Ref. Ares(2016)1512245 - 30/03/2016

**Horizon 2020**

**Societal Challenge: Improving the air quality and reducing the carbon footprint of European cities**

**Project: 690105 – ICARUS**

Full project title:

**Integrated Climate forcing and Air Pollution Reduction in Urban Systems**

# D6.2 Report on the Visionary Scenarios

**WP6: Developing pathways to green, smart and healthy cities**

Lead beneficiary: UNEXE

Date: October 2018

Nature: Report

Dissemination level: Public

# TABLE OF CONTENTS


ACRONYMS USED ..... 3

1 INTRODUCTION ..... 4

2 DEVELOPING VISIONS ..... 5

2.1 Introduction to Visions ..... 5

2.2 Methodology ..... 5

2.3 Summary of Trends Analysis ..... 6

2.4 Summary of Literature Review ..... 7

2.5 Summary of Horizon Scanning Results – Emerging Technology ..... 14

3 EXPERT WORKSHOP ..... 15

3.1 Overview ..... 15

3.2 Findings ..... 16

4 STAKEHOLDER WORKSHOP ..... 21

4.1 Overview ..... 21

4.2 Personal Visions ..... 22

4.3 Group Visions ..... 24

5 REFINING THE VISIONS AND LINKING TO OTHER SCENARIO FRAMEWORKS ..... 28

5.1 The ICARUS Visions ..... 28

5.2 Narratives from representative citizens ..... 32

6 NEXT STEPS ..... 34

7 REFERENCES ..... 35

8 APPENDIX 1: WORKSHOP AGENDA ..... 36

9 APPENDIX 2: GROUP VISIONS ..... 41

## Document Information

| | | | |
|---|---|---|---|
| **Grant Agreement Number** | 690105 | **Acronym** | ICARUS |
| **Full title** | Integrated Climate forcing and Air pollution Reduction in Urban Systems | | |
| **Project URL** | http://icarus2020.eu/ | | |
| **Project Officer** | Mirjam Witschke - Mirjam.WITSCHKE@ec.europa.eu | | |

| | | | | |
|---|---|---|---|---|
| **Delivery date** | **Contractual** | October 2018 | **Actual** | October 2018 |
| **Status** | Draft □ | | Final √ | |
| **Nature** | Demonstrator □ | Report √ | Prototype □ | Other □ |
| **Dissemination level** | Confidential □ | Public √ | | |

| | | | | |
|---|---|---|---|---|
| **Responsible Author (Partners)** | UNEXE | | | |
| **Responsible Author** | Tim Taylor | | **Email** | Timothy.j.taylor@exeter.ac.uk |
| | **Partner** | UNEXE | **Phone** | |
| **Other partners (Institution)** | AUTH, USTUTT, EUCENTRE, MU, SWISSTPH, UNEXE, ISCIII, JSI, EUC, NCSRD, AU | | | |

## Document History

| Name (Institution) | Date | Version |
|---|---|---|
| UNEXE | September 2018 | First version |
| AUTH | October 2018 | Second version |
| UNEXE | October 2018 | Final version |
| | | |

## ACRONYMS USED

| | |
|---|---|
| **CVD** | Cardiovascular Disease |
| **IPCC** | Intergovernmental Panel on Climate Change |
| **SSPs** | Shared Socioeconomic Pathways |
| **VR** | Virtual Reality |

# 1 Introduction

The ICARUS WP6 objective is to develop visions of smart, green and healthy cities through employing a foresight approach - combining participatory workshops, literature review and horizon scanning. Horizon scanning involves consultation with experts, state-of-the-art evidence reviews and web-based horizon scanning to identify new and emerging issues. The main element of these urban visions will be a combination of the use of digital technologies and green city planning to promote and optimize well-being whilst curbing air pollution and mitigating climate change.

This deliverable constitutes a report on visionary scenarios developed as part of the ICARUS project. The next section provides an overview of the approach we have used to develop visions and some of the background insights drawn from earlier work in the ICARUS project that feeds in to these visions. Section 3 presents the results of an expert workshop that highlights the key trends and challenges for healthy, sustainable and smart cities. Section 4 presents the outputs of a stakeholder workshop where individual and group visions were made. Section 5 pulls together this information and gives narrative scenarios, linking to existing scenarios such as the IPCC to enable better modelling in the next stages of ICARUS. Section 6 outlines the next steps in the implementation of these visionary scenarios.

# 2 Developing Visions

## 2.1 Introduction to Visions

The development of narrative visions of the future can help us to think about what the world might look like in 2050. Narrative visions can be linked into modelling processes and can provide the target or may provide some ideas on parameters for key models. They are not projections, but can insights into how society may develop and help us to get there.

An example of a narrative vision is given by President John F. Kennedy, who in 1961 outlined a vision:

*"We choose to go to the moon. We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too."*

This vision formed the basis of advances in space travel, with side impacts on the development of a range of products that we use today. The visionary scenarios developed in ICARUS should provide a similar basis for aspiration and inspiration.

## 2.2 Methodology

The method employed in developing visions is described in Figure 1. A range of different approaches were used to feed into the visions:

- The analysis of trends (presented as part of Deliverable D6.1 of the ICARUS project);
- A review analyzing key themes from the literature on smart, green and healthy cities;
- Horizon scanning on key technologies;
- An expert workshop which identified the key trends and issues in future cities; and
- A stakeholder workshop where visions were developed individually and then in groups.

All of this information was synthesized and used as the basis for the development of different narrative futures. This approach is similar to that taken in other projects, including the Volante project and INHERIT.

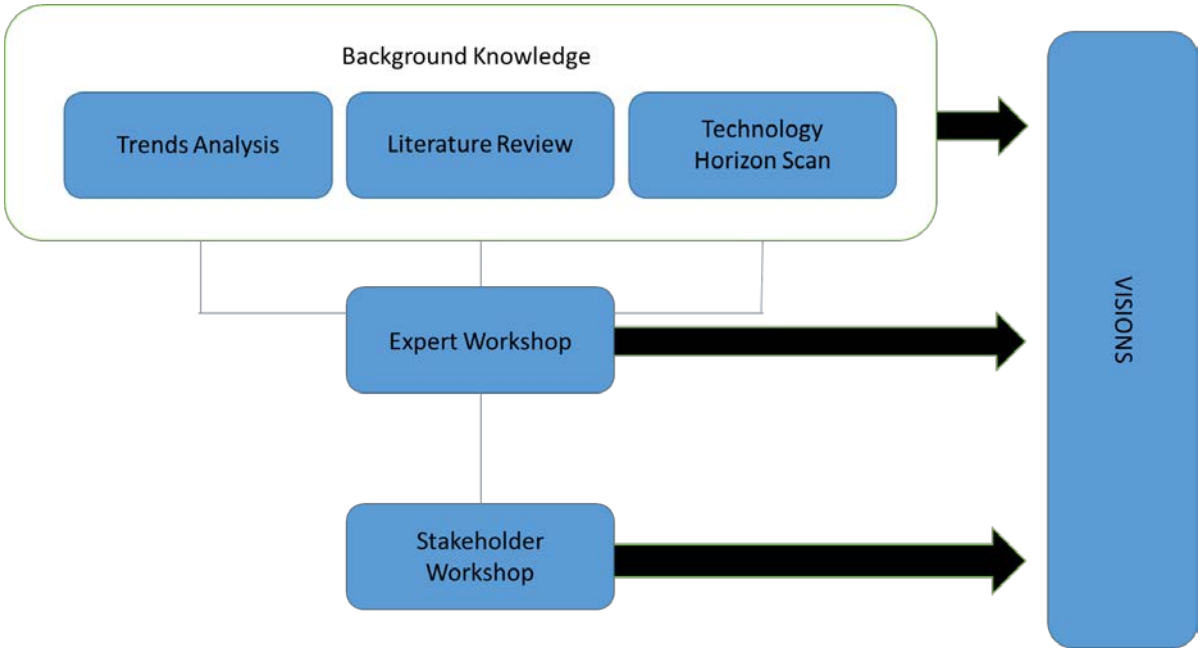


**Figure 1: Methodology for Deriving Visions**

## 2.3 Summary of Trends Analysis

The trends analysis is reported in full in D6.1. Key findings are summarized in this section.

The energy sector is likely to face a number of key changes:

- Switch from fossil fuel to renewable energy sources;
- Increasing electrification due to increase demand for air conditioning, heat pumps and electrical devices in the home;
- Marginal changes in industrial demand over time – due in part to energy efficiency measures;
- Energy demand in the residential sector expected to plateau due to energy efficiency measures; and
- Potential expansion in cogeneration of heating and electricity to reduce carbon emissions.

These changes are all likely to occur and hence, should be built in to future visions.

The transport sector faces a number of challenges in the coming decades. Key trends for this sector include:

- Private cars likely to contribute about 67% of passenger travel by 2050;
- Increases in cycling may continue, but may be small in overall magnitude;

- The emergence of autonomous vehicles may change transport habits;
- Aviation is likely to continue to rise in terms of demand;
- Some expansion in rail travel is likely in response to measures to reduce carbon emissions; and
- Freight travel is projected to increase significantly.

Key populations trends include:

- Continuing urbanization of the population;
- An ageing of the populations; and
- Environmental health challenges in cities are likely to continue.

## 2.4 Summary of Literature Review

A review was conducted of a range of key reports on smart, green and healthy cities. A number of key themes emerged. These are summarized in Table 1.

**Table 1: Key themes and quotes from literature review**

| Theme | Key quotes | Reference |
|---|---|---|
| *Urban design* | | |
| Urban design: megacities vs decentralisation | *"An issue for the future is whether to promote a few large cities, or focus on a larger number of smaller cities, possibly linked into wider functional regional economic systems"* | Government Office for Science (2016), p13 |
| Moves towards healthy and sustainable cities | *"We will ensure that the natural and built environment in and around cities improves livability and safety, mitigates disease, promotes human health and well-being. We pursue secure and safe access to food, water, energy, sanitation for all, culture and education, as well as clean air and soil".* | ICLEI (2018) |
| *Smart Transport Systems* | | |
| The rise of autonomous vehicles | *"Looking further into the future, fully autonomous vehicles could ultimately be integrated into a transport system of smart roads, traffic lights, signs, streetlights and parking".* | Government Office for Science (2014), p23 |
| Reduced congestion through smart transport solutions | *"Opportunities for the future could include combining location data with projected routes to simulate a whole-journey congestion map to route vehicles around* | Government Office for Science (2014), p24 |

| Theme | Key quotes | Reference |
|---|---|---|
| | *anticipated bottlenecks. Such a development could significantly reduce congestion, bringing economic and environmental benefits".* | |
| Role of autonomous transport in improving wellbeing in an ageing society | *"Autonomous or near-autonomous vehicles could allow people to drive for longer into later life, preserving social networks and wellbeing and providing potential road safety benefits both for drivers and other road users".* | Government Office for Science (2016c), p99 |
| People centred solutions for sustainable transport | *"We will promote sustainable passenger and freight mobility, prioritize clean fuel policies and electric vehicles from renewable energy where possible, and give priority to walking, cycling, public transit and shared mobility as part of people-centred solutions"* | ICLEI (2018) |
| Design of transport network to reflect active travel options | *"In terms of mobility, well-built transport networks need to be put in place to ensure that the city is walkable and 'bikeable'".* | EEA (2016), p30 |
| Intermodality to be encouraged in the future | *"Smart transport systems could be built to prevent accidents, and reduce fuel consumption and congestion". Smart mobility can combine different modes and options (public transport, car-sharing, car rental services, taxis and a bicycle system) to cater for mobility needs by using IT, apps, and smart invoicing"* | EEA (2016), p59 |
| Smart mobility systems reduce commuting times | *"By 2025, cities that deploy smart mobility applications could cut commuting times by 15–20 percent on average, with* | McKinsey and Company (2018) p6 |

| Theme | Key quotes | Reference |
|---|---|---|
| | *some people enjoying even larger reductions".* | |
| *Virtual Reality* | | |
| Increased use of Virtual and Augmented Reality in Recreation and Leisure, particularly among the elderly | *"Technologies such as augmented reality services can facilitate virtual participation in a wide range of activities such as social events, the pursuit of hobbies or virtual tourism".* | Government Office for Science (2016c), p94 |
| *Smart Food systems* | | |
| Increased traceability of food | *"Sensors with geo-location capability can provide information to consumers concerning the origin of food and production methods"* | Government Office for Science (2014), p32 |
| *Internet of Things* | | |
| The increasing role of sensors in measuring health | *""In the future we will carry sensors that measure our health and how we move around the environment in which we live. These will help us to socialise and navigate the world in ways that we can barely imagine"*<br><br>*"Some experts argue that applications and smart wearable devices will be a driving force for a healthier society"* | Government Office for Science (2014), p6<br><br>Government Office for Science (2014), p30 |
| Need for smart homes to aid with ageing population | *"Future housing has the potential to do far more than today's. Smart home technology, for example, can enable remote monitoring, turning the home into a place of healthcare".* | Government Office for Science (2016c) |

| Theme | Key quotes | Reference |
|---|---|---|
| The need for interoperability | *"For the Internet of Things to flourish, interoperability must apply across all parts of the system, including the transmission networks and the data being transmitted".* | Government Office for Science (2014), p8 |
| Smart city solutions using internet of things could improve policing | *"Cities that deploy a range of applications to their maximum effect could reduce fatalities from homicide, road traffic, and fires by 8–10 percent. In a city with the population and crime profile of Rio, this could mean saving some 300 lives each year. Predictive policing, real-time crime mapping, and gunshot detection have the greatest impact on preventing deaths".* | McKinsey et al (2018) |
| Air quality information via smartphone may reduce health risks | *"Sharing real-time air quality information with the public via smartphone apps enables individuals to take protective measures, potentially reducing negative health effects by 3–15 percent, depending on current pollution levels".* | McKinsey et al (2018), p8 |
| *Smart Energy Systems* | | |
| Smart energy systems could lead to significant energy efficiency savings | *"If smart meters are combined with thermostats, weather sensors and boilers, energy savings could range from 6-29%. These technologies have the potential to reduce energy* | Government Office for Science (2014), p6 |

| Theme | Key quotes | Reference |
|---|---|---|
| | *bills, carbon emissions and overall demand for electricity".* | |
| Improved materials and smarter grids will improve energy system | *"…introducing new materials to dramatically improve the efficiency of photovoltaic cells and the safety of nuclear fuel cells; rolling out a smarter grid that supports distribution and a variety of different generation technologies; and by simplifying the task and associated safety risks of infrastructure maintenance".*<br><br>*"Adding perovskite – one of a new generation of materials exploiting crystalline structures from substances like ammonia, iodine, and lead – on top of a silicon solar cell can boost overall power output by half".* | Government Office for Science (2017) p23 |
| Industry | | |
| Moves towards circular economy | *"We will decouple urban, economic development from resource consumption and environmental degradation and factor environmental and social costs into the price of goods and services. We will encourage equitable access to resources and create closed-loop urban and peri-urban systems to end linear economic activity"* | ICLEI (2018), p28 |
| *Policy* | | |
| Need for behavior change and technology to work together to improve the urban environment | *"It is clear from the evidence that if we are to progress towards more sustainable, resilient and liveable future, both citizen behaviour change and technological* | Government Office for Science (2016), p14 |

| Theme | Key quotes | Reference |
|---|---|---|
| | *developments are necessary- reliance on technology alone will almost certainly prove ineffective"* | |
| Need for changed models of governance of green space | *"In response to the trend towards privatisation and enclosure of public and 'ecosystem service' space, creative forms of governance are needed to deliver new systems of access, stewardship and investment for such spaces"* | Government Office for Science (2016), p27 |
| Use of Virtual Reality in Decision making | *"The creation of virtual environments, including through the use of augmented reality techniques, is another way of bringing issues alive, e.g. simulating the possible implications of extreme weather events or of different transportation systems on the future built form of that city".* | Government Office for Science (2016b) |
| *Changes in Employment* | | |
| Changes in types of employment | *"System architects, who can apply knowledge of advanced digital technology to classical engineering challenges, will be essential".* | Government Office for Science (2014), p8 |
| Increased home working in the future | *"Working from home is likely to become increasingly common in the future, particularly among older people. As with care in the home, this can be supported by suitable design and enabling access to necessary technologies, such as high-speed broadband"* | Government Office for Science (2016c) p 60 |

## 2.5 Summary of Horizon Scanning Results – Emerging Technology

Key emerging technologies that emerge from analysis of the web include the following:

- 3D printing – 3D printing is advancing significantly, including the use of 3D printers in building properties in China;
- Artificial meat – the potential for the production of artificial meat for reducing the carbon footprint of food is significant;
- Autonomous vehicles – the potential for autonomous vehicles is significant, though challenges exist in the application of the technology; and
- Virtual reality – the potential development of VR may have significant implications for health and wellbeing in cities.

# 3 Expert Workshop

## 3.1 Overview

An expert workshop was held in Madrid on 20th September 2018. The participants included experts from a number of fields, including public health, economics, environmental engineering, social sciences, atmospheric modelling and urban planning.

First, an overview of the ICARUS project and its objectives was given, before a series of short presentations to help the participants focus in on the issues at hand. The participants were split into four equal groups, facilitated by one senior member of the ICARUS team. Participants were reminded that Chatham House rules applied.

Each group was given a series of topics to discuss, with four topics to be discussed in each hour. The topics were as shown in Box 1. A rapporteur was appointed by each group to give feedback and further discussion followed.

A summary of the key points from the Expert Workshop was made and presented at the Stakeholder Workshop to help support the discussions.

**Box 1: Topics for Expert workshop**

- Digital technology:
    - The role of digital technology in connecting cities regionally and globally
    - Digital technology and energy, adaptation and transport sectors
    - Digital technology and health and wellbeing of urban citizens, including vulnerable groups
    - Risks associated with digital technology
- Low carbon:
    - Emerging and future technologies and how relate to carbon and health agendas ,
    - The role of mobility systems in cities in 2050, and trends in current transport systems and elements in fossil and pollution 'free' transport system
    - Trends and elements in low-carbon heating and production systems
    - What are the trends in urban nature and its inclusion in urban development
- Wellbeing, health and equity:
    - What are the major trends in urban health for different population groups
    - The role of emerging technologies in urban health and wellbeing
    - Direct and indirect links in the city between health and social issues, and energy, transport, adaptation

## 3.2 Findings

### 3.2.1 Digital technology

Key themes from discussions included the following:

- Increased interconnectivity and home working patterns leading to changes in transport demands, but these need appropriate logistics and there is the potential to increase the digital divide, with the most vulnerable not able to access technological solutions.
- The potential exists for the use of technology to be useful in reducing stereotypes and helping social integration;
- Fears of the Googleisation of information – including the need for education to encourage deep learning and to facilitate a healthier view of technology (i.e. not trusting Google search results which may be biased or e.g. Wikipedia sources necessarily). Overall, there is the need for Augmented Reality to be used to enable change. Knowledge is available fast, but it may be superficial and some questioned the physiological impacts e.g. on memory.
- Risks include the potential impact of a transition phase for the uptake of digital technology, including the potential for regional/national differences in uptake, with some places being slower and lagging, leading to a digital divide.
- Equity of access may impact on e.g. potential for some to access money (particularly poorer groups) and for economic development to be slowed.
- The potential exists for full connection, with smart systems enabling better transport and energy systems. However, smart transport systems relying on computers run the risk of catastrophic failure.
- One group suggested that an increase in technology would lead to a reduction in jobs, due to mechanisation and advances in robotics. This may have consequences:
    - Labour may be able to move into jobs that are more interesting;
    - There may be new jobs created from new emerging industries; and
    - Those with no jobs may need new forms of entertainment to give them enrichment, maybe based around Virtual Reality, though there may be a risk of a loss of connection with reality.
- Privacy fears were raised by one group, not so much around the issues of private companies using the data to generate sales, but more the threat of governments using the data for judging or manipulating certain groups in society (an example was given of the use of databases by the Chinese government to track individuals).
- There was a fear expressed by some that an increase in digital connectivity may lead to a loss of personal contact and leading to loneliness and potential associated health issues. It was suggested that digital substitutes (“digital people”) may become more interesting than real social contact and fears were expressed around this.
- One group suggested that there was a need to allow agency – as some people will not want to embrace digital technology, so there is a need to allow for eco-warriors who want to

disappear into the woods or for those who want to use bicycles rather than autonomous vehicles.

- The potential for data to be used for knowledge generation was highlighted, along with the potential for such data to feed better policy making. Citizen sensing to capture environmental data was highlighted as a potential area for opportunity.
- The use of digital/smart technology in public spaces and transport was discussed. The impact on trip numbers was uncertain, but there was felt to be a potential in the use of the virtual environment for jobs. The role of public space was questioned, with the potential for the use of space in cities to change with emerging technologies.
- The potential for digital technology access to change inter-regional connectivity was discussed. For example, regions that are currently close due to geography may form stronger bonds with other regions thanks to technology.
- The potential for data to reduce health inequalities and impacts on vulnerable groups was discussed. An example was given of the potential for better information on air quality to be shared with people with asthma.
- The impact on social inequality was felt to be uncertain.
- Threats include the possible use of digital technology to create monopolies.
- Possible benefits include the potential for enhanced multimodality in cities.

### 3.2.2 Low carbon

*Technology and Carbon/Health*

Issues discussed included:

- The potential for electrification to improve air quality and that in general pollution would be lower;
- The potential for new materials and technology to improve energy efficiency of buildings was raised.
- Drones represent a potential disruptive technology, with the potential for online goods and services to be delivered by drone. This may need building redesign (e.g. landing pads) and there are potential hazards of noise and accidents.
- Urban form was raised as potentially changing – with it being queried whether urban sprawl would continue in the same pattern given changes in technology. There is the potential for new design scenarios, based around condensed settlements or X shaped designs with high tech development – this is not the current design of cities. Issues included:
    - The impact of the introduction of the autonomous vehicle with potential changes in commuting behaviour (longer commutes with potential to work and so leading to further sprawl).
    - The potential for changing working patterns as digital technology becomes more widespread – this may lead to increased home working with impacts on where people live.
    - Unintended consequences were highlighted – with rural repopulation and satellite villages leading to potential risks. One participant noted that the impact of the

economic crisis and house prices in Greece have lead to off plan communities and increased use of summer homes as permanent dwellings, which have reduced resilience to wildfire risk in the case of Athens.

*Mobility Systems*

Topics covered included:

- Car sharing, which was mentioned by more than one group as being likely to increase.
- The use of non-motorised forms of transportation was expected to rise (e.g. walking and cycling). Two groups highlighted this independently.
- The role of electric cars was questioned – with some feeling they would increase.
- Increased use of economic instruments such as road pricing for cars was highlighted.
- The potential for expanding public transport through increased use of trolley buses was discussed by one group.
- An increase in intermodality and interconnectivity of systems was discussed by one group.
- The role of autonomous vehicles was discussed by one group, including:
    - the potential for use of electricity from renewables and optimisation systems to provide for a more fluid traffic flow.
    - Increase in sealed area of asphalt to take increased traffic generated
- The example of car free days in Bogata was highlighted as a potential for inspiration.

*Heating*

- It was generally felt that there would be more use of electricity for heating.
- The role of heat pumps was discussed by one group.
- Potential increasing importance of renewable energy was discussed by two groups, with some questions as to the extent.
- Fusion energy was highlighted by two groups.
- For both renewable and fusion it was emphasised by some that we do not know the impacts of mass implementation of these systems at present.
- Other technologies discussed included increasing use of geothermal where this is possible and the use of CCS systems.
- The role of new materials for insulation and building was discussed by one group.
- It was felt that there was a need for a paradigm shift in terms of energy systems towards decentralisation and increasing internationalised systems.

*Nature*

- The potential conflict between green space for recreation and the need for land for residential development was discussed. The potential for constructing higher houses and so reducing the footfall of the properties and the potential to convert paved courtyards to green spaces were highlighted as possible ways to reduce this conflict.

- The role of nature based solutions in urban design was highlighted, as was the importance of pollution control and spreading green space over cities to reduce inequalities of access and to increase security;
- The role of green spaces in reducing the heat island effect and the potential expansion of green roofing was highlighted.

### 3.2.3 Wellbeing, Health and Equity

*Trends*

- The need to take into account differences in national vs EU regulation and standards was highlighted.
- Air pollutants were generally felt to be falling, with likely increased air quality for those in poorer areas. However, air quality measurement is at stations and so the location of gains may not be optimal.
- One participant suggested that air quality issues in Europe do not impact on health.
- Heatwaves are likely to increase in frequency and intensity. This has led to:
    - increases in air conditioning in Southern Europe, with possible effects on the habits of the population (e.g. no longer taking siestas and reduced socialisation in the community in the evening).
    - Potential health inequality as low income groups cannot afford to install air conditioning systems.
- There is increasing awareness of environmental health issues, but inequalities remain high. Access issues to health systems and technologies.
- In terms of urban form, there has been an intermingling of new migrants with possible societal inequalities resulting.
- The ageing population in Europe was discussed, with better health systems leading to improved health and burden on the health systems by older patients. The migratory flux could redress the aging tend ad change this, leading to social and cultural inequality.

*Technology*

Potential new technologies or better use of existing technologies discussed included:

- The use of biomass by different classes in society:
    - Poorer groups using it as cheap energy and being impacted by worsening air quality;
    - Richer groups embracing the woodburning fad as a low carbon option and being impacted by worsening air quality.
- Bicycle use by different groups – the poorer groups who cannot afford personalised transport and well situated people with green preferences. The potential health gains (e.g. reduced CVD) and risks (exposure to low air quality) were discussed.
- The potential for monitoring of new chemical compounds was highlighted using new sensor technology;

- Smart cities need to be able to adapt to climate change and can build on sensors to respond to threats.
- Personalised medicines were felt to be increasing, but not all think positive and sensors might lead to a fake sense of risk. There is need to enhance education around the determinants of health.

*Direct and Indirect Impacts*

- Healthy spaces were identified as a potential area for urban design to provide spaces to work and relax/play outside. Potential "win-wins" for climate change and health from these.
- Cities need to be designed with climate change adaptation in mind.
- There is need for enhanced policy at both global and local levels to address health and wellbeing associated with climate change adaptation and mitigation.

# 4 Stakeholder Workshop

## 4.1 Overview

A stakeholder workshop was held on 21st September 2018, following the Expert Workshop. Stakeholders from a number of ICARUS cities attended and were supplemented by members of the ICARUS team. A series of presentations was given to lay the groundwork for the visions workshop, including presentations by the Madrid team on how they were using visions, the ICARUS project, and the results of the Expert workshop.

Those present were then given a range of resources, including photographs, drawing materials, modelling clay and paper to enable them to think through how they would like their lives to be in 2050 in four areas (Figure 2). This was used to help get the participants to think in terms of the future, before forming groups to develop group visions of the future.

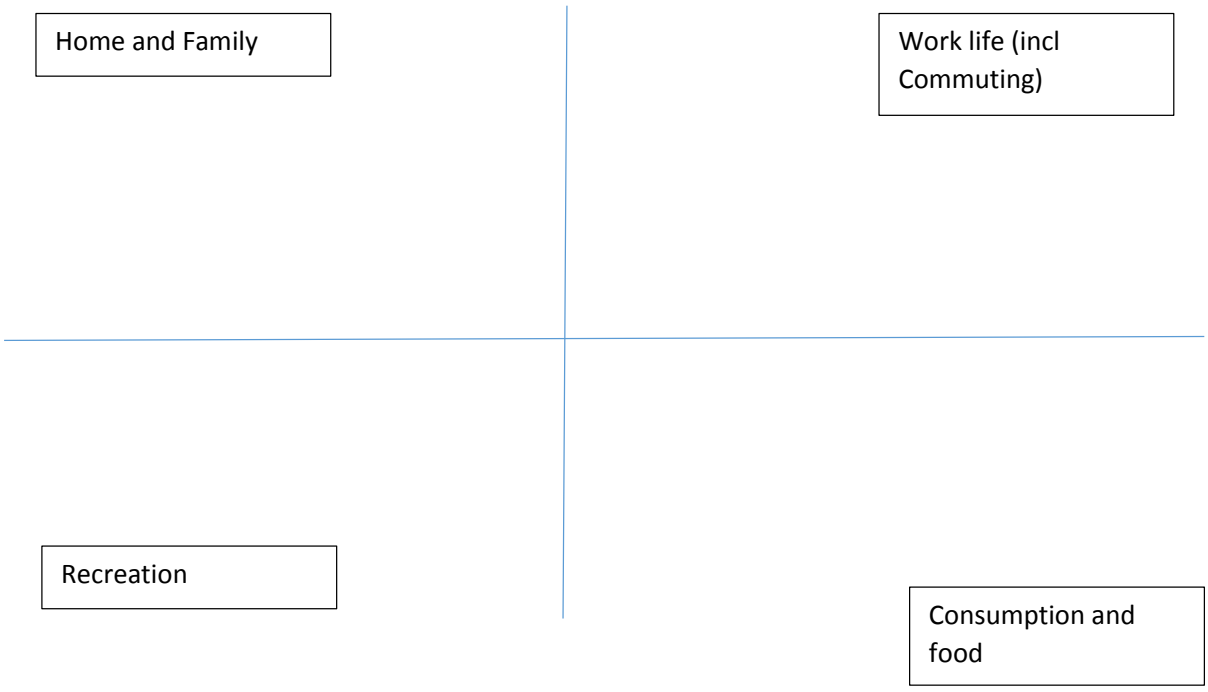


**Figure 2: Dimensions of Personal Life in 2050**

Participants self-organized into groups to develop visions of the future. Similar to the personal visions, four key dimensions were the focus of discussion (Figure 3). Initially two groups formed on the basis of similarities in visions, but then one of the groups split in half over a disagreement on certain issues.

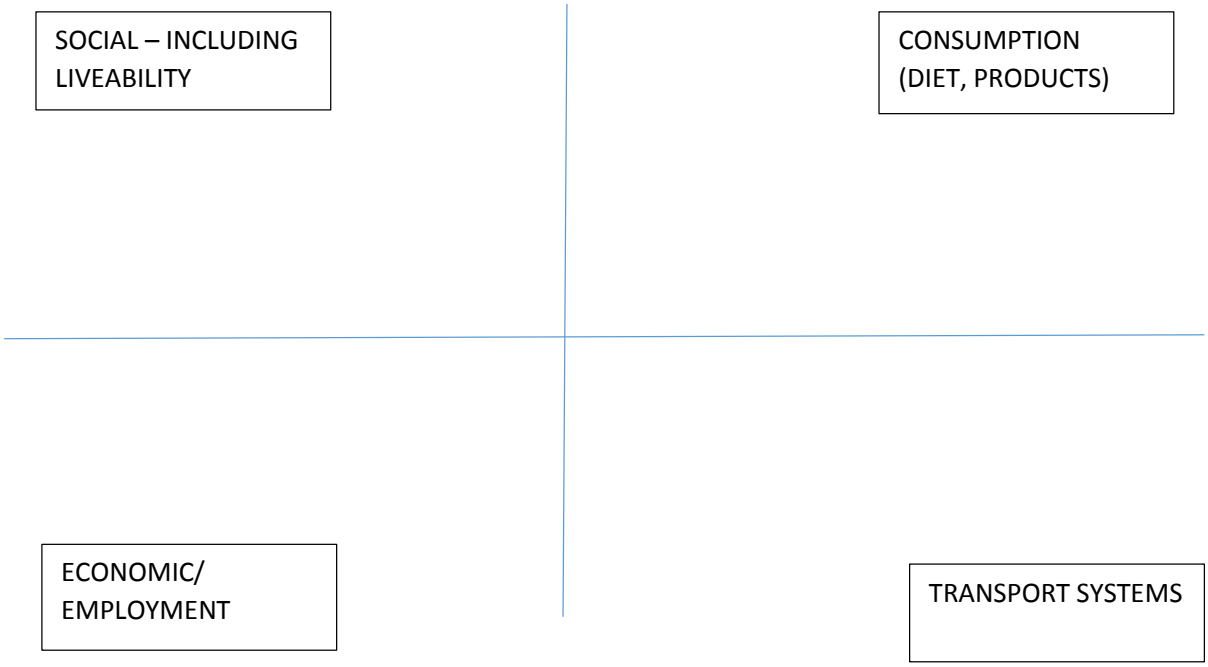


**Figure 3: Dimensions of Group Visions**

## 4.2 Personal Visions

A selection of images of personal visions developed is given below in Figure 4. The personal visions are largely used in this context to get participants to think in terms of the future – and are hence not summarized here in any detail.

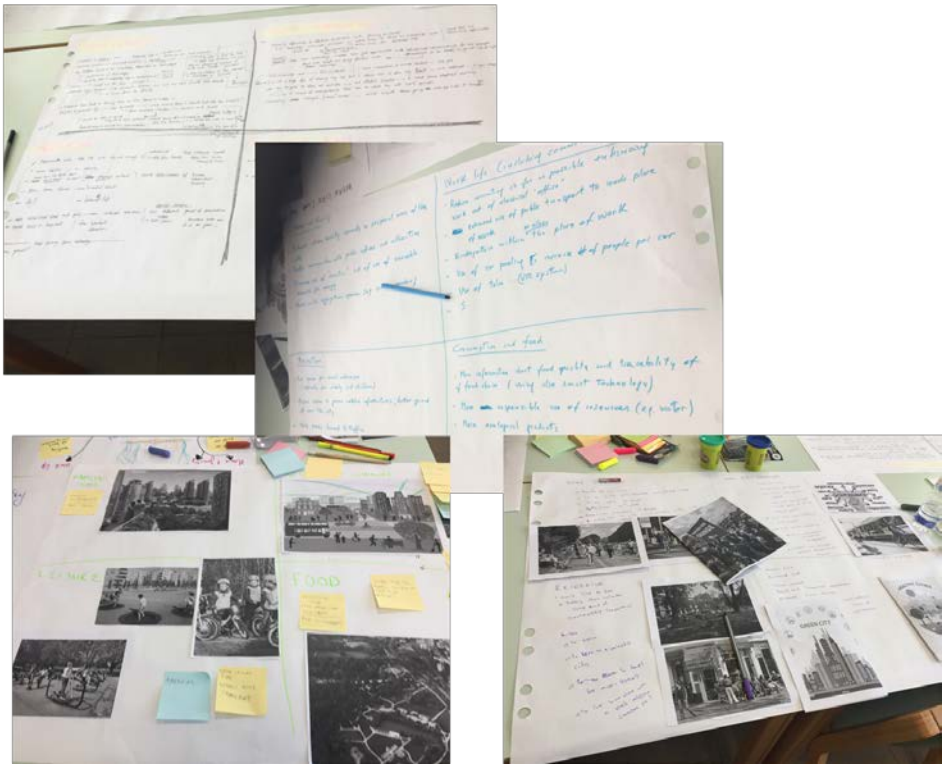

**Figure 4:Selection of personal visions for 2050**

## 4.3 Group Visions

Groups were encouraged to form on the basis of self clustering drawing on similarities in personal visions of the future. Initially two groups formed, but as discussions went on a sub-group formed out of one of the groups based on a disagreement on the best vision of the future in certain areas. This led to a total of three visions being formed – for Groups A, B and C. Group A was an offshoot of Group C. The results of discussions were captured on Flip Charts (see Appendix 2) and fed back to the workshop by rapporteurs in an Expo session. The Expo session was captured on video and transcribed. The videos will be available from the ICARUS website.

### 4.3.1 Vision from Group A

Group A focused on the sharing economy and also potential changes in the workplace:

*"We covered the category for social jointly [with Group C] and then we created our own group. We looked at economy and employment. The points we came up with were as follows. Work [in 2050 will involve] interaction with colleagues at the workplace, but with an option to work at home. So more flexibility in location and time. We have a suggestion for technology for interconnectedness and cross collaborations, so work and technology that would allow engagement that way. Also gender and equity. Employment opportunities [will arise] by linking academia with the public and private sector and thereby creating better quality entry level jobs for young people. And then we had a proposal that one day of the week you would spend on social and environmental engagement in a community and that would count towards your total employment hours.*

*In terms of transport, we didn't go into as much detail,… everything was based around a smart mobility scheme but also emphasis on the use of cycling or nonpowered vehicles through connected green spaces and not through congested areas. A focus on intermodality, ability to choose amongst different modes of transport and for people living outside of town where there is no public transport, there will be a park and ride option. The focus is on high quality public transport to carry as much of the city population as possible, leading to reduced car traffic and congestion on the streets. We are assuming that all transport will be electrified by then and in terms of smart technologies, the Internet of Things for example, there will need to be interconnectivity through the devices for parking spaces and for sharing cars, bikes etc. The goal here is less traffic in cities in general, hopefully less cars. We were also thinking size of the vehicles adjusted to purpose might be helpful and advances in ride sharing giving preferred lanes, and having lanes for buses.*

*In terms of consumption and food, the choice being seasonal and ecological foods, less processed foods, less chemicals and pesticides, but also distribution more socially just – so not only accessible to certain economic sectors. And there would be labelling and information with educational purposes on the food. So not only do you know what you are buying, but where it came from, there would be a price attached to food that is extra local, accounting for the food origin.*

*We favour less consumption and less waste. More recycling, reuse, repair. Also what emerged was that ownership is transitioning towards a sharing concept, with shared spaces, cars, foods where you order from farms and share between households."*

### 4.3.2 Vision from Group B

Group B's vision related to significant advances in smart transport systems, supported by smart home solutions to optimize the use of energy:

*"Our vision is dominated by a new transport system. The main ingredient in that are self-driving or autonomous driving cars or small buses with electric engines. The idea is that when you are at home and want to go somewhere, you type it into your smart phone where you want to go and your smart phone gives you the option basically whether a private car or a bus will come to your house. Then you step in and this car or bus will bring you to your destination. If it is a bus it will take a bit longer because the bus will also go to some other clients nearby and to some other destinations. But if it is your private car then you will go automatically there. You step out of the car and the car will drive to the next customer or to a space where it is loaded with electricity again. In the city there are no private cars or vehicles allowed, only bicycles are private. All of the cars are not private. Then this is for the city.*

*It might be that we have to keep the railroad or metro that is there, because otherwise we might still get traffic jams if only using cars. However, to avoid traffic jams, the price is depending on the time and the destination. At certain times, it might be that it is expensive so that some people decide to wait an hour and have reduced prices so that we can avoid traffic jams. Of course, all cars are interconnected, so you can optimise where these cars drive and so that no traffic jams occur.*

*Then when you want to go somewhere outside of the city there are options. One option is your private car brings you to the main station and you step into a train, on which you travel to the next city. There a car is waiting for you to show you around. The other option, especially if you do not want to go to a city but want to go to the Black Forest or something, then you go to a big space at the border of the city where you change your city car into a car which has a longer capacity which you can drive wherever you want, and only when you come back to the city do you change to a car which can operate in the city again. There will also be maybe different kinds of cars so if you want to have a bit more of a luxury car, you will of course have to pay more but then you would get maybe a car which is a bit more luxury. That is the main idea of our transport system.*

*Basically, what is not so prominent there is the public transport. But then cycling is allowed. However, you have your private bicycle, and you can ride this around. Now to somehow plan or rule this system you have two kinds of areas – mixed zones where you have autonomous cars, bicycles, as well as pedestrians. In these you have to be careful about this so cars aren't allowed to run fast. As well you have separated areas, for through traffic. In these you have lanes for bicycles and lanes for autonomous vehicles. But these are now separated and so the speed can be much higher and more optimised.*

*With the heating system, we will have smart housing. So to optimise not only the amount of heating but also when we need to operate the heating, because the heating will be mostly powered by electricity. Solar electricity is not always there, if the sun is not shining, so there will be additional demand side measures – also for when you operate your washing machine. The main techniques for this will be heat pumps or air conditioner converters, which have the great advantage that you can not only heat the house but you can cool with this device if it is really hot. There will be much better insulation of the houses than we have now, which means you need some mechanical ventilation system because you have to have a large air exchange to help with your health issues, to make the indoor air*

*pollution not too high. And this device has a heat recovery so you save on air pollution and greenhouse gas emissions.*

*Other things include social things, where it was mentioned that we need enough spaces in and outdoor where people can meet just to encourage the people that they don't only look into mobile phones and communicate via WhatsApp or whatever but also have opportunity to meet in person, especially as more and more things will go online. There will be a number of people who work at home. Or in terms of shopping, there will be a number of people who shop online at home and so you will have less and less opportunities to meet with other people. And you need space to do something to give opportunities to meet. This might not just be physical spaces, but also by providing more cultural events where people come together and have common experiences (like a concert or something).*

*With economy and employment, more and more hard work will be made by robots. This may not mean that employment will be reduced or that you have more unemployed but it might mean that those that had unskilled work will need to find something else – e.g. promoting social activities or care of the elderly. To pay for this you will need to increase taxes. And taxes would not necessarily be on income, but on robots. So if a robot produces something, 10 percent of the production value would go as taxes to the government.*

*For consumption and diet, especially healthier food, a shorter food chain is important for quality. But the most important change might be less meat production, because meat production is not so environmentally friendly. The question is whether this will be compensated by more artificial food or not. We don't know. The opinion here was that it was not so bad to use GM food if it is done properly, as this would reduce the use of pesticides.*

*Last and not least, the more efficient use of energy will be supported by the point that all consumer products will be smart products, that will be interlinked via the internet and systems will optimise the use of these consumer products."*

### 4.3.3 Vision from Group C

The vision for Group C highlighted changes needed in education for improving human capital and potential improvements in food standards and quality:

*"We started with social, we were talking about multicultural society in 30 to 40 years time. This multicultural society will be different from what it is today. For instance, multiculturality will be a common ethical framework. It's not that each one can do what he wants. This will need education. Education will lead to a new paradigm around human capital. This will lead to an equitability of society.*

*For employment and economy, we discussed about the projections of the population in European countries where more and more people will be there, making it difficult to maintain the rest of society. We need kids, we need to import kids or have kids to have the population to support. Maybe the only way will be to not retire at 65 but to retire at maybe 75 years old. And technology will need to support this possibility.*

*We suppose that these people, will have high skilled education.*

*We discussed the work model. For these people of this age, to work at home to move from home to work is not easy. To work at home you need to be skilled. So there needs to be a paradigm change in education.*

*For transport, autonomous vehicles, green space for communities, bicycles, change of engines.*

*Finally, consumption of food. We will have better standards for food and quality, because technology will allow us to control better. Not only to cook, but control preparations. Food may not be natural, to grow independently to have places to grow their own products. We are going to achieve some balance between artificial food and natural. "*

# 5 Refining the visions and linking to other scenario frameworks

## 5.1 The ICARUS Visions

Drawing together the visions and other materials, it is possible to identify three distinct visions of future cities that would be broadly sustainable, smart and healthy. Different attributes of these can be seen in Table 2.

The resulting visions need names that convey what they contain:

- Smart Tech City – has more emphasis on technology as a solution to environmental and health issues, with individualistic values being important.
- Sharing Smart Communities – takes the community at the centre and considers interconnection to be an important driver for improved societies;
- Connected Cobweb City – considers a more dispersed, individualistic society, with more of a balance between technology and socially contingent solutions to the challenges facing our cities.

If we consider these visions and comparing these to other frameworks for futures analysis, it is clearly important to think of the work of the Intergovernmental Panel on Climate Change. The IPCC has developed the SSPs – Shared Socioeconomic Pathways – narrative scenarios with additional quantitative scenarios which underpin the analysis of emissions under the Representative Concentration Pathways.

The SSPs are described in brief in Table 3. The consistency between the ICARUS visions and the SSPs is difficult to state categorically, but broadly:

- Smart Tech City – would be more comparable with SSP3 and SSP5 – as the reliance on technology and underpinning assumptions on urbanization are broadly similar;
- Sharing Smart Communities – is broadly comparable with SSP1, with increased awareness of environmental issues and increasing localization;
- Connected Cobweb Cities – is broadly comparable with SSP2, being a middle of the road alternative between the most sustainable future and increasing reliance on technology

**Table 2: Overview of visions for smart, green and healthy cities**

| | **Smart Tech City** | **Sharing Smart Communities** | **Connected Cobweb City** |
|---|---|---|---|
| Economy/Employment | Increased use of robots reduces demand for low skilled workers, leading to need for increase skills and/or reductions in employment. | Technology facilitates interconnection between home and office space, reducing need for commuting.<br><br>Higher skilled employment becomes the norm.<br><br>Improved equity. | More flexible employment, with home working.<br><br>Increased employment in health care in particular. |
| Transport | Autonomous vehicle fleet in cities, with public transport hubs in between.<br><br>In rural areas, different vehicles may be needed with longer distances to travel.<br><br>Space for cycling in cities. | Public transport, powered by electricity, is the dominant form of transport.<br><br>Use of green space as commuter space for bicycles.<br><br>A focus on intermodality – facilitated by smart phones will help aid fast transport. | Autonomous vehicles, with high speed connectivity between urban centres.<br><br>Increased use of virtual reality for entertainment reduces demand for leisure travel. |
| Energy Systems | Renewable energies supplemented by smart technology to increase energy efficiency.<br><br>Use of heat pumps/coolers. | Renewable energies and use of smart tech to enable reuse and recycling to reduce energy demand. | Increased use of wind and solar power.<br><br>Better insulation of buildings. |

| | **Smart Tech City** | **Sharing Smart Communities** | **Connected Cobweb City** |
|---|---|---|---|
| Society | Individualistic society, with economic incentives encouraging behavior change.<br><br>Social spaces to encourage physical interactions, including cultural activities and green space.<br><br>Risk of isolation from use of technology. | Increased sharing of ownership – shared spaces, cars, to reduce footprint of society. | Multicultural society built on shared ethos of respect and community.<br><br>Increased immigration to support population growth. |
| Consumption | Reduction of meat consumption and increased use of artificial meat substitutes.<br><br>Increased use of 3D printing to reduce on need for transporting goods and services.<br><br>Use of drones for transporting goods and services. | Locally grown food dominates.<br><br>Farms in buildings in town centres to reduce on transportation need. | Food quality improves through increased use of smart tech in traceability of food.<br><br>Balance between artificial and natural foods – to ensure healthier diets. |
| Urban form | Urban centres continue to be important, with current patterns remaining.<br><br>Need for buildings and spaces to facilitate drone deliveries. | Reduction in need for commuting leads to more dispersed communities. | Ribbon development along main highways, with dispersed urban centres. |

**Table 3:** Summary of SSP narratives.

| SSP | Description |
|---|---|
| SSP1 | Sustainability – Taking the Green Road (Low challenges to mitigation and adaptation)<br>*The world shifts gradually, but pervasively, toward a more sustainable path, emphasizing more inclusive development that respects perceived environmental boundaries. Management of the global commons slowly improves, educational and health investments accelerate the demographic transition, and the emphasis on economic growth shifts toward a broader emphasis on human well-being. Driven by an increasing commitment to achieving development goals, inequality is reduced both across and within countries. Consumption is oriented toward low material growth and lower resource and energy intensity.* |
| SSP2 | Middle of the Road (Medium challenges to mitigation and adaptation)<br>*The world follows a path in which social, economic, and technological trends do not shift markedly from historical patterns. Development and income growth proceeds unevenly, with some countries making relatively good progress while others fall short of expectations. Global and national institutions work toward but make slow progress in achieving sustainable development goals. Environmental systems experience degradation, although there are some improvements and overall the intensity of resource and energy use declines. Global population growth is moderate and levels off in the second half of the century. Income inequality persists or improves only slowly and challenges to reducing vulnerability to societal and environmental changes remain.* |
| SSP3 | Regional Rivalry – A Rocky Road (High challenges to mitigation and adaptation)<br>*A resurgent nationalism, concerns about competitiveness and security, and regional conflicts push countries to increasingly focus on domestic or, at most, regional issues. Policies shift over time to become increasingly oriented toward national and regional security issues. Countries focus on achieving energy and food security goals within their own regions at the expense of broader-based development. Investments in education and technological development decline. Economic development is slow, consumption is material-intensive, and inequalities persist or worsen over time. Population growth is low in industrialized and high in developing countries. A low international priority for addressing environmental concerns leads to strong environmental degradation in some regions.* |
| SSP4 | Inequality – A Road Divided (Low challenges to mitigation, high challenges to adaptation)<br>*Highly unequal investments in human capital, combined with increasing disparities in economic opportunity and political power, lead to increasing inequalities and stratification both across and within countries. Over time, a gap widens between an internationally-connected society that contributes to knowledge- and capital-intensive sectors of the global economy, and a fragmented collection of lower-income, poorly educated societies that work in a labor intensive, low-tech economy. Social cohesion degrades and conflict and unrest become increasingly common. Technology development is high in the high-tech economy and sectors. The globally connected energy sector diversifies, with investments in both carbon-intensive fuels like coal and unconventional oil, but also low-carbon energy sources. Environmental policies focus on local issues around middle and high income areas.* |
| SSP5 | Fossil-fueled Development – Taking the Highway (High challenges to mitigation, low challenges to adaptation)<br>*This world places increasing faith in competitive markets, innovation and participatory societies to produce rapid technological progress and development of human capital as the path to sustainable development. Global markets are increasingly integrated. There are also strong investments in health, education, and institutions to enhance human and social capital. At the same time, the push for economic and social development is coupled with the exploitation of* |

| | |
|---|---|
| | *abundant fossil fuel resources and the adoption of resource and energy intensive lifestyles around the world. All these factors lead to rapid growth of the global economy, while global population peaks and declines in the 21st century. Local environmental problems like air pollution are successfully managed. There is faith in the ability to effectively manage social and ecological systems, including by geo-engineering if necessary.* |

Source: Raihi et al (2017)

## 5.2 Narratives from representative citizens

In the ongoing INHERIT project, the use of stories from representative citizens living under different visions has proved useful in communicating these visions to the public and stakeholders. Here we attempt to develop similar narratives for three different people.

Simon – Smart Tech City

*"Life has certainly got easier over the past 30 years. Robots have taken a lot of jobs, but taxes on businesses now provide for what we need and we have a lot of freedom and free time. I love using the transport system now, I don't need to find a parking space and a car drives up to my door and lets me drive wherever I want in the city. These autonomous vehicles are great, you just type into your phone where you want to go and either a bus or a car comes to your door in minutes.*

*When I don't need to rush, I can cycle on dedicated cycle paths and get some fresh air. Air pollution has reduced a lot, thanks to the electrification of cars and increased use of smart systems. Smart technology has opened a lot of doors, I love experimenting with different synthetic meats in my food and the rise of 3D printing means we no longer need to have big lorries moving furniture across Europe – we can programme in the design and it comes out on a printer in our neighbourhood. Everything is really convenient. Drones have also reduced the number of vehicles driving in the city, and they drop off our shopping quickly.*

*There were fears that technology would limit our social interaction, but I find that I have more time for socializing now and that communicating through my smart phone helps me to set up more face to face meetings than ever."*

Cynthia – Sharing Social Communities

*"I love the freedom I have to work from home, yet stay in touch with my office when I need to talk to people. The technology has advanced so much, it's almost like I am in the office when I'm speaking to someone. I use the bus when I need to get into the centre of town, and that's always clean and frequent so it doesn't really bother me. I like to meet with my neighbours while I'm travelling and have a good discussion on what's going on. And I can always use my smart phone to figure out the fastest route anywhere if I need to get somewhere quickly – there are shared bikes and cars when I need them.*

*I love my local food supplier, and it's so great to actually see where your food comes from. Having a farm in my building is great too, as I can get the freshest eggs and know that all the waste is being put to good use keeping us warm in the winter!*

*I live in a small village on the outskirts of a big city, most people do nowadays as we don't need to go into work so much. It's great as you can get to know your community well."*

Max – Connected Cobweb Cities

*"I work as a nurse, providing care to people in my community. Life is a lot easier than it was when I started as more and more money is being put into community nursing, so I can spend time with the people I'm caring for. They say it's because robots have increased efficiency, well I'm all for that. I'm able to move between appointments in autonomous vehicles – that saves so much time and effort.*

*I'm able to keep fit using my Virtual Reality gear in my house – it's great as I can imagine I'm cycling the Tour de France while being in my living room. Of course I have to cheat and slow the opposition down a bit!*

*I keep healthy by eating a balanced diet, with my smart fridge providing me meal suggestions that are really tasty and nutritious too. I love that I am able to know where my tomato has come from, just at the press of a button on my phone.*

*Cities are almost a thing of the past, as we're increasingly able to live along highways without any pollution. It's great, as we are so close to the countryside yet life is so convenient too."*

# 6 Next steps

The 3 ICARUS visions will be presented in workshops and used as the basis for framing the analysis of future strategies and policies to be analysed. They will need to be refined at local level for acceptability, and after refinement resources could be developed to present these in graphical or video formats.

# 7 References

EEA (2016) Towards clean and smart mobility: Transport and Environment in Europe. European Environment Agency, Copenhagen.

Government Office for Science (2014) *The Internet of Things: making the most of the Second Digital Revolution.* Government Office for Science, London. Available online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/409774/14-1230-internet-of-things-review.pdf.

Government Office for Science (2016) *Future of Cities: The Science of Cities and Future Research Priorities.* Government Office for Science, London. Available online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/516407/gs-16-6-future-cities-science-of-cities.pdf.

Government Office for Science (2016b) *Future of Cities: Foresight for Cities. A resource for policy makers.* Government Office for Science, London.

Government Office for Science (2016c) *Future of an Ageing Population*. Government Office for Science, London.

Government Office for Science (2017) *Technology and Innovation Futures 2017.* Government Office for Science, London. Available online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/584219/technology-innovation-futures-2017.pdf.

ICLEI (2018) *The ICLEI Montréal Commitment and Strategic Vision 2018 - 2024.* Bonn, Germany.

McKinsey and Company (2018) Smart Cities: Digital solutions for a more livable future. Available online at https://www.mckinsey.com/~/media/mckinsey/industries/capital%20projects%20and%20infrastructure/our%20insights/smart%20cities%20digital%20solutions%20for%20a%20more%20livable%20future/mgi-smart-cities-full-report.ashx.

Raihi, K, van Vuuren, D et al (2017) The Shared Socioeconomic Pathways and their energy, land use, and greenhouse gas implications: An overview. Global Environmental Change, Vol 42, pp153-168.

# 8 Appendix 1: Workshop Agenda

ICARUS

## Smart, Green and Healthy Cities Workshop Expert and Stakeholder Workshop: Task 6.1 and 6.2 ICARUS

## 20th – 21st September 2018

## National School of Public Health, Carlos III Health Institute, Madrid Av. Monforte de Lemos, 5, Pab. 7, Room 9-10. 28029 Madrid (Spain)

Objective of the workshops are to outline visions of future cities that are smart, green and healthy, and concomitantly increase the capacity of cities to curb climate changes and air pollution, and social wellbeing, equality and livability.

The flow of the workshops runs in two stages. The first stage focus on collecting and teasing out of mechanisms and dynamics of current challenges in joint activities among experts. Experts represent detailed knowledge, insights and experience within the areas of urban development, air quality (emissions, distribution, impacts on health), climate change (mitigation and adaptation), energy, transport, social (social inclusion and cohesion), health challenges (low birth weight, lungs, allergic, cancer, a.o.), climate and air quality related business innovation, and culture. Trends will be discussed and specified in a short and medium term perspective (time horizon 2050), and recognizing a local/urban to global scale. Other aspects of urban development – housing, social policy, recreation, etc. will be included to the extent they are relevant for dynamics within the mentioned sectors.

The second stage focusses on bringing these trends and challenges into visions developed among urban stakeholders. The stakeholders represent the major sectors that are involved in visions with a focus on cities that are smart, green and healthy. Participants will in vision processes start with individual and everyday life visions and bring this mindset into collective processes of creating visual and textual images of smart, green and healthy cities in 2050. This also involves the transition process, i.e. the role of governing institutions, experts, participatory processes, citizens in decision making and implementation of the visions. These joint processes will be documented and each vision group will produce a product that represent the vision.

After the workshops, the ICARUS WP6 team (specifically Task 6.1 and Task6.2) will analyze the output of stage 2 and formulate narrative visions based on this. These joint vision narratives will be discussed

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690105

in each of the ICARUS cities and be integrated in the formulation of city specific visions of smart, green and healthy futures.

# Programme

**Expert workshop: Trends and challenges for Smart, Green and Healthy Cities 2050**

**Thursday 20th Sep. 11.00 – 17.00**

| | |
|---|---|
| 11.00-11.15 | Registration and coffee |
| 11.15-11.35 | **Introduction** to the workshop. Introduction of participants. Short overview of ICARUS |
| 11.35 – 12.30 | **Input to discussion of future trends: Smart, Green and Healthy cities in 2050**<br>Denis Sarigiannis: European cities – current challenges and trends<br>Tim Taylor: Researching uncertain and dynamic futures<br>Tasia Gkika: 1 min introduction to the nine ICARUS cities<br>Overview of afternoon |
| 12.30 – 13.30 | **Lunch** |
| 13.30 – 14.30 | **The smart city in 2050: Digital technology, expert knowledge and citizen science**<br>- The role of digital technology in connecting cities regionally and globally<br>- Digital technology and energy, adaptation and transport sectors<br>- Digital technology and health and wellbeing of urban citizens, including vulnerable groups<br>- Risks associated with digital technology<br>Group discussion – each group discusses all questions and collect main points on posters ICARUS moderator to step in if needed 2-4 in each group, mixed professional background |

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690105

Presentation of main points for all

14.30 – 15.30 **The green city in 2050: Sustainable and green cities – connected sectors in low-carbon and healthy futures**

- Emerging and future technologies and how relate to carbon and health agendas ,
- The role of mobility systems in cities in 2050, and trends in current transport systems and elements in fossil and pollution 'free' transport system
- Trends and elements in low-carbon heating and production systems
- What are the trends in urban nature and its inclusion in urban development

Group discussion – each group discusses all questions and collect main points on posters ICARUS moderator to step in if needed 2-4 in each group, mixed professional background

Presentation of main points for all

15.30-16.30 **The healthy city in 2050: Wellbeing, health and equity in cities**

Group discussion – 2-4 in each group, mixed back ground

- What are the major trends in urban health for different population groups
- The role of emerging technologies in urban health and wellbeing
- Direct and indirect links in the city between health and social issues, and energy, transport, adaptation

Group discussion – each group discusses all questions and collect main points on posters ICARUS moderator to step in if needed 2-4 in each group, mixed professional background

Presentation of main points for all

16.30 – 17.00 **Summing up the day**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690105

**Stakeholder workshop: Visio of Smart, Green and Healthy Cities**

**Friday 21st Sep. 9.00-15.00**

Coffee, water, cookies, fruit accessible all day

9.00 – 9.15 **Coffee and regristartion**

9.15 – 9.30 **Introduction** to the workshop. Introduction of participants.

- The vision workshop concept, Chattenham rules
- Icarus use of the visions, participants output

9.30 – 9.45 **The role of visions in urban development**.

9.45 – 10.15 **Framing the vision**: Visions integrate across all urban areas and sectors (holistic). Input from experts.

The Madrid case study (Julio Soria -10 min)

10.15 – 10.30 **Coffee break**

10.30 – 10.45 **Forming vision groups**:

- Recap of vision Chattenham rules
- Core element in future city/major challenge to address
- Colour coded groups

10.45 – 11.15 **Individual visions**. Volante method

11.15 – 12.45 **Developing the city visions**: The city in 2050 within key sectors crucial for smart, green and healthy urban life

- Joint work
- Explorative
- Use different media

12.45 – 13.15 **Lunch**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690105

13.15 – 14.30 **Developing the city vision, cont.: The smart, Green and Healthy city in 2050 takes shape**

- Reworking of city visions – core idea, main elements, etc.
- Communication the vision – representation of visions in a product – model, poster, images, use the creative imagination

14.30 – 14.45 **Grand expo**

- Presentation of visions for all. Questions, ground breaking points, challenging points
- Recorded on video

14.45 – 15.00 **Goodbye and summing up next steps in vision process in ICARUS**

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 690105

# 9 Appendix 2: Group Visions

The following pages contain images of flip charts generated by the groups and used as the basis for presentation in the Expo session.

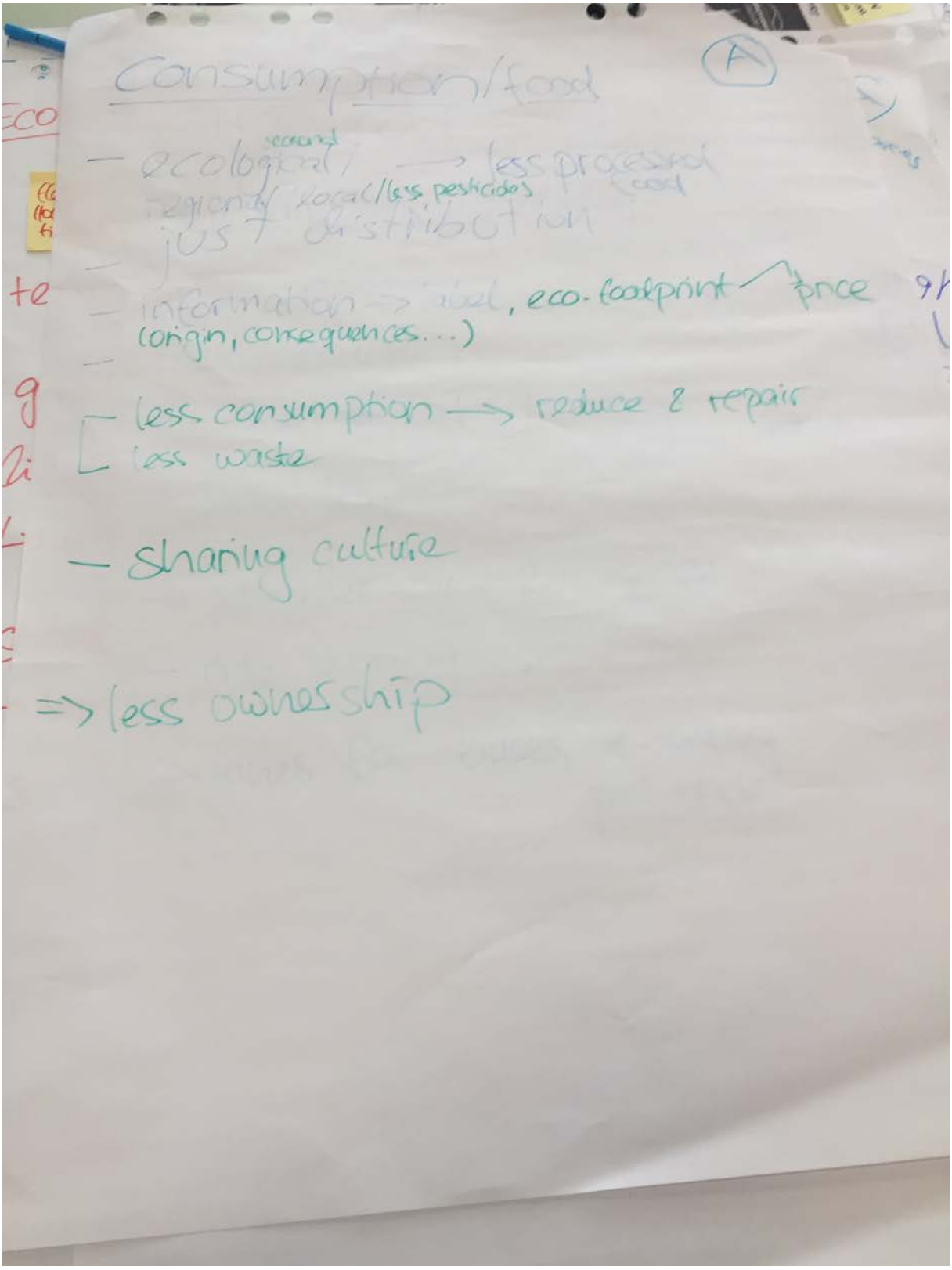


**Figure 5:Group A vision on Consumption and Food**

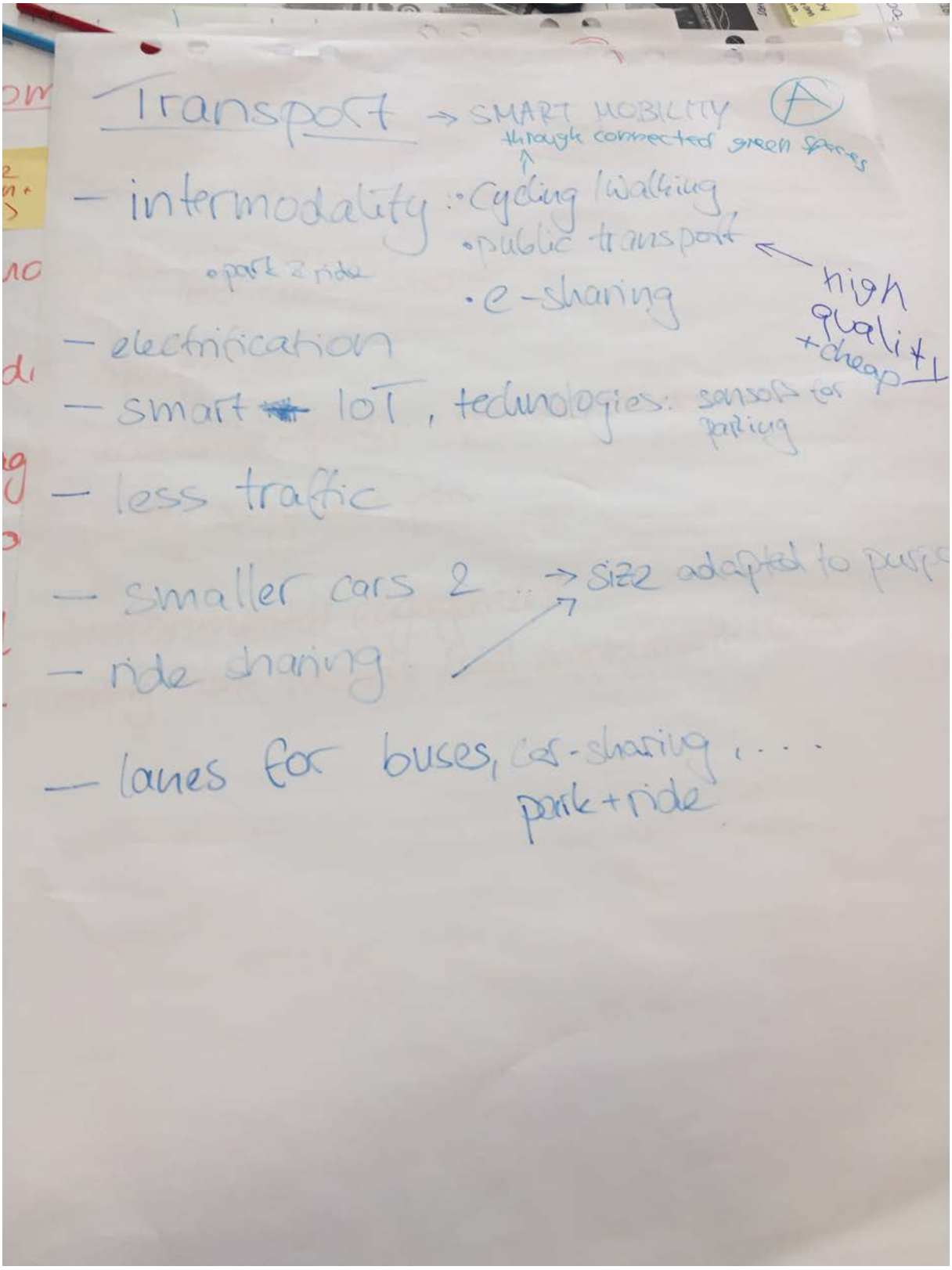


**Figure 6:Group A vision on Transport**

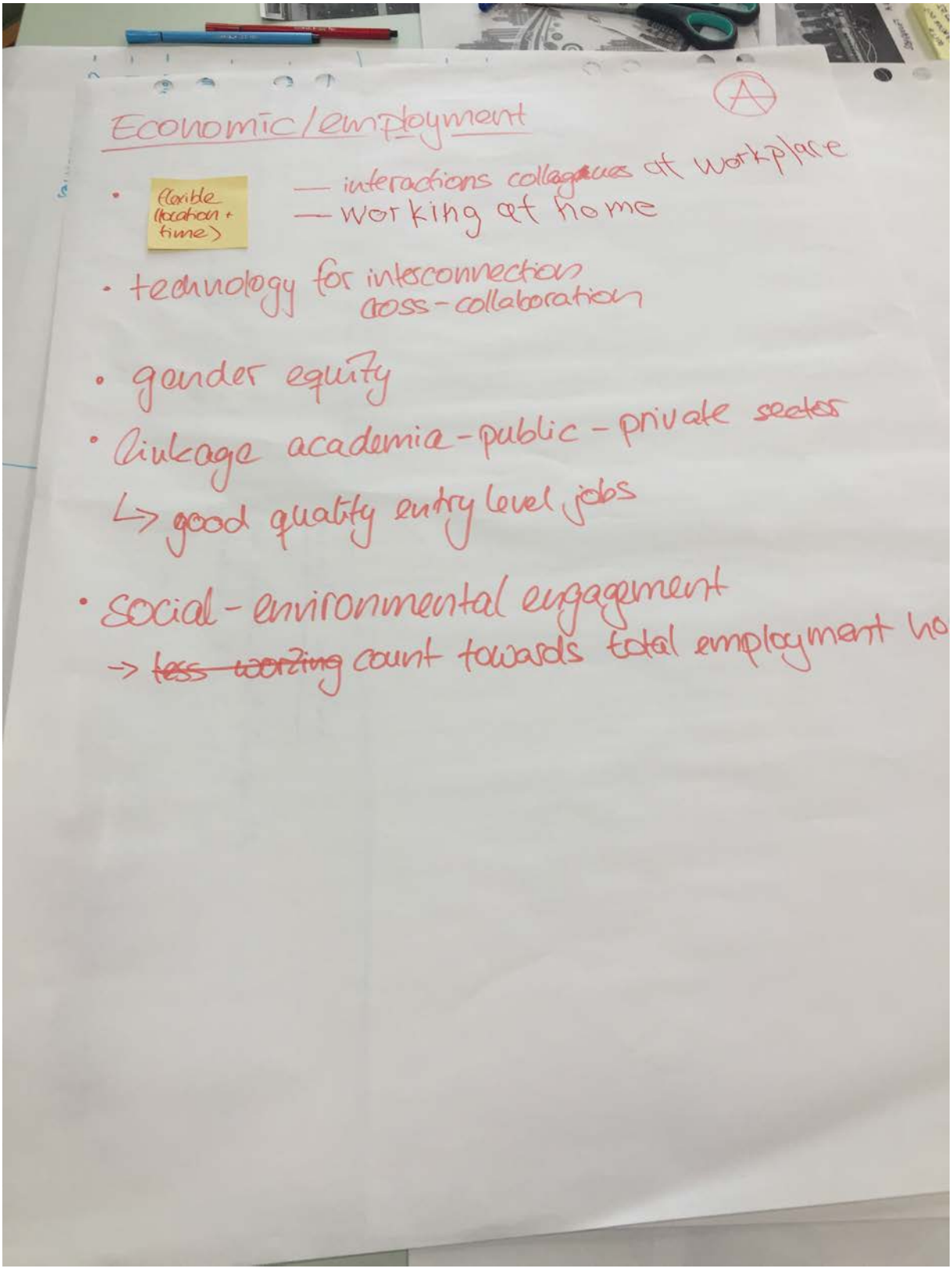


**Figure 7: Group A Vision on Economy and Employment**

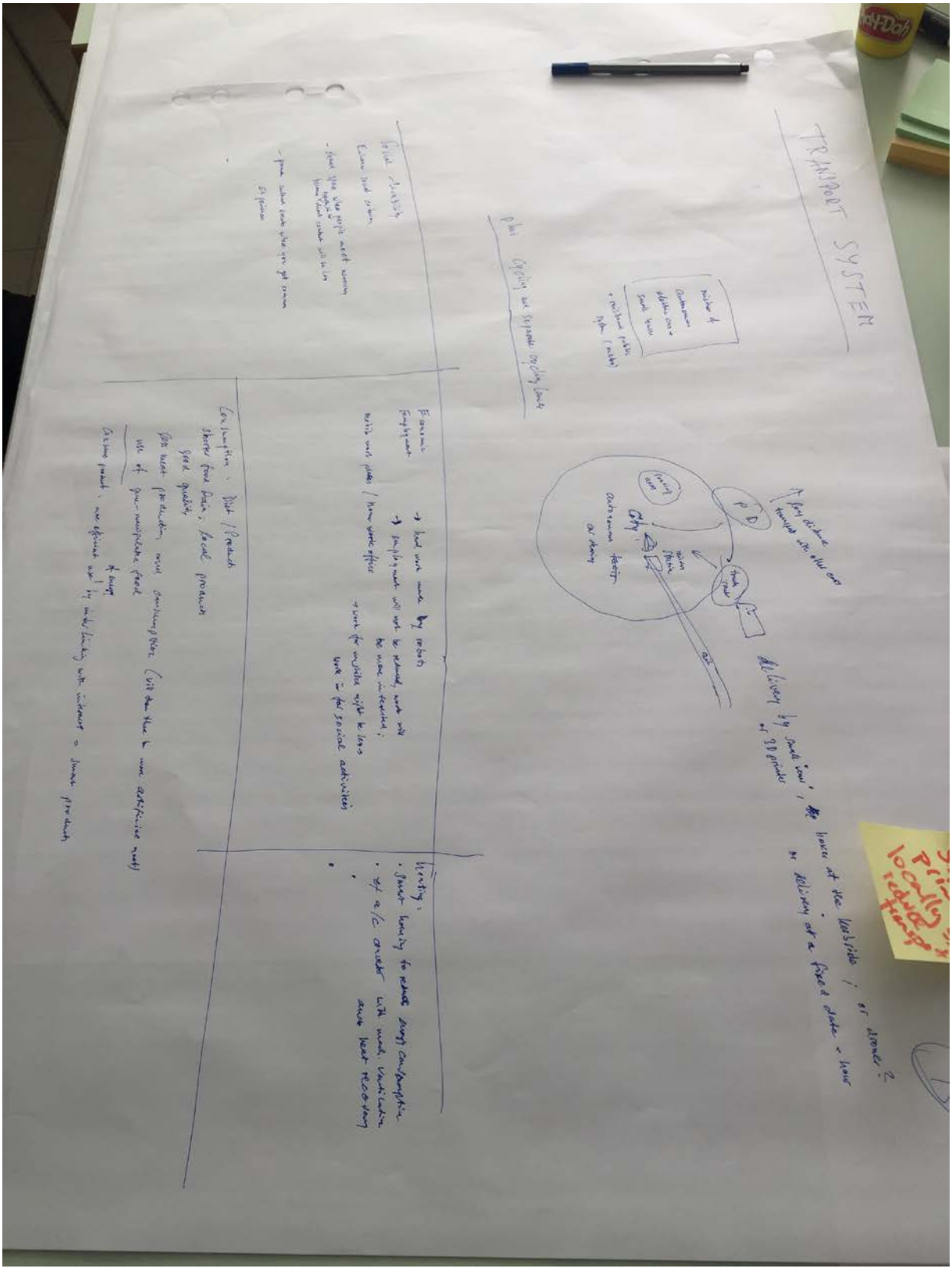


**Figure 8: Group B Vision**

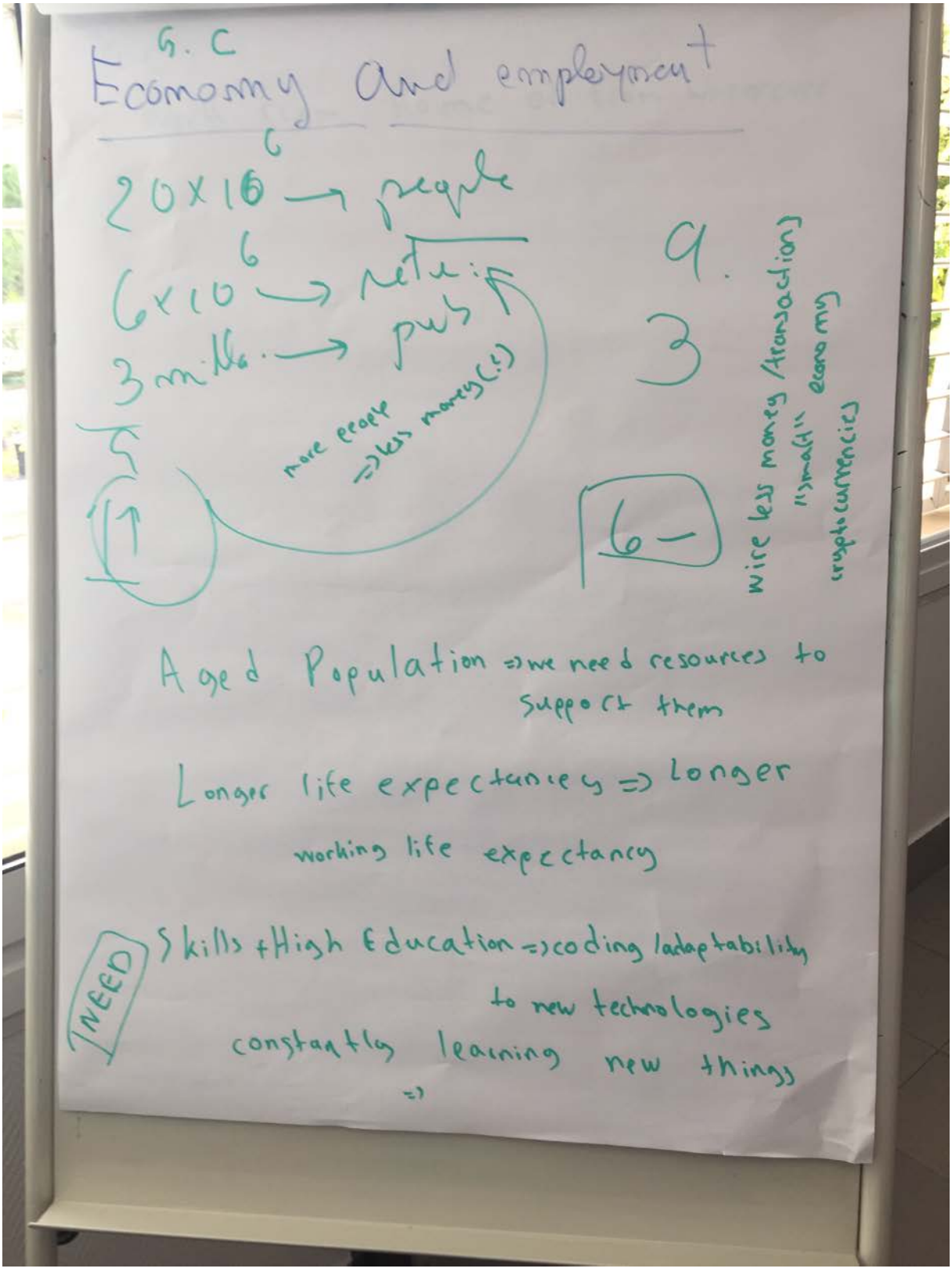


**Figure 9: Group C Vision on Economy and Employment**

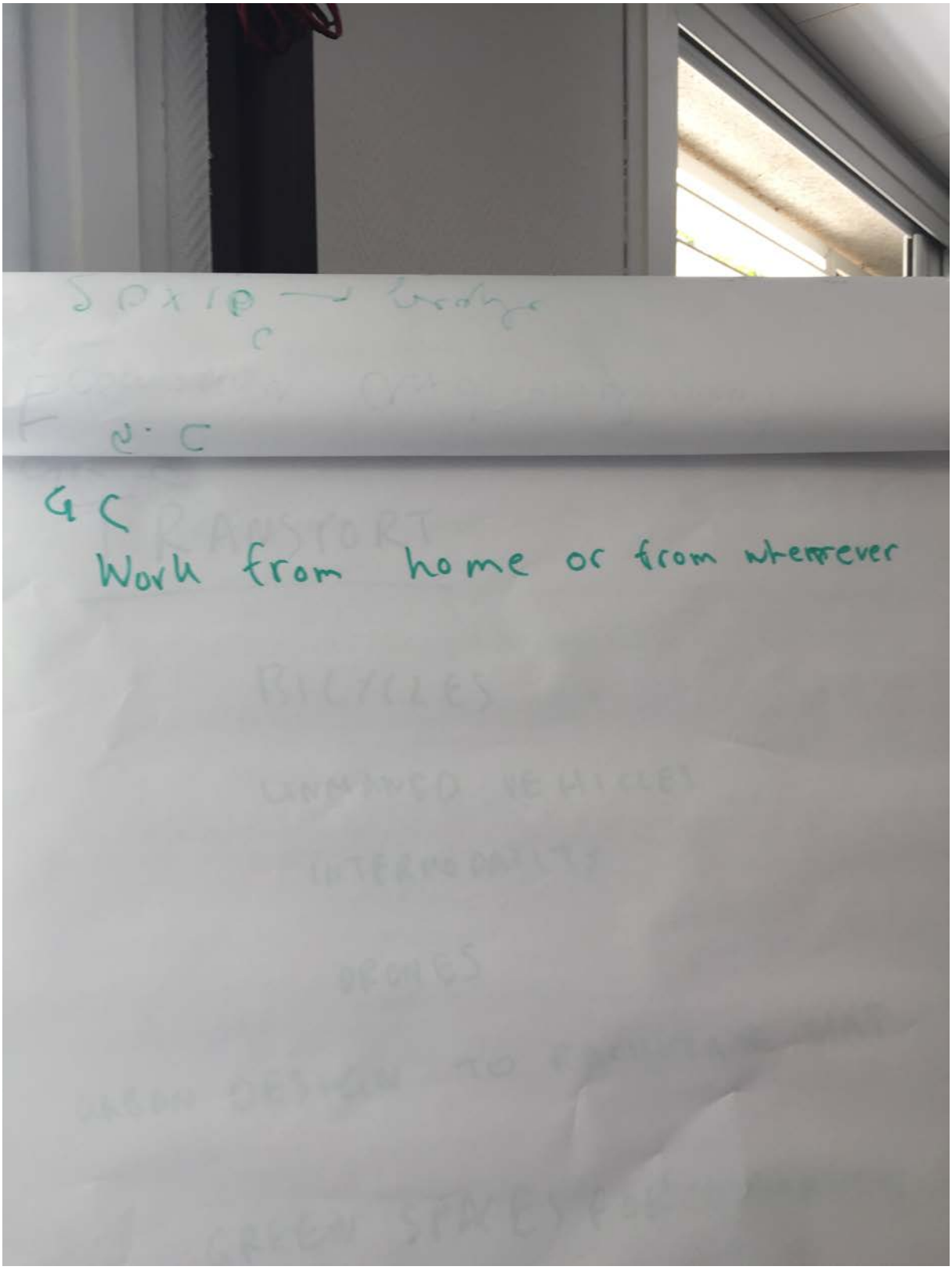


**Figure 10: Group C vision on Economy and Employment continued**

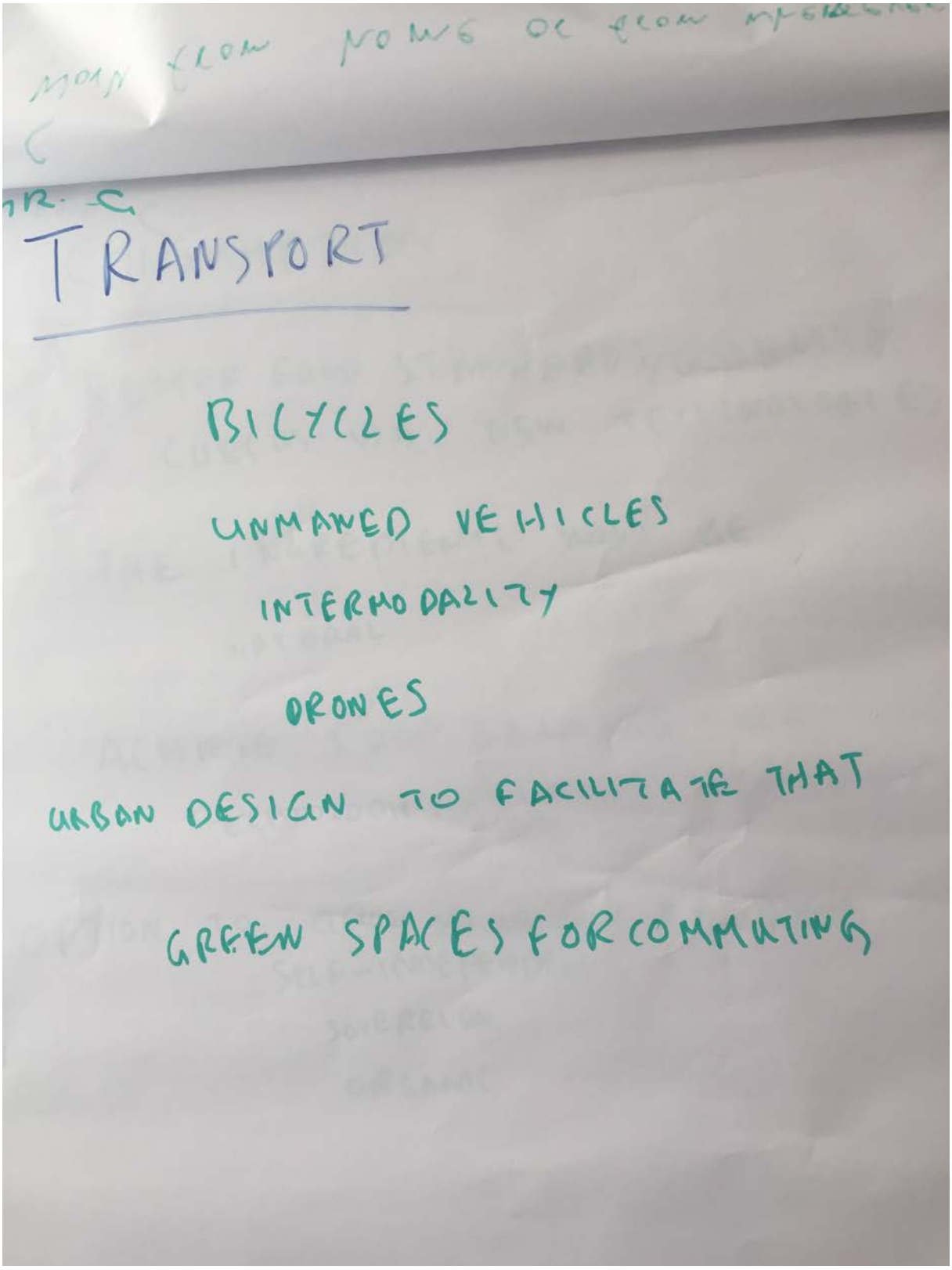


**Figure 11: Group C Vision on Transport**

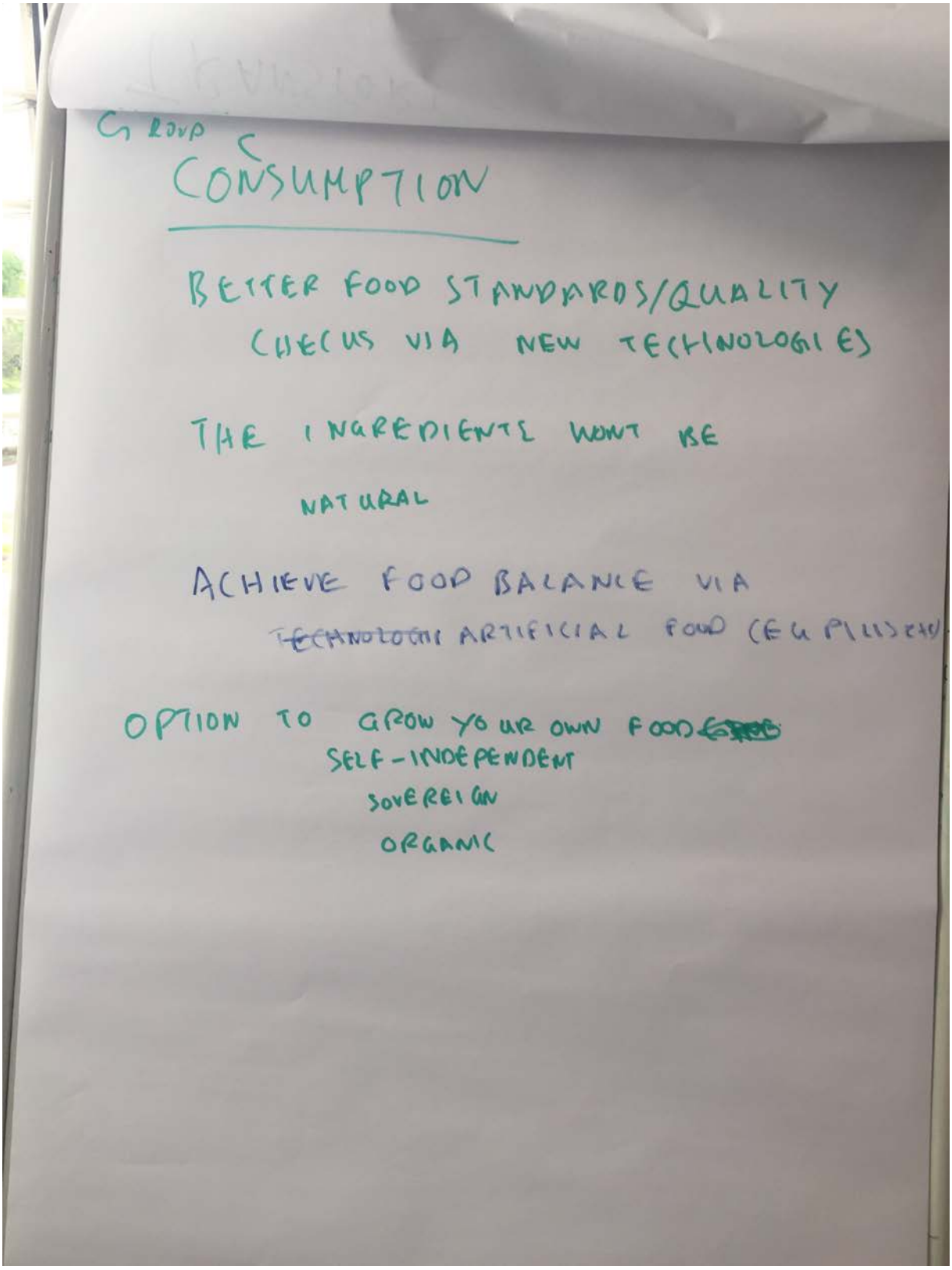


**Figure 12: Group C Vision on Consumption**