won't be affected by this scenario. With respect to the future urban space allocation, no changes are expected. Finally, regarding urban freight transportation, a slight decrease of the share of green deliveries is foreseen.

Concerning the transport service level, the results from the analysis of all the scenarios show controversial results. At one end, a slight/moderate increaser to the share of passengers that use smart methods in public transportation is expected however the public vehicles won't be significantly equipped with smart technologies for providing real-time data to the users. Regarding the potential impact to the costs of alternative transport modes, two out of three scenarios expect a moderate decrease.

In terms of urban freight transportation, the city expects a definite crease to the urban delivery prices and two out of three scenarios foresee also a moderate to high increase in the goods delivery frequency.

One of the main negative consequences justified by all three scenarios is related to the city's transport service volumes. The future shows more congested streets, with more daily urban freight trips to be implemented for covering the higher demand for next hour – same day last mile deliveries.

Besides this negative outcome, the city is quite optimistic with regards to their environmental performance. More specifically, all three scenarios expect a cleaner city with less CO2 emissions and a decreased Air Quality Index.

Finally, concerning the social dimension of the city's mobility state, the results are controversial . On the one hand, the city expects an urban mobility with more accidents in both passenger and freight transport services, with two out of three scenarios to justify it. On the other hand

though, higher affordability of using mobility services and higher accessibility by all categories of passengers is expected by all three scenarios.

Finally, in terms of employment, the city will experience a slight increase of the Gig employment.

4 Conclusions

This deliverable analyses and presents the sustainability impacts of the future scenarios developed in Task 3.1.

The impact assessment process that was followed was based on the consequence analysis approach and an in depth analysis of the economic, environmental and societal consequences of each mobility scenario was implemented.

A three step methodological process was followed for the implementation of this deliverable:

1. The first step concerns the development of the consequence analysis framework and the identification of the main consequence areas and consequence indicators that will be assessed. Following the outcomes of the first step, an online questionnaire, using the Survey Monkey online tool, was conducted and distributed to the 1st layer SPROUT cities.

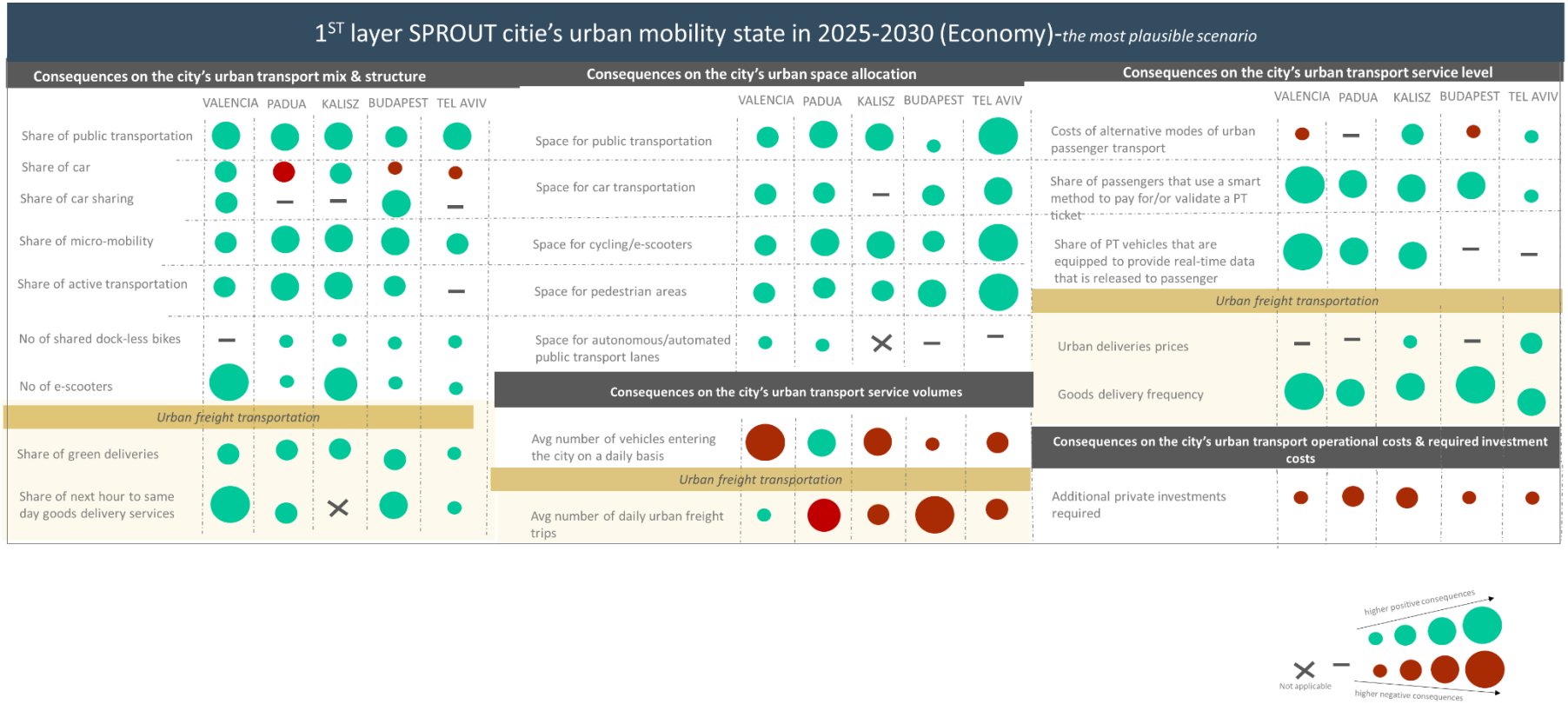
2. The cities were responsible for the data collection process. The process for gathering the data though was not not a straightforward one. The majority of the cities followed a consensus building approach for the data collection where the local stakeholders were all gathered through virtual workshops (due to the Covid-19 pandemic), the survey was discussed in local language, an agreement was reached on their view on each survey's questions and at the end the city filled in one questionnaire. Only two cities (Padua and Valencia) shared the surveys to each local stakeholder individually (either through e-mail or through personal interviews) and the survey was then returned directly by the stakeholders.

3. The third and final methodological step concerns the data analysis for each city. For Valencia and Padua, -i.e. the cities that didn't follow a consensus building approach-, the analysis goes in more depth analysing the different opinions among the stakeholders which sometimes resulted to controversial outcomes.

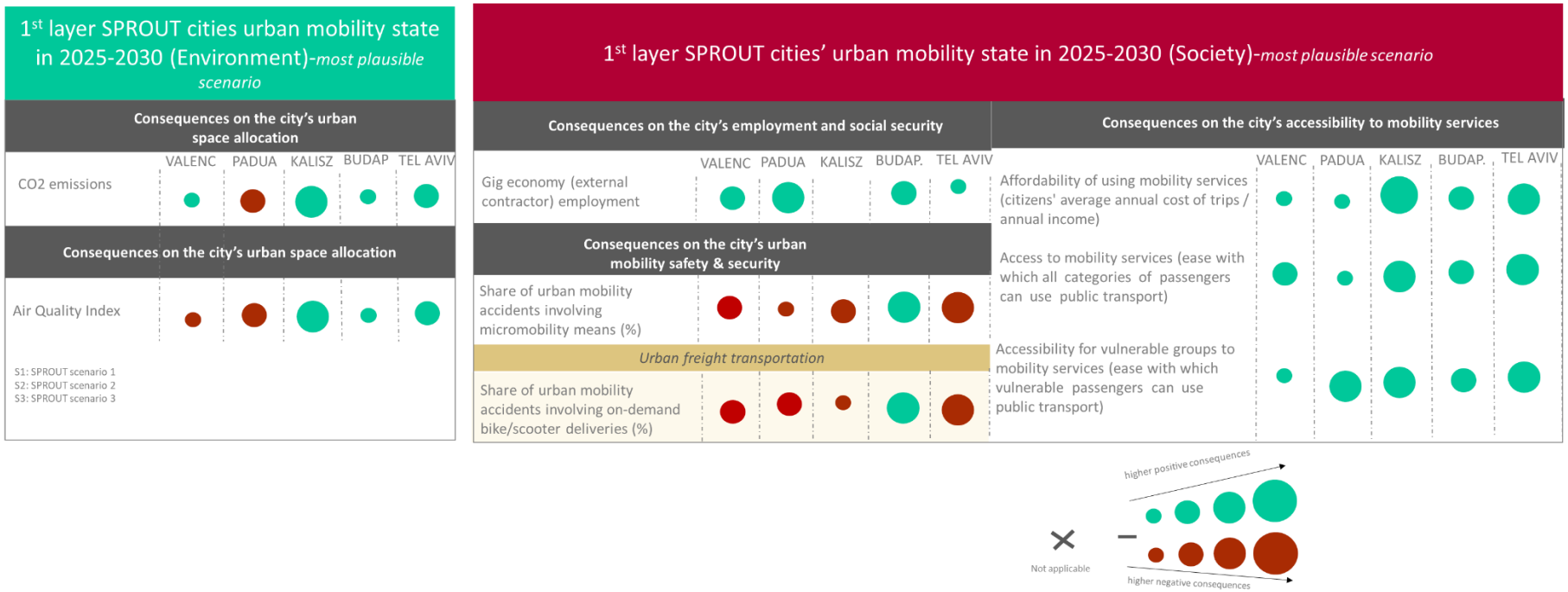
The following Graph presents a consolidated view on the outcomes of the sustainability impact assessment of the 3rd scenario of each 1st layer SPROUT city. The third scenario was chosen as this is the most likely future development according to the city stakeholders.

These figures show a clear transition of the cities 'mobility towards the use of more green transport modes and the allocation of more urban space for these which will result to a better environment in general with better air quality and less CO2 emissions. The cities expect by 2025-2030 the public transportation system to be smarter; the level of transport services for both passenger and freight transportation to be better and the mobility services to be more accessible and affordable by all type of passengers.

On the other hand though, the future show that the streets will be more crowded with both passenger and freight vehicles and the issue of safety and security is also raised by the majority of the 1st layer cities.



Graph 77 1st layer SPROUT cities urban mobility state in 2025-2030 (Economy) - the most plausible scenario



Graph 78 1st layer SPROUT cities urban mobility state in 2025-2030 (Environment - Society) - the most plausible scenario

Annex I : The Consequence Matrix

The following Table presents the final list of consequence areas and indicators that will be used for the sustainability assessment of the SPROUT 1st layer cities and their continuum of performance. The final column of the Table indicates the sources that were used for selecting the most appropriate continuum of performance for each indicator.

	Expected impact on:	1	2	3	4	Source
ECONOMY	**Econ CA 1: The urban transport service structure/mix.**					
	Share of public transport (%)	<5%	5-10%	10-15%	>15%	Mirko Goletz, Dirk Heinrichs, Irene Feige (2016), "Mobility trends in cutting-edge cities", Final report ,ifmo Institute of Mobility research
	Share of car transport (%)	<5%	5-10%	10-15%	>15%	Mirko Goletz, Dirk Heinrichs, Irene Feige (2016), "Mobility trends in cutting-edge cities", Final report ,ifmo Institute of Mobility research
	Share of micromobility (%)	<5%	5-10%	10-15%	>15%	Mirko Goletz, Dirk Heinrichs, Irene Feige (2016), "Mobility trends in cutting-edge cities", Final report ,ifmo Institute of Mobility research
	Share of active transport (%)	<5%	5-10%	10-15%	>15%	Mirko Goletz, Dirk Heinrichs, Irene Feige (2016), "Mobility trends in cutting-edge cities", Final report ,ifmo Institute of Mobility research
	Share of car sharing transport (%)	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners

	Share of green deliveries (cargo bikes, electric tricycles, green autonomous/automated means) (% of daily deliveries)	<10%	10-30%	30-50%	>50%	Martina Joerss, Jürgen Schröder, Florian Neuhaus, Christoph Klink, Florian (2016),"Parcel delivery, the future of last mile ", Mann McKinsey& Company;Travel, Transport and Logistics; September 2016
	Share of next hour to same day goods delivery services (% of daily deliveries)	<10%	10-15%	15-20%	20-25%	Statista's GmbH online statistics : www.statista.com (last entered: April 2020)
	Number of shared dockless bikes	<30%	30-60%	60-100%	>100%	Cbinsights, March 2018; "The Global Bike-Share Boom: Dockless Models Look To Solve Urban Commutes & Transit Access (https://www.cbinsights.com/research/bike-sharing-boom/ last entered: April 2020) Felix Richter, March 2015, "Bike-Sharing Is Taking Off Around the World", Statista's GmbH, https://www.statista.com/chart/3325/bike-sharing-systems-worldwide/ (last entered: April 2020)
	Number of shared e-scooters	<30%	30-60%	60-100%	>100%	Megan Rose Dickey, April 2019, ; "Shared electric scooter rides accounted for 45.8% of all micromobility trips in 2018" https://techcrunch.com/2019/04/17/shared-electric-scooter-rides-accounted-for-45-8-percent-of-all-micromobility-trips-in-2018/ (last entered: April 2020) EUR (2019); "The Future of Cities. Opportunities, challenges and the way forward", JRC, Luxemburg
	Econ CA 2: The urban space allocation					

	Share of urban space for public transport	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
	Share of urban space for private/shared cars	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
	Share of urban space for cycling/scooter lanes	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
	Share of urban space for pedestrian areas	<5%	5-10%	10-15%	>15%	EUR (2019); "The Future of Cities. Opportunities, challenges and the way forward", JRC, Luxemburg
	Number of autonomous/automated PT services on dedicated lanes	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
	Econ CA 3: The urban transport service volumes					
	Average number of daily urban freight trips	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
	Average number of vehicles entering the city on a daily basis	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
	Econ CA 4: The city' s urban transport service level					
	Costs of alternative modes of urban passenger transport	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
	Share of passengers that use a smart method to pay for or validate a PT ticket (%)	<10%	10-30%	30-50%	>50%	EUR (2019); "The Future of Cities. Opportunities, challenges and the way forward", JRC, Luxemburg

	Share of PT vehicles that are equipped to provide real-time data that is released to passengers (%)	<10%	10-30%	30-50%	>50%	EUR (2019); "The Future of Cities. Opportunities, challenges and the way forward", JRC, Luxemburg
	Urban deliveries prices (€/package)	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
	Goods delivery frequency (average number of weekly deliveries to consumers)	<10%	10-15%	15-20%	20-25%	Capgemini Research Institute Report, "The last-mile delivery challenge. Giving retail and consumer product customers a superior delivery experience without impacting profitability "
	Econ CA 5: The urban transport operational costs & required investment costs?					
	Additional private investments required (% of existing annual investment cost)	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners

ENVIRONMENT	**Expected impact on**	1 (<25%)	2 (25-50%)	3 (50-75%)	4 (>75%)	
	Env CA1: Climate change					
	CO2 equivalent or GHG emissions	<25%	25-50%	50-75%	>75%	ALICE-ETP, (2019), Roadmap towards Zero Emissions Logistics 2050
	Env CA2: Air quality index					
	Air quality index	<25%	25-50%	50-75%	>75%	Website: http://www.airqualitynow.eu/about_indices_definition.php

SOCIETY

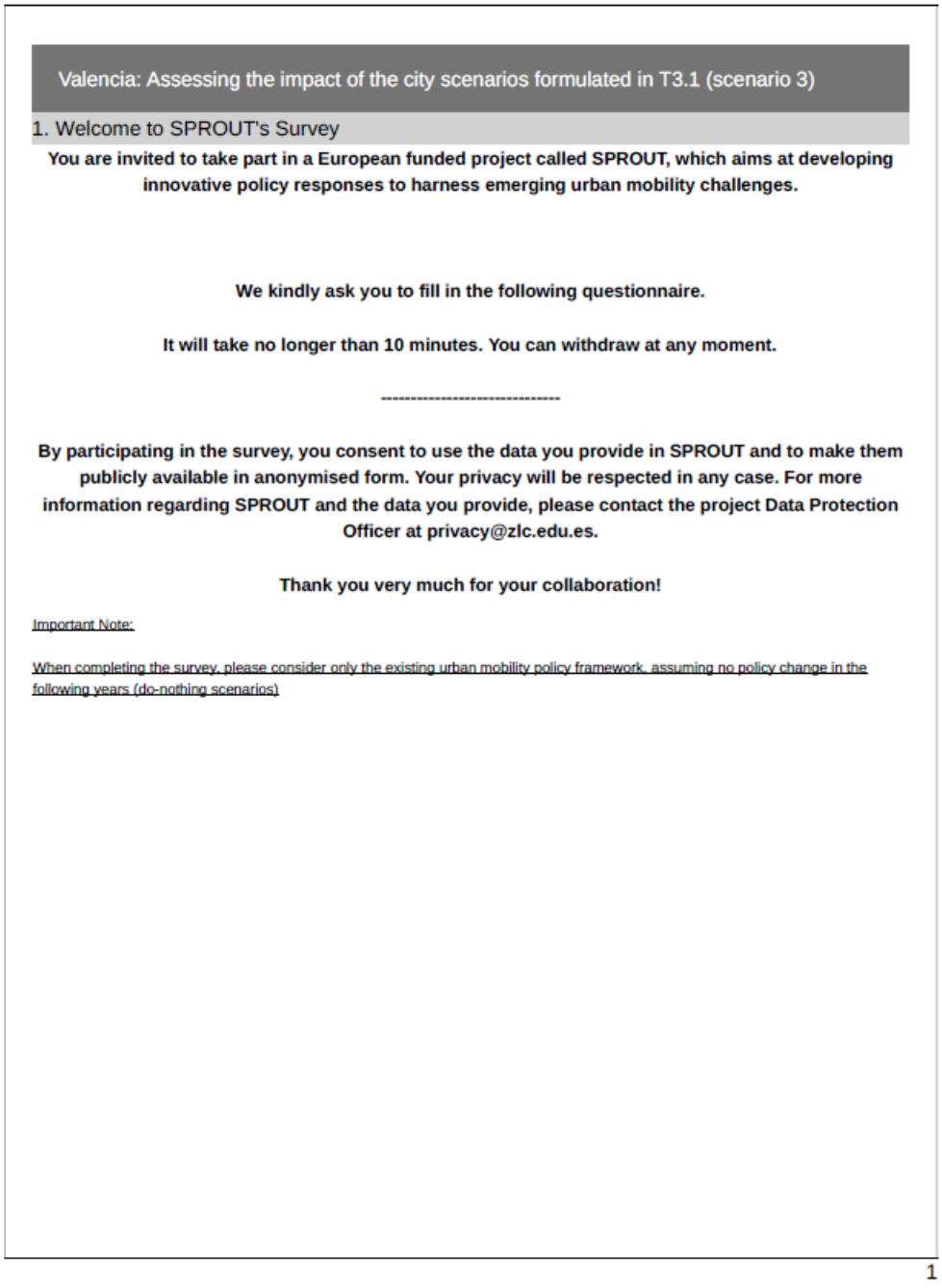
Soc CA1: Employment & social security?					
Expected impact on	1	2	3	4	
Gig economy (external contractor) employment (% of total employees)	<10%	10-30%	30-50%	>50%	I. Mitic, 2020, "Gig Economy Statistics 2020: The New Normal in the Workplace", https://fortunly.com/statistics/gig-economy-statistics#gref; last entered: April 2020

Soc CA2: Safety & security?					
Expected impact on	1 (<5%)	2 (5-10%)	3 (10-15%)	4 (>15%)	
Share of urban mobility accidents involving micromobility means (%)	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
Share of urban mobility accidents involving on-demand bike/scooter deliveries (%)	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners

Soc CA3: Access to mobility services?					
Expected impact on	1 (<5%)	2 (5-10%)	3 (10-15%)	4 (>15%)	
Affordability of using mobility services (citizens' average annual cost of trips / annual income)	<5%	5-10%	10-15%	>15%	Consensus building among the SPROUT Partners
Access to mobility services (ease with which all categories of passengers can use public transport)	Minor	Moderate	High	Major	Consensus building among the SPROUT Partners

	Accessibility for vulnerable groups to mobility services (ease with which vulnerable passengers can use public transport)	Minor	Moderate	High	Major	Bekiaris et al. (2018) "Research for TRAN Committee - Transport and tourism for persons with disabilities and persons with reduced mobility" ;Policy Department for Structural and Cohesion Policies Directorate General for Internal Policies of the Union;IP/B/TRAN/IC/2017-017; PE 617.465

Annex II – Consequence analysis survey (Valencia's example)



Valencia: Assessing the impact of the city scenarios formulated in T3.1 (scenario 3)

1. Welcome to SPROUT's Survey

You are invited to take part in a European funded project called SPROUT, which aims at developing innovative policy responses to harness emerging urban mobility challenges.

We kindly ask you to fill in the following questionnaire.

It will take no longer than 10 minutes. You can withdraw at any moment.

By participating in the survey, you consent to use the data you provide in SPROUT and to make them publicly available in anonymised form. Your privacy will be respected in any case. For more information regarding SPROUT and the data you provide, please contact the project Data Protection Officer at privacy@zlc.edu.es.

Thank you very much for your collaboration!

Important Note:

When completing the survey, please consider only the existing urban mobility policy framework, assuming no policy change in the following years (do-nothing scenarios)

1

Valencia: Assessing the impact of the city scenarios formulated in T3.1 (scenario 3)

2. Purpose of the survey and main Instructions

The purpose of this survey is to identify the expected impacts of the urban mobility scenarios for 2025/2030 developed in Task 3.1.

These scenarios represent the possible development of the urban mobility system by taking into consideration that no new policies are introduced to harness transition. Three scenarios have been co-created with the involvement of local stakeholders.

The main question that the present survey would like to answer, is: What is the expected impact of the scenarios developed in T3.1?

In the following pages you will find s brief description of each scenario followed by a list of scenario consequences (impacts) and corresponding performance indicators (PI). The impacts have been grouped into three areas: Economy, Environment and Society.

You are kindly requested to assess for each of three scenarios the extent of its impacts by selecting the appropriate response to each question.

ASSESSMENT INSTRUCTIONS:

Step 1: Please read carefully each scenario.

Step 2: Read the main consequences (impacts) per each sustainability area which are presented in the first question of each section.

Step 3: Choose the Variant State of each Performance Indicator (PI). The options you have are: Increase, Decrease, Not affected, Not applicable.

Step 4: Estimate the level of change of each PI in the following questions. If you have chosen the option "Not affected" or "Not applicable", then place the value

2

Valencia: Assessing the impact of the city scenarios formulated in T3.1 (scenario 3)

3. SPOUT future urban mobility scenario 3:

Growing political support for mobility will ensure the completion of line 10 of Metrovalencia, which will mean a transfer of users from private transport to the PT option. it will also facilitate the transfer of current bus users to the new line, reducing the number of passengers on busses. Thanks to decreased corruption, investments are optimized, sustainable mobility will benefit, and participatory processes linked to transport policies positively affect policies and their transparency. Higher taxation in favour of sustainable mobility will result in cleaner mobility. Increasing tourism will lead to more mobility, but efficiency of services will increase, and lower cost of mobility. Ease of access to certain areas will increase. Packages will be developed for tourists' mobility that includes sustainable options, which provide new business opportunities.

An economic recession will lead to a decline in mobility, but online retail will grow strongly and become more efficient with the use of big data technologies. Increasing densification will lead to lower transport costs. Population increase will generate more opportunities for mobility. Strong growth in the electrification of mobility will lead to improved infrastructure. The growth of consumer and citizen-oriented digitalization will improve real-time information on transport options. More frequent extreme weather due to climate change means that private mobility will grow but personal mobility vehicles will be more difficult to maintain and local air quality will decrease.

Main take-aways:

- **Political support for sustainable mobility, taxation, tourism, immigration, urban density, extreme weather due to climate change, population: increase**

-New employment arrangements, new business models, (e.g. collaborative consumption, sharing economy): weak growth
-Corruption, economic growth, people choosing not to own cars, local environmental quality: decrease
-Electrification of mobility, smart-city technology, consumer- and citizen-oriented digitalization: strong growth
- Labour and employment: more regulation

3

Valencia: Assessing the impact of the city scenarios formulated in T3.1 (scenario 3)

4. Impacts on the economy

4.1. Impacts on urban transport service structure/mix

Note: Q1 aims to define whether an increase or decrease of the share of a specific transport mode/service will occur until 2030. Then the following questions try to define the extent of such increase or decrease.

* 1. **How do you believe the following transport mode/service shares will change in 2030?**

-Which transport mean will rule the streets? Will the citizens use more public transportat (PT), their car or shared car, their own or shared e-scooter/bike or will they just walk? So, how do you believe the share of each mode will be affected?
-Are there e-scooters and shared bikes in your city? If yes, do you expect an increase in their number or not?
-Will the last mile operators use more environmentally friendly modes for last mile deliveries? If yes/no, how do you believe the existing share of green deliveries will be affected?

	Increase	Decrease	Not affected	Not applicable
Share of public transport (%)	○	○	○	○
Share of car transport (%)	○	○	○	○
Share of micromobility (i.e. e-scooters, bikes e.tc.) (%)	○	○	○	○
Share of active transport (%)	○	○	○	○
Share of car sharing transport (%)	○	○	○	○
Share of green deliveries (cargo bikes, electric tricycles, green autonomous/automated means) (% of daily deliveries)	○	○	○	○
Share of next hour to same day goods delivery services (% of daily deliveries)	○	○	○	○
Number of shared dockless bikes	○	○	○	○
Number of shared e-scooters	○	○	○	○

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* 2. Based on your answers in Q1, what do you estimate to be the amount of increase/decrease of the **share of the different transport modes below** ?

	<5%	5-10%	10-15%	>15%
Share of public transport (%)	○	○	○	○
Share of car transport (%)	○	○	○	○
Share of micromobility (%)	○	○	○	○
Share of active transport (%)	○	○	○	○
Share of car sharing transport (%)	○	○	○	○

* 3. Based on your answers in Q1, **what do you estimate to be the increase/decrease of the following urban freight services** in 2030?

	<10%	10-30%	30-50%	>50%
Share of green deliveries (cargo bikes, electric tricycles, green autonomous/automated means) (% of daily deliveries)	○	○	○	○
Share of next hour to same day goods delivery services (% of daily deliveries)	○	○	○	○

* 4. Based on your answers in Q1, what do you estimate to be the i**ncrease/decrease of the following new mobility services in 2030?**

	<30%	30-60%	60-100%	>100%
Number of shared dockless bikes	○	○	○	○
Number of shared e-scooters	○	○	○	○

4.2. Impacts on urban space allocation

Note: Q5 aims to define whether an increase or decrease of the share of a specific urban space category will occur until 2030. Then the following questions try to define the extent of such increase or decrease.

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* 5. How do you believe, **the city' s urban space allocation will be affected**?

-Will the public transport lanes be more congested, so the share of urban space for public transport will increase?
-Will the private or shared cars rule the streets, so the share of urban space will increase or not?
-Will the cycling and scooter lanes be more crowded, so the share of urban space for such lanes will increase
-Do you believe that there will be a need for dedicated lanes for autonomous vehicles?

	Increase	Decrease	Not affected	Not applicable
Share of urban space for public transport (%)	○	○	○	○
Share of urban space for private/shared cars (%)	○	○	○	○
Share of urban space for cycling/scooter lanes (%)	○	○	○	○
Share of urban space for pedestrian areas (%)	○	○	○	○
Number of autonomous/automated PT services on dedicated lanes	○	○	○	○

* 6. Based on your answers in Q5, what do you estimate to be the amount of increase/decrease of the below-mentioned aspects of your **city's urban space?**

	<5%	5-10%	10-15%	>15%
Share of urban space for public transport (%)	○	○	○	○
Share of urban space for private/shared cars (%)	○	○	○	○
Share of urban space for cycling/scooter lanes (%)	○	○	○	○
Share of urban space for pedestrian areas (%)	○	○	○	○
Number of autonomous/automated PT services on dedicated lanes (no)	○	○	○	○

4.3. Impacts on urban transport service volumes

Note: Q7 aims to define whether an increase or decrease will occur until 2030. Then the following questions try to define the extent of such increase or decrease.

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* 7. How do you believe, the future trends identified in this scenario will affect **the city' s urban transport service volumes** ?

-Will the average number of cars entering the city daily, or the number of goods' delivery trips, increase or decrease? Do you expect the streets to be more congested or not?

	Increase	Decrease	Not affected	Not applicable
Average number of daily urban freight trips	○	○	○	○
Average number of vehicles entering the city on a daily basis	○	○	○	○

* 8. Based on your answers in Q7, what do you estimate to be the amount of increase/decrease of the below-mentioned aspects of the city's **urban transport service volumes?**

	<5%	5-10%	10-15%	>15%
Average number of daily urban freight trips (no)	○	○	○	○
Average number of vehicles entering the city on a daily basis (no)	○	○	○	○

4.4. Impacts on urban transport service level & cost

Note: Q9 aims to define whether an increase or decrease will occur until 2030. Then the following questions try to define the extent of such increase or decrease.

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* 9. How do you believe will the city' s **urban transport service level be affected?**

Indicative Questions:
-Do you expect the costs of (alternative to PT) transport modes such as bikes, e-scooters to increase?
-What about the urban delivery prices? Do you expect them to increase or decrease?
-Do you expect the frequency of goods deliveries within the city to be affected?
-Now, regarding the use of new technologies in Public Transport, do you expect more passengers to use smart methods for public transport services?

	Increase	Decrease	Not affected	Not applicable
Share of passengers that use a smart method to pay for or validate a PT ticket (%)	○	○	○	○
Share of PT vehicles that are equipped to provide real-time data that is released to passengers (%)	○	○	○	○
Costs of alternative modes (i.e. bikes, walking, e-scooters) of urban passenger transport (€)	○	○	○	○
Urban deliveries prices (€/package)	○	○	○	○
Goods delivery frequency (average number of weekly deliveries to consumers)	○	○	○	○

* 10. Based on your answers in Q9, what do you estimate to be the increase/decrease of the following **urban transport costs?**

	<5%	5-10%	10-15%	>15%
Costs of alternative modes of urban passenger transport (€)	○	○	○	○
Urban deliveries prices (€/package)	○	○	○	○

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* 11. Based on your answers in Q9, what do you estimate to be the amount of increase/decrease of the use of **New Technologies in urban transport ?**

	<10%	10-30%	30-50%	>50%
Share of passengers that use a smart method to pay for or validate a PT ticket (%)	○	○	○	○
Share of PT vehicles that are equipped to provide real-time data that is released to passengers (%)	○	○	○	○

* 12. Based on your answers in Q9, what do you estimate to be the increase/decrease of the **goods delivery frequency ?**

	<10%	10-15%	15-20%	>20%
Goods delivery frequency (average number of weekly deliveries to consumers) (no/week)	○	○	○	○

4.4. Impacts on urban transport operational and capital expenditure costs (OpEx & CapEx)

* 13. How do you believe will the **city's urban transport private investment costs** be affected?
-Do you expect these trends will require **additional private investments (% of existing annual investment costs) or not?**

*Please slide the bar below to the amount of increase (+) or decrease (-) of the additional private investments that will be required (% of existing annual investment costs), based on your opinion.

-15% 0 +15%

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5. Impacts on the environment

* 14. How do you believe **climate change will be affected**?

*Please slide the bar below to the amount of expected increase (+) or decrease (-) of CO2/GHG emissions, as a result of urban mobility.

-75% 0 +75%

* 15. How do you believe the **city's air quality will be affected?**

*Please slide the bar below to the amount of expected increase (+) or decrease (-) of the Air quality index, as a result of urban mobility.

The air quality index (AQI) is a number used to report the quality of the air on any given day. The Index is based on measurement of particulate matter (PM2.5 and PM10), Ozone (O3), Nitrogen Dioxide (NO2), Sulfur Dioxide (SO2) and Carbon Monoxide (CO) emissions.

-75% 0 +75%

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6. Social impacts

6.1. Impacts on employment & social security

* 16. What will be the impact on **employment & social security**?

-Do you expect changes in the current types of employment and a transition towards Gig economy employment (i.e. independent contractors and freelancers)?

*Please slide the bar below to the amount of expected increase (+) or decrease (-) of the Gig Economy employment (% of total employees) in urban mobility (both passenger & freight).

-50% 0 +50%

6.2. Impacts on safety

Note: Q17 aims to define whether an increase or decrease will occur until 2030. Then the following questions try to define the extent of such increase or decrease.

* 17. What will be the impact on **urban transport safety & security** ?

-Do you expect an increase in accidents involving e-scooters or bikes?
-Do you expect an increase in the accidents involving delivering goods with bikes/e-scooters?

	Increase	Decrease	Not affected	Not applicable
Share of urban mobility accidents involving micromobility means (%)	○	○	○	○
Share of urban mobility accidents involving on-demand bike/scooter deliveries (%)	○	○	○	○

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* 18. Based on your answers in Q17, what do you estimate to be the **amount of increase/decrease of the share of urban mobility accidents ?**

	<5%	5-10%	10-15%	>15%
Share of urban mobility accidents involving micromobility means (%)	○	○	○	○
Share of urban mobility accidents involving on-demand bike/scooter deliveries (%)	○	○	○	○

6.3. Impacts on access to mobility services

Note: Q19 aims to define whether an increase or decrease will occur until 2030. Then the following questions try to define the extent of such increase or decrease.

* 19. What will be the impact on the **accessibility to mobility services**?

-Do you expect an increase in the affordability of using mobility services or not?
-Do you expect an increase in the accessibility to transport services by all citizens?

Accessibility for vulnerable groups (elderly, people with reduced mobility, parents with strollers) to mobility services (ease with which vulnerable passengers can use public transport)

	Increase	Decrease	Not affected	Not applicable
Affordability of using mobility services (citizens' average annual cost of trips / annual income)	○	○	○	○
Access to mobility services (ease with which all categories of passengers can use public transport)	○	○	○	○
Accessibility for vulnerable groups to mobility services (ease with which vulnerable passengers can use public transport)	○	○	○	○

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* 20. Based on your answer in Q19, what do you believe will be the amount of increase/decrease of the level of city' s **affordability of the mobility services?**

	>5%	5-10%	10-15%	>15%
Affordability of using mobility services (citizens' average annual cost of trips / annual income)	○	○	○	○

* 21. Based on your answer in Q19, what do you believe will be the amount of increase/decrease of the level of city' s **accessibility to mobility services?**

	Minor	Moderate	High	Extreme
Access to mobility services (ease with which all categories of passengers can use public transport)	○	○	○	○
Accessibility for vulnerable groups to mobility services (ease with which vulnerable passengers can use public transport)	○	○	○	○

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7. The End

Thank you for participating in this Survey!

The results will be included in the SPROUT's Deliverable 3.2. "Sustainability impact analysis of city-specific scenarios"

If you need any further information about this survey you can contact: elpixenou@certh.gr

If you need further information about the SPROUT project you can contact: mdelacruz@zlc.edu.es or broyo@zlc.edu.es

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