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# Health Scenarios stories

### Report Information

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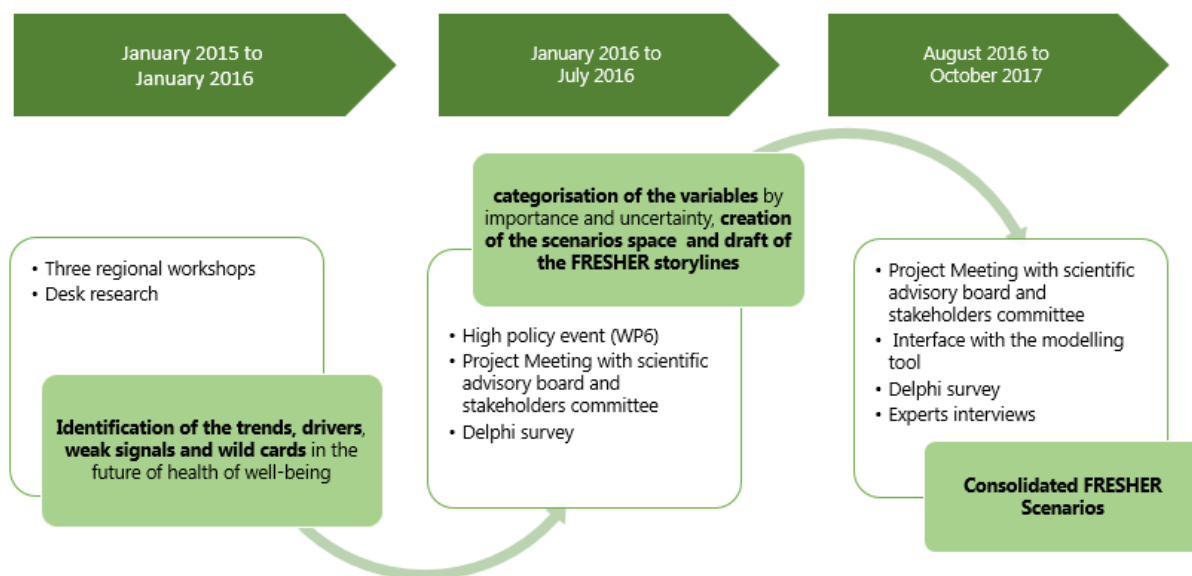
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## Executive summary

**FRESHER Scenarios** will offer a medium – long-term vision aimed at policy-makers for planning future policy actions, delineating policy alternatives and new policy combinations.

Building FRESHER Scenarios is a systematic and creative process. In the first step of “Horizon Scanning”, the project team has identified the short, medium and long-term trends and drivers related to NCDs. To complement the literature review on well-researched risk factors, three regional workshops (Vienna, Brussels, and Lisbon) have been organized to elicit stakeholder’s observations about possible changes, wider correlations and potential indications of new emerging issues. The results of these consultations are included in the FRESHER report 3.1 “Horizon Scanning” available at the FRESHER web-site<sup>1</sup>.

The second step, reported in this document, aims at ranking the resulting list of trends based on their importance and uncertainty in order to devise the most appropriate Scenarios space. Trends considered to be of “high importance/ low-uncertainty” are included in the Scenarios as key drivers to shape current strategies and plans whereas “high importance/ high uncertainty” trends are viewed as “critical uncertainties” and potential game changers. The results of the Survey and a Scenarios space will be further discussed in the following project steps within the consortium and external stakeholders in order to craft plausible and desirable Storylines.

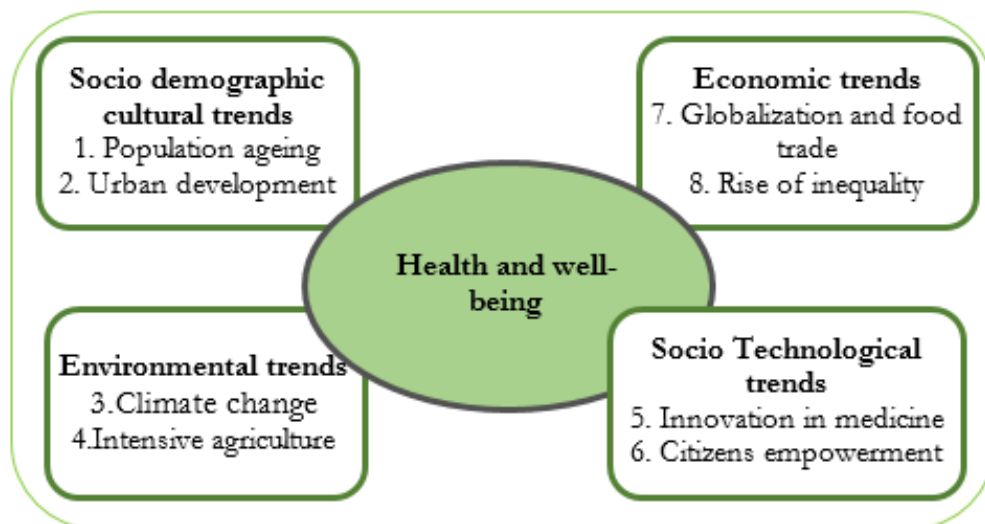


**Figure 1: FRESHER Scenarios Building Process**

The Scenarios will be finally refined and consolidated in interaction with the modelling work and microsimulation model developed by partners at AMU and OECD. The FRESHER project will thus complement its foresight driven approach by a data-driven approach. It will allow, as much as possible, for the integration of the contribution of qualitative foresight scenario building in the quantitative modelling. Therefore, it will provide an innovative approach to combining Foresight approaches with Microsimulation modelling. The consolidated FRESHER Scenarios will be finalised by December 2017.

<sup>1</sup> <http://www.foresight-fresher.eu/en/Tools/Project-Documents/>

FRESHER Project is now in the second step of the Scenarios Building process and the report presents the desk analysis and the survey that have been carried out to build the FRESHER Scenarios space. The report is organised as follows: the next section presents the factsheets on eight key trends that were elaborated to support the stakeholders survey. The eight key trends, represented in the table below, were selected by aggregating and fine tuning the drivers emerged in the Horizon Scanning Phase.



**Figure 2: FRESHER key trends for health and well-being**

Each factsheet has been developed following a common structure featuring:

- The description of the key trend and the drivers influencing the trend: including references to the available data on past evolutions and highlighting modalities in which change can occur and affect patterns of development.
- The description of the trend's implications on health and NCDs: including references to quantitative data and qualitative information on the impacts on health and NCDs of the trends considered.
- The description of the five available indicators that could best represent the associations between the trend analysed and its impact on health/non-communicable diseases.

In the second part, the paper reports the survey questions and a summary of the experts' opinions. The FRESHER survey "What will impact your health the most?" was launched on 8th June 2016 and remained on-line until the 15<sup>th</sup> of July with the aim of eliciting stakeholders' contributions on the identified trends and their implications for health and NCDs. The survey asked experts their educated guesses in different fields as regard eight trends:

- **Uncertainty of the trend at 2050** – evaluated according to the following scoring system: fully predictable, mostly predictable, predictable, partially predictable, unpredictable trends;
- **Importance of the trend in reducing the incidence of NCDs at 2050** – evaluated according the qualitative scoring system: critically important very important, of medium importance, of low importance;
- Identify **indicators** that could measure the trend evolution and impact on health and NCDs.

The last section sets the frame for the following works by focusing on survey's results analysis and proposing a FRESHER Scenarios space.

# **Part I Building the FRESHER Survey: factsheets and indicators for eight key trends for health and well-being**

## 1.1. Demographic change

### Demographic change – trend description and drivers

Across the world, the basic determinants of population size and structure — fertility, mortality and migration - have been fundamentally shaped by the processes of social and economic development. As a result, the global population doubled to 7 billion in the last half century and will continue to grow in coming decades, although regional trends differ markedly. In advanced economies, populations are ageing and in some cases reducing in size.

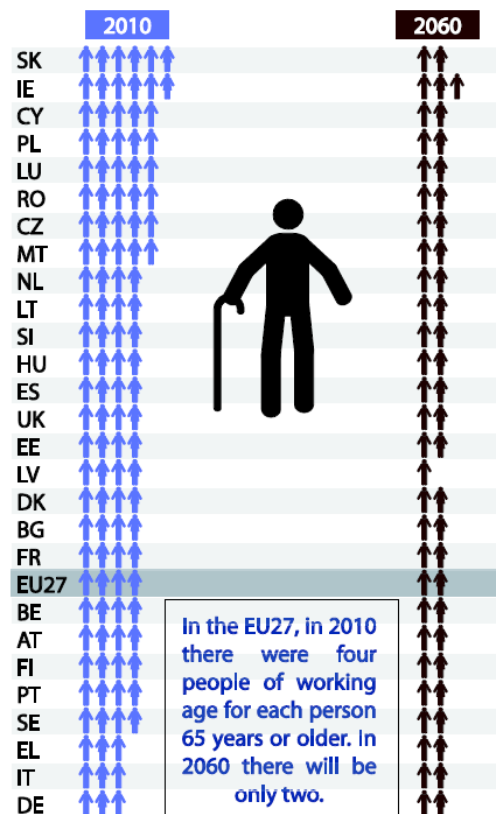
**Ageing is one of the greatest social and economic challenges of the 21st century for European societies and beyond.** It will affect all EU countries and most policy areas. In the next few decades, the proportion of elderly persons in EU countries is set to rise fast, while that of working-age people will fall significantly. The old-age-dependency indicator, which presents the ratio between the total number of elderly persons that have reached an age when, generally speaking, they are economically inactive (aged 65 and over) and the number of persons of working age (from 15 to 64), increased in the period 2001-2014 from 23.5 to 28.1 (Eurostat). **By 2025 more than 20% of Europeans will be 65 or over, with a particularly rapid increase in the number of over-80s** (European Commission Ageing Policy website, 2013). As old-age dependency ratios increase, the social contract may come under strain.

**Public finances could worsen as a smaller, economically active population is relied upon to provide for the pensions, health and long-term care and other needs of the elderly.** Preserving living standards as population's age and avoiding a breakdown in social cohesion will require that countries plan ahead, using the period when they benefit from a large workforce to prepare for subsequent population ageing and decline.

With over a million refugees arriving on Europe's shores in 2015 alone according to the UNHCR, migration has become a top priority on the EU political agenda. **Migration** can also be seen as a demographic solution to the consequences of ageing population; it has contributed to population increase in many low-fertility countries that would otherwise experience a decline in population.

**In 2011, around one out of ten residents in the EU was born in another country** (Eurostat 2013). High numbers of immigrants, typically combined with their younger age structure and often with higher fertility rate, could contribute significantly to the number of births in the EU country. On the other hand, the permanent settlement of immigrants with different socio-cultural backgrounds demands policies and actions aimed at appropriate integration without which societies run the risk of cultural crash and social unrest.

Fig. 1: Old age dependency ratio (+65/15-64)



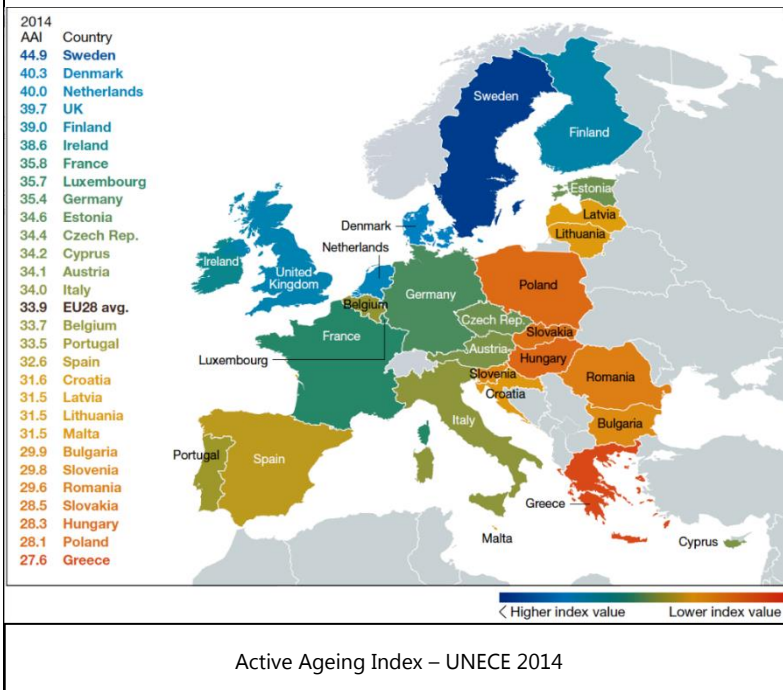
Data source: [European Commission](#), 2012

### Implications on health and NCDs

NCDs account for nearly 90% of the disease burden for the over-60s in low, middle and high-income countries, and **people over 70 accounted for 57.9% of the 38 million deaths from NCDs worldwide in 2015 (WHO)**. David Stuckler, in a study on the causes and consequences of leading chronic diseases, analyzed mortality rates from cardiovascular and chronic non-communicable diseases in the decades 1960-1980. The population ageing explained 10 percent of the changes in mortality rates for heart disease and 25 percent for chronic NCDs, and the rest was attributed to macrosocial and macroeconomic factors. Furthermore, **ageing is also associated with an increased risk of a person having more than one disorder at the same time (multimorbidity)**. Multimorbidity can lead to interactions between disorders or between treatment recommendations for different disorders. As a result, the effects of multimorbidity on functioning, quality of life, and mortality risk might be much greater than the individual effects of these disorders. **In a period of financial constraints, the rise of chronic diseases and multi-morbidity require health care systems to reorient and integrate their services.** Health systems are urged to shift from a reactive model toward a broader multi-sectoral response, and political leadership needs to move from a sectoral perspective toward a more comprehensive vision. The future will depend upon the systems' ability to become "proactive rather than reactive, comprehensive and continuous rather than episodic and disease specific and founded on **lasting patient-provider relationship rather than incidental, provider-led care**" (WHO 2014).

**The health system reform has to be accompanied by the promotion of healthy and active ageing** for all European residents. More years in good health translate to a better quality of life, more independence and the possibility of meaningful activity. A population in good health reduces pressure on health systems with fewer premature retirements from work due to ill health, thus, contributing positively to European economic growth. At the EU level, the number of **healthy life years (HLY) at 65 is now quite similar in women and men, with the EU average for both being 8.5 years in 2012**. Over the period 2008-2012, there was a significant increase in HLY for women and men, respectively, in 10 and 15 Member States but not in all Member States –

even though the methods adopted in the monitoring might have influenced the results. (Health at a Glance 2014). **The European Innovation Partnership (EIP) on Active and Healthy Ageing**, applies an innovative approach to policy making by providing a forum for key stakeholders (end users, public authorities, industry) in which they can cooperate, united around a common vision that values older people and their contribution to society, identify and overcome potential innovations barriers and mobilise instruments. The EIP focuses on the following areas throughout a person's life: **prevention, screening and early**



**diagnosis, care and cure (integrated care), active ageing and independent living. This Partnership sets a target of increasing the healthy lifespan of EU citizens by two years by**



**2020. The Active Ageing Index (AAI)** is a tool to measure the untapped potential of older people for active and healthy ageing across countries. It measures the extent to which older people live independent lives, participate in paid employment and social activities as well as their capacity to actively age. The AAI weighs 22 individual indicators (grouped into four distinct domains) and summarises them into a single score that is presented in the graph above.

### The search for indicators

The standard indicator for analysing aging is the *share of population aged 65 and above* in the total population. (Eurostat 2016b, Eurostat 2016a, World Bank 2016).

As the health system financing is often relying on the share of working age population, it is reasonable to also look at the relationship between younger working population and older population. The *old-age dependency ratio* is the relation of people older than 64 to the working-age population, i.e. those ages 15-64 are (Eurostat 2016a, World Bank 2016 and UN ESA Division "World Population Ageing 1950-2050" 2011).

One of the determinants to demographic change is that the *life expectancy* is constantly increasing. In terms of NCDs it means that the burden of disease is bigger and people live longer with the chronic diseases, resulting in more years lived with disability (YLD). Therefore, it is important to look at the data considering life expectancy at birth. The indicator shows the number of years a new born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. (World Bank 2016, World Health Organization and Eurostat 2016a databases).

*Population's growth rate* is the increase (or decrease) in the number of persons in the population during a certain period of time, expressed as a percentage of the population at the beginning of the time period. The average annual growth rates for all ages as well as for particular age groups are calculated on the assumption that growth is continuous (World Bank 2016).

Finally, *the median age of a given population* is the age separating the group into two halves of equal size. Median is preferred instead of the mean due to the fact that population age groups are skewed and a larger proportion of people are among older age groups. In order to find the central tendency, median age is more appropriate. Median age indicator provided by United Nations database (United Nations Statistics Division 2016).

In conclusion, the following indicators of the megatrend "Demographic change" were selected:

1. Population aged 65 and above (% of total);
2. Old-age dependency ratio;
3. Population growth rate;
4. Life expectancy at birth;
5. Median age of population;



## 1.2. Urbanisation development

### Urbanisation development - trend description and drivers

**We live in an urban world and the trend will continue to grow in the future.** In 2050, 67% of the world population will be living in cities, with exponential growth of mega-cities and slums in developing countries. In Europe, the proportion of urbanised population was 72.6% in 2010, and is expected to reach 86% by 2050. With a projection of 90.7%, northern Europe will be one of the sub-regions with the highest proportion of urbanised population by 2050. With more than 80% of global GDP generated in cities (World Bank 2016), urbanisation can contribute to sustainable growth - if managed well - by increasing productivity, allowing innovation and new ideas to emerge. Economic productivity depends on healthy citizens, who need easy access to education, healthcare, security, food, water, transport, clean air and electricity. Cities can also play an important role in tackling climate change, as they consume close to two-thirds of the world's energy and account for more than 70% of GHG emissions (World Bank 2016). **The challenge for EU countries will be renovating urban space so that the system actually "works" – offering inclusive, safe, resilient, and healthy place for all citizens.** Cities' sustainability requires intensive policy coordination, brave investment choices and a multi-disciplinary partnership between urban planners, parks/recreation officials, transportation engineers, public health officials, and citizens.

Region	Tipping Point	2010 urban %	2050 urban %	Difference in urban population 2010-2050 %
World		50.6	70.0	19.4
Europe	Before 1950	72.6	83.8	11.2
Eastern Europe	1963	68.8	80.0	11.2
Northern Europe	Before 1950	84.4	90.7	6.3
Southern Europe	1960	67.5	81.2	13.7
Western Europe	Before 1950	77.0	86.5	9.5

UN Habitat – 2010

### Implications on health and NCDs

Cities change how people live their lives, the ways in which they behave and what they consume. For many people, this means unprecedented access to employment, education, social mobility and good housing with benefits for their health and well-being. On the other hand, city living can mean high living costs, social isolation, fear of crime, air and water pollution and a low-quality community and home environment — in short, a cocktail of disadvantages that undermines health and well-being. Unsurprisingly then, poor health and inequality in health and well-being are frequently concentrated in urban environments. As example, between 2009 and 2011, up to 96 % of city dwellers were exposed to fine particulate matter (PM<sub>2.5</sub>) concentrations above WHO guidelines and up to 98% were exposed to ozone (O<sub>3</sub>) levels above WHO guidelines. **In 2011, an estimated 458 000 premature deaths in 40 European countries were attributed to fine particulate matter (EEA, 2013).** Whereas a growing body of research in the United States and Western Europe documents significant effects of the **physical environment (toxins, pollutants, noise, crowding, chaos, and housing, school and neighbourhood quality)** on children and adolescents' cognitive and socioemotional development (Ferguson et al., 2013). Over the last three decades there has been increasing global concern over the public

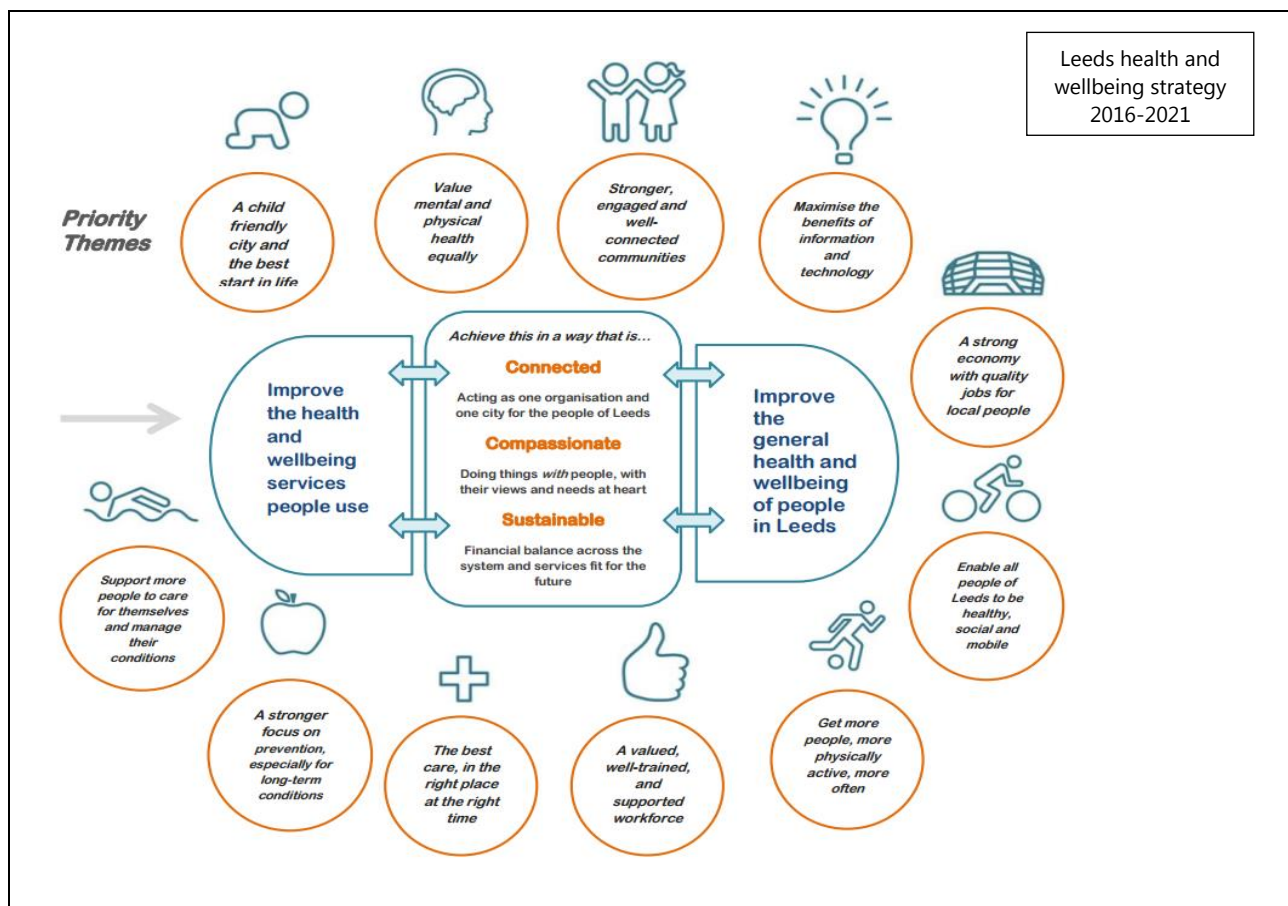
health impacts attributed to environmental pollution, in particular, the global burden of disease. The World Health Organization (WHO) estimates that about a quarter of the diseases facing humankind today occur due to prolonged exposure to environmental pollution. (FRESHER 3.1 Horizon Scanning).

**Cities can positively influence citizens' health. Built environment can promote physical activity** via adequate facilities and environments, for example walkability in community design, density, connected streets, mixed land uses, access to transit and public transportation, pedestrian and bicycle facilities, building designs such as stair cases, parking places. **Local stores, supermarkets, and fast food restaurants can influence nutrition-related behaviours** via access and marketing of foods and beverages. Some studies indicate that perceived availability of food are linked to healthy nutritional behaviour. In addition, a growing body of studies show that **accessibility to tobacco** retailers is associated with increased tobacco consumption. Greater access to social destinations and community design features in the built environment may promote **socialization and prevent or work against symptoms of depression**.

**The WHO European Healthy Cities Network** consists of cities in the WHO European Region that are committed to health and sustainable development: nearly 100 cities and towns from 30 countries. The European Healthy Cities Network identifies the following urban policies that can influence health, well-being and equity:

- ✓ **Regulation.** Cities are well positioned to influence land use, building standards and water and sanitation systems and enact and enforce restrictions on tobacco use and occupational health and safety regulations.
- ✓ **Policy integration.** Local governments have the capability of developing and implementing integrated strategies for health promotion.
- ✓ **Intersectoral partnerships.** Cities' democratic mandate conveys authority and sanctions their power to convene partnerships and encourage contributions from many sectors.
- ✓ **Citizen engagement.** Local governments have everyday contact with citizens and are closest to their concerns and priorities. They present unique opportunities for partnering with the private and not-for-profit sectors, civic society and citizens' groups.
- ✓ **Equity focus.** Local governments have the capacity to mobilize local resources and to deploy them to create more opportunities for poor and vulnerable population groups and to protect and promote the rights of all urban residents

As example, Leeds Health and Wellbeing Strategy 2016-21 aims at creating a "healthy and caring city for all ages, where people who are the poorest will improve their health the fastest". The vision requires acting in the priority themes represented in the image below.



## The search for indicators

The search urbanity, urban population AND non-communicable diseases, chronic diseases in PubMed showed many works using a wide range of urbanity scales, differentiate for types of indicators adopted and their content. In addition, the validity and sensitivity of these scales have been put under question in several studies. Therefore, specific urbanity scales were not used for this report. However, most of the articles stated that proportion of the *population living in urban settings* and *population density* are the essential characteristics of urbanization (Jones-Smith, Popkin 2010, Dahly, Adair 2007, Allender et al. 2011, Cyril, Oldroyd & Renzaho 2013). Based on that, the following three indicators were chosen from World Bank database. *Urban population* indicator is based on the number of people living in an area defined as urban per 100 total population and is expressed as a percentage. According to Eurostat, urban area definition has two criteria. It needs to have a minimum of 5000 inhabitants and a population density of at least 300 inhabitants per 1 km<sup>2</sup>. *Urban population growth* refers to as an annual urban population growth in percentages. *Population density* is midyear population divided by land area in square kilometres (Eurostat 2016b, World Bank 2016).

Additionally, two indicators were chosen from Sustainable Development Goals (SDGs) indicators. SDGs came into force in the beginning of 2016 and their ignition idea came from the Millennium Development Goals. Initiated by United Nations, SDGs aim to end poverty and address a range of social needs including education, health, social protection, and job opportunities, while tackling climate change and environmental protection. SDGs are not legally binding but serve a purpose of international action. Among others, SDGs Goal 11 includes an indicator called the *proportion of urban population living in slums, informal settlements or inadequate housing*. It is important to assess the share of people living in slums, because it is often related with high level of insecurity, poverty and social exclusion and these conditions lead

to poorer health. The indicator is defined as the proportion of people living in households lacking at least one of the following five housing conditions: access to improved water; access to improved sanitation facilities; sufficient-living area (not overcrowded); durable housing; and security of tenure (Sustainable Development Solutions Network).

Lastly, an indicator of the ratio of *land consumption rate to population growth rate* was selected. It is an indicator that measures land-use efficiency from economic, environmental and social perspective and monitors the relationship between land consumption and population growth (Sustainable Development Solutions Network).

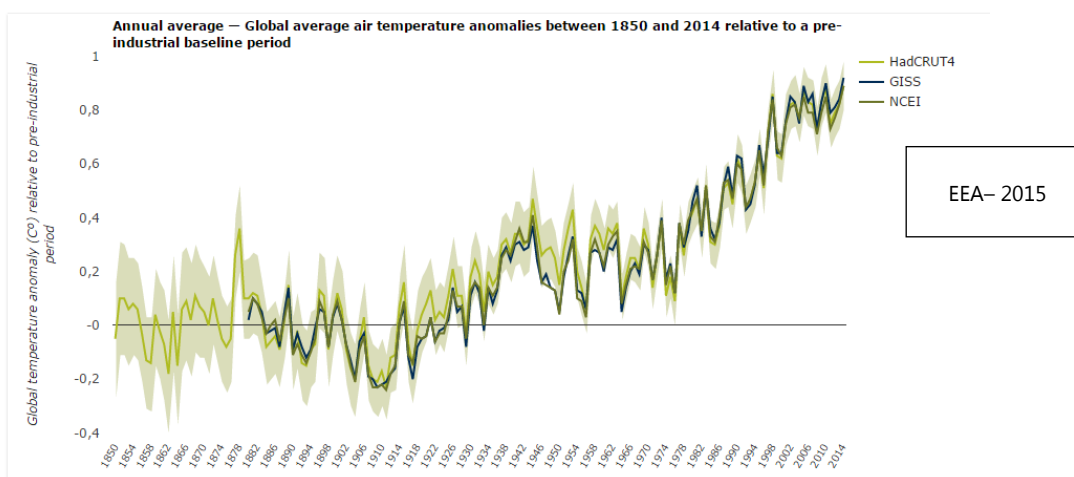
In conclusion, the following indicators of the megatrend "Urban Development" were selected:

1. Urban population (% of total);
2. Urban population growth (annual %);
3. Population density (people per sq km of land area);
4. Proportion of urban population living in slums, informal settlements or inadequate housing;
5. Ratio of land consumption rate to population growth rate.

### 1.3. Climate change and low carbon transition

#### Climate change and low carbon transition - trend description and drivers

Climate change could be the biggest global health threat of the 21st century (Lancet and University College London Institute for Global Health Commission, 2009). The increase in concentration of greenhouse gases (GHG) and the consequent rise in temperature is a recognized mega-trend driven by human activity. The concentration of CO<sub>2</sub> in the Earth's atmosphere is approximately 396 ppm (parts per million) as of 2013, about 145% higher than the atmospheric CO<sub>2</sub> levels before the Industrial Revolution in the 1750s. The Earth (global average land and ocean temperature) has warmed by 0.85°C between 1880 and 2012. **The Intergovernmental Panel on Climate Change (IPCC) has stated that the global average temperature rise needs to be less than 2°C to avoid the risk of potentially catastrophic climate change impacts.** Without further mitigation efforts regarding total GHG emissions, the rise in global mean surface temperature will likely be in the range of 0.3°C to 0.7°C for the period 2016– 2035 (relative to 1986–2005) and 0.3°C to 4.8°C for 2081–2100.



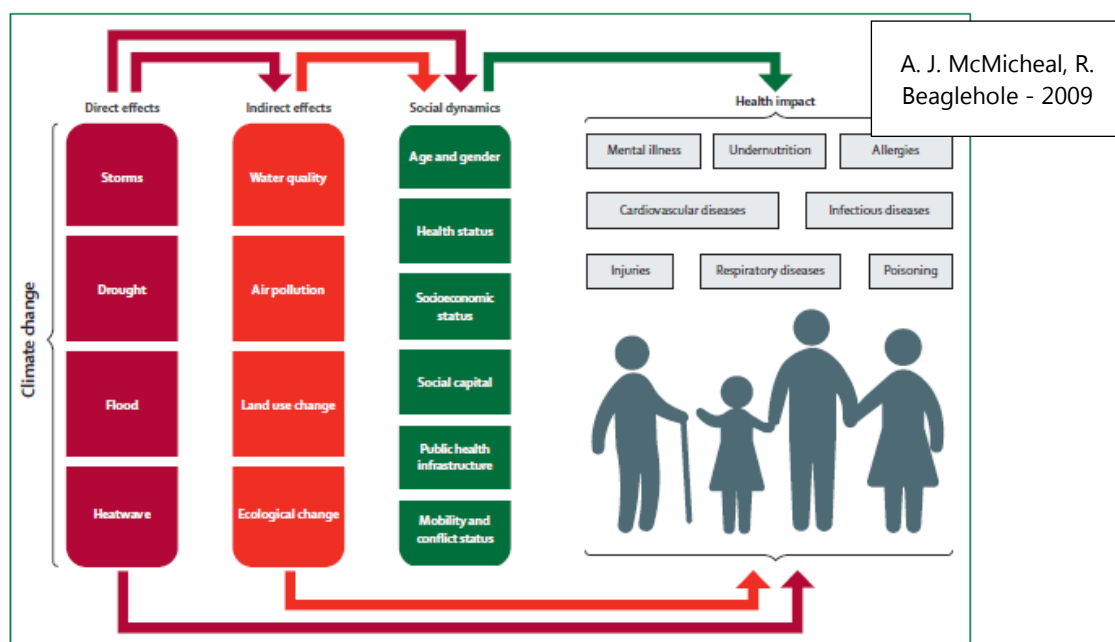
**About 70% of all GHG emissions can be traced back to the burning of fossil fuels for the production of energy services, goods or energy extraction.** Energy is the basis for economic growth, and ensuring access to affordable, reliable, sustainable and modern energy for all is one of the UN Sustainable Development Goals (Goal n.7). **Decarbonising our energy system and investing in low carbon technologies are mandatory pathways for achieving economic development and climate resilience.** Decarbonising the energy sector by 2050 is possible, as shown by the Deep Decarbonization Pathways Project (DDPP) but requires acting on three pillars of energy system transformation: **energy efficiency and conservation, decarbonizing electricity and fuels, and switching end uses to low-carbon supplies.** The climate pledges at COP21 are the right first step towards meeting climate goals and require, among other things, that one-quarter of the world's energy supply be low carbon by 2030.

#### Implications on health and NCDs

Climate change influences health outcomes through direct and indirect mechanisms, as shown in the figure below. **Direct risks are storms, floods, droughts and heat waves that could lead to migration and conflicts.** In EU countries, it is estimated that mortality increases by 1–4% for each degree rise in temperature, meaning that heat-related mortality could rise by 30,000 per year by the 2030s, with 50,000 to 110,000 deaths per year by the 2080s. **Interacting with social, economic and demographic dynamics, climate change could influence the quality and availability of land, food, water and ecosystem services in general.** All these risks have a social

and geographical dimension and will be unevenly distributed around the world.

As shown in the table below, a **low carbon transition produces multiple positive impacts on health**. It limits the risk of exposure to climate-related illnesses such as temperature-related mortality and morbidity, extreme weather-related effects, water and food diseases, vector-borne and rodent-borne diseases, water and food shortages and mental health. Reducing the combustion of fossil fuels has positive impacts for decreasing the incidence of diseases caused by air pollution (cardiorespiratory disease, lung cancer, acute respiratory infection, cardiovascular disease and stroke) and by land and water contamination (acute radiation sickness, cancer, drowning, physical injury, mental health). **In the EU, it is estimated that reduced air pollution from policies to mitigate climate change could deliver benefits valued at €38 billion a year by 2050 through reduced mortality and reduce the social costs of non-CO<sub>2</sub> air pollutants by €50 billion.** In addition, this energy transformation could promote healthy behaviours, especially with regard to active travel.



**Figure 2: The direct and indirect effects of climate change on health and wellbeing**  
There are complex interactions between both causes and effects. Ecological processes, such as impacts on biodiversity and changes in disease vectors, and social dynamics, can amplify these risks. Social responses also ameliorate some risks through adaptive actions.

## The search for indicators

Greenhouse gases emissions (GHG) is the main determinant of climate change. GHG are referred to six different gases: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>). They are sometimes also called as the "Kyoto basket" of greenhouse gases, which comes from Kyoto Protocol produced in 1997 by [United Nations Framework Convention on Climate Change \(UNFCCC\)](#). All these gases are converted into a single unit using gas-specific global warming potential factors. The aggregated *greenhouse gas emissions* are expressed in units of CO<sub>2</sub> equivalents (Eurostat 2016b, Eurostat 2016a).

GHG emissions, in turn, have increased *the surface temperature* of the earth. If looking at the combined temperature of land and marine surface, it shows a clear growth trend. Moreover, temperature of European land area has increased more than the global average. Due to this warming, extreme heat waves occur more often. Heat waves are often a reason for large bush fires, which increases pollution and therefore has an impact on NCDs, foremost respiratory diseases. Furthermore, heat waves impact the agricultural productivity that can affect people's



diet and thereby be a risk factor for NCDs (Eurostat 2016b, English et al. 2009).

Pollution resulting from climate change is also a threat to *safe drinking water*, which is a cornerstone for good health. Sustainable development goals have created an indicator referred to as proportion of population using safely managed drinking water services. It measures the percentage of the urban and rural population using safely managed drinking water services. The term 'safely managed' is proposed to describe a higher threshold of service; for water, this includes measures for protecting supplies and ensuring water is safe to drink (Sustainable Development Solutions Network).

Besides the indicator of safe drinking water, an *indicator of renewable energy* share in the total final energy consumption was selected from SDGs indicators' list. Renewable energy consumption as a share of total energy consumption is also brought out in World Bank and Eurostat Database (Eurostat 2016a, World Bank 2016, Sustainable Development Solutions Network).

Finally, the measure of *energy intensity* from SDGs indicators was selected, also available in World Bank and Eurostat Database. It measures the energy consumption of economy and its overall energy efficiency. It is a ratio between energy supply and gross domestic product measured at purchasing power parity. Energy intensity is an indication of how much energy is used to produce one unit of economic output (Eurostat 2016a, World Bank 2016, Sustainable Development Solutions Network).

In conclusion, the following indicators of the megatrend "Climate Change" were selected:

1. Greenhouse gases emissions;
2. Apparent temperature;
3. Proportion of population using safely managed drinking water services;
4. Renewable energy share in the total final energy consumption;
5. Energy intensity measured in terms of primary energy and gross domestic product;



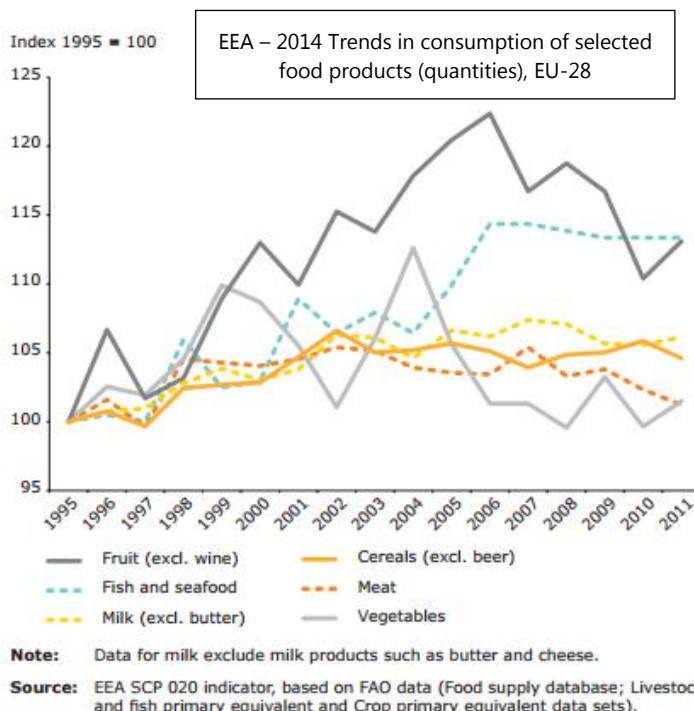
## 1.4. Industrialised agriculture

### Industrialised agriculture – trend description and drivers

*"A collaborative effort to build a more locally-based, self-reliant food economies- one which sustainable food production, processing, distribution, and consumption are integrated to enhance economic, environmental and social health"*  
Feenstra 2002

The world's human population and food consumption is growing. The last 50 years have brought big changes and developments in agriculture worldwide. **Agricultural intensification** can be technically defined as an increase in agricultural production per unit of input (which may be labour, land, time, fertilizer, seed, feed or cash). For practical purposes, intensification occurs when

there is an increase in the total volume of agricultural production that results from a higher productivity of inputs (FAO). On the one hand, increased agricultural productivity allows consumers to have **a stable supply of affordable food**. On the other, the loss of elements from traditional farming practices to intensive agriculture and the diffusion of large scale livestock production throughout the EU has increased the **environmental degradation**. Soil erosion by water and wind affects close to 15% of EU land, GHG emissions from agriculture accounted for 10% of total GHG emissions in 2008, and the irrigable area in Mediterranean member countries has increased by about 20% between 1990 and 2005 (EEA 2016). The total quantity of pesticides sold increased between 2000 and 2005 in 60% of EU countries and fungicides and herbicides were the most sold pesticides in 2005 in countries for which data were available (Eurostat). Over the past five decades, the EU Common Agricultural Policy (CAP) - accounting for around 40% of the EU budget — has encouraged the rapid modernisation of the sector and the intensification of agricultural production. Reforms of the CAP in the 1990s, in 2003 and 2008 have brought about some improvements and post-2013 attempted to pay more attention to preserve and use natural resources better in Europe's agricultural areas.



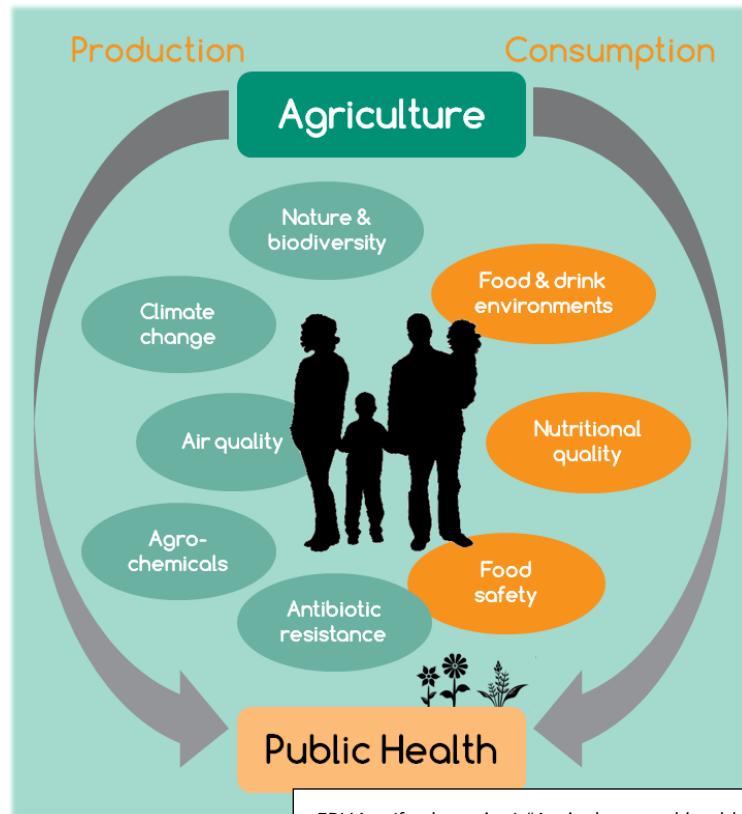
### Implications on health and NCDs

Agriculture is essential for good health — it produces the world's food, fibre, and materials for shelter, and can produce medicinal plants. At the same time, agriculture can lead to poor diet and health. Despite this strong connection, health considerations play little part in the decisions farmers make about production or in the design of agricultural policies. There have been repeated calls for CAP to address nutrition-related health, particularly obesity and non-communicable diseases (NCD) in the EU. However, aligning agricultural policy such as CAP with nutrition is complex, not least because the aims of agricultural policy are predominantly economic, presenting a challenge for developing coherence between agricultural trade and health policy.

**The EPHA Paper "Agriculture and health: consumption linkage" (forthcoming)** provides an

overview of the health implications of agriculture, some of them strictly related with NCDs and NCDs risks factors:

- Occupying 40% of the EU land area, agriculture is a main driver of **ecosystem degradation and biodiversity loss**. Only 16% of European natural habitats are considered to be in good state and under current trends, most ecological indicators are set to decline further.(EEA 2015)
- More than 400.000 people die prematurely from **air pollution** in the EU each year. Agriculture is a major emitter of ammonia and methane which are key contributors to air pollution.(CGIAR)
- The food system is responsible for up to 30% of EU greenhouse gas emissions, influencing the **climate change** rise.
- For now, more than 25.000 people die in the EU each year from infections caused by **antibiotic resistant bacteria**. The rise of antibiotic resistance is attributable to antibiotics overuse in both human and veterinary medicine. Intensive livestock systems and antibiotics use are closely linked. (FAO 2015, WHO 2014)
- **Agrochemicals** use contributes to ecosystem degradation and pesticides are an occupational threat extending to farm workers, their families and potentially inhabitants of areas exposed to application.



EPHA – (forthcoming) "Agriculture and health: consumption linkage"

Endocrine disrupting chemicals found in various pesticides are an increasing concern.

- **Food and drink environments** agricultural policies can create incentives for specialisation in specific crops, resulting in greater than normal quantities or lower than normal prices for the affected products with knock-on effects on final consumption patterns.
- There are firm indications that the **nutrient content of various vegetables and fruit** has declined compared to about fifty years ago, which may be related to changes in the food system including plant breeding priorities and soil quality (Aileen Robertson et al. (2004). **Animal product quality** is also correlated with agricultural choices, with grass-fed meat and milk consistently showing superior nutritional profiles. (B. H. Schwendel et al. (2014). Although debated, a number of recent reviews suggest organic products having on average better compositions on several nutritional indicators. The cumulative long-term impact of these differences on public health however remains unclear.
- More than 200 types of diseases are spread through food causing a wide scope of symptoms ranging from diarrhoea to cancer. In 2013, 310.000 cases of bacterial food borne diseases were reported in the EU, resulting in 322 deaths. Individual disease outbreaks can lead to peaks in the harm caused.

## The search for indicators

As described above, the use of pesticides in agriculture is one of the main indicators in relation to health. Pesticides are different plant protection products that can be divided into three main groups: fungicides (effective against fungi); herbicides (effective against plants considered to be 'weeds'); insecticides (effective against insects). *Use of different pesticides* in Europe can be found from FAOSTAT database, where trends can be analysed by pesticide groups, individual pesticides in all countries from 1990 to 2011 (Eurostat 2016b, Eurostat 2016a, Food and Agriculture Organization of the United Nations 2013).

Like any other economic sector, the agriculture sector produces GHG and is a major source of the non-CO<sub>2</sub> GHGs methane and nitrous oxide. Both of these gases are many times more powerful GHGs than CO<sub>2</sub>. Data of *GHG emissions in agriculture* are available on Eurostat database and are expressed in million tonnes of CO<sub>2</sub> equivalent (Eurostat 2016b, Eurostat 2016a).

In order to reduce the negative impacts of industrialization of agriculture, organic farming production should be practiced more widely. Organic farming emphasizes environmental protection and avoids or largely reduces the use of different chemical inputs in production, including pesticides. Farming is only considered to be organic in European Union, if it complies with specific framework for the organic production of crops and livestock and for the labelling, processing and marketing of organic products, while also governing imports of organic products into the EU. Data is available in Eurostat database and is measured as the *share of total utilised agricultural area occupied by organic farming* (Eurostat 2016a).

Furthermore, the *overall share of the land that is under agriculture* should be assessed. World Bank database has aforementioned data available. They describe agricultural land as: "...the share of land area that is arable, under permanent crops, and under permanent pastures. Arable land includes land defined by the Food and Agriculture Organization as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded. Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber. Permanent pasture is land used for five or more years for forage, including natural and cultivated crops." (World Bank 2016).

*Livestock production* has a significant contribution to environmental problems and the production is estimated to increase in future. Although it is not a big sector economically, it plays an important role socially and politically. It accounts for 40% of agricultural gross domestic product (GDP) and creates livelihoods for one billion of the world's poor. At the same time, livestock products provide one-third of humanity's protein intake, and are a contributing cause of obesity and a potential remedy for undernourishment. Being a significant determinant in agriculture production, climate change and people's health, the indicator of *total livestock density of utilised agricultural area* is included in this report. Data is available in Eurostat database and described as livestock density index (Eurostat 2016a, The Livestock, Environment and Development (LEAD) 2006).

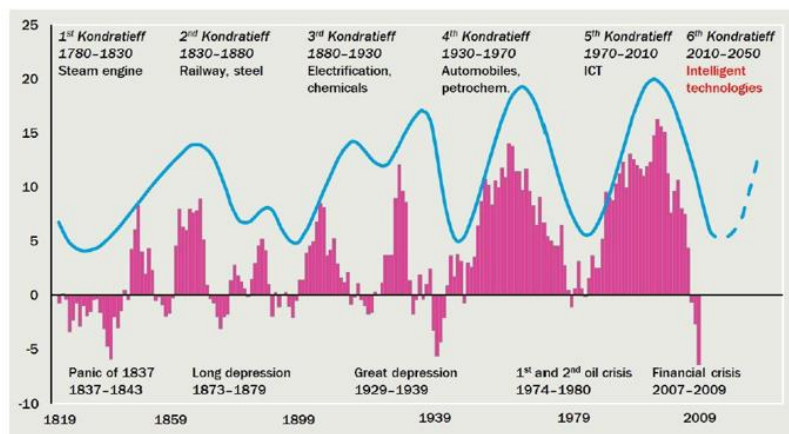
In conclusion, the following indicators of the megatrend "Agriculture and Health" were selected:

1. Consumption of pesticides;
2. Greenhouse gas emissions from agriculture (CO<sub>2</sub> kilotons per year);
3. Share of total utilised agricultural area occupied by organic farming;
4. Land use of agriculture (% of total land area);
5. Total livestock density of utilised agricultural area.

## 1.5. Innovation in medicine

### Innovation - trend description and indicators

The report "Surfing the sixth wave. Exploring the next 40 years of global change" published by Finland Futures Research Centre (2012) suggests that what is currently being experienced is a **'socio-technologic paradigm shift'**, described as the shift from ICT (1970-2010) to **intelligent technologies** (2010-2050). The report adopts as framework for analysis the Kondratieff long cycle theory that explains economic expansion and contractions according to regular cycles (K-waves). Kondratieff's observations postulate that capitalist countries tend to follow the long rhythmic pattern of approximately half a century (on average 54 years in length). By the end of a 25-30 year upwave period, the heating up of the economy sets the stage for a deep recession that jolts the economy. The depression marks a new era in which new technologies and social practices are developed which in turn heralds a new period of rapid growth. It has been suggested that the transition between successive k-waves is marked by technological changes (W. R. Thomson). According to this report, **the 6<sup>th</sup> wave would primarily be driven by resource efficiency** because of environmental strains and increasing scarcity of natural resources. The development of **new technologies such as biotechnology and nanotechnology combined with exponentially growing ICTs (NBIC) would become the major driver of the 6<sup>th</sup> wave.**



From "Surfing the sixth wave. Exploring the next 40 years of global change".

Modern economies fluctuate in a cycle of 40-60 years. Rolling 10-year yields of Standard & Poors 500 equity index and Kondratieff's waves.  
 Source: Datastream

The technological change is projected to be **more rapid and multidisciplinary** than before, which raises the issue of how to best **prepare human capital** to surf the next technological wave. Despite the pledges of the Lisbon targets, expenditure in R&D is about 1.9% of GDP in the euro zone, against 2.6% in USA and 3.7% in Sweden. The relevance of sector- related new technologies is smaller in Europe than in the USA (7% of GDP against 10%). In 2010, the EU2020 strategy set up the target of attaining a 3% GDP yearly investment in R&D by 2020. Today, the US has twice as many scientists and engineers per million people as the EU, and scientific brain drain from Europe to the US continues. China will become the 2nd largest R&D power in the world by the mid-2010s well ahead of major EU Member States, and with efforts focused in the most promising cutting-edge areas. Overcoming the missing link between research and development-deployment in Europe is the key to future development (FLAGSHIP Report 2014). The use of nanotechnology, biotechnology and life sciences, ICTs, cognitive sciences and neurotechnologies opens up a world of opportunities but if not properly regulated can exacerbate the **existing tensions regarding class disparities, privacy protection, and cultural threats** (Anton, Philip S. (2001)).

### Implications on health and NCDs

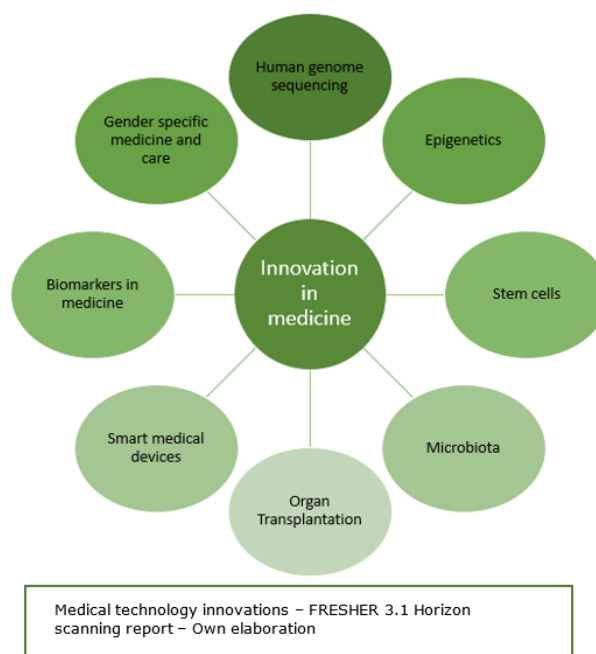


The WHO defines health technology “devices, drugs, medical, and surgical procedures—and the knowledge associated with these—used in the prevention, diagnosis and treatment of disease as well as in rehabilitation, and the organizational and supportive systems within which care is provided”.

The FRESHER Report 3.1 “Horizon Scanning” contains a comprehensive description of today's potentially transformative innovations in treating NCDs, briefly summarized in the pages below and in the graph. Today, health care systems in high-income countries make extensive use of technologies, whereas people in the world's poorest countries often lack most fundamental drugs and devices. Medical innovations are indeed one of the key drivers of health care spending and the economic crisis has pressed health systems to look for those **disruptive innovations and frugal technologies** that can make health care effective and sustainable. In 2009, total global investments in health R&D (both public and private sector) reached US\$240 billion. Only about 1% of all health R&D investments were allocated to neglected diseases in 2010. Diseases of relevance to high-income countries were investigated in clinical trials seven-to-eight-times more often than were diseases whose burden lies mainly in low-income and middle-income countries. (Røttingen J.A.2013). Most health technology is produced by companies from high-income countries for high-income markets, as shown by the market for medical devices; the top 30 companies, which account for 89% of sales revenues, all have their headquarters in high-income countries, 19 of which are in the US. Their sales overwhelmingly take place in high-income countries—87% of which are in the EU (plus Norway), Japan, and US. Health technology is therefore mostly designed for an environment with high spending on health, a reliable energy supply, and large numbers of trained health-care professionals (Technology for global health 2012).

Here are some of today's potentially transformative trends, resulting from biomedical sciences, engineering and computer science advances, new findings in genomics, stem cells, new pharmaceuticals, medical devices, imaging and diagnostic devices, new surgical approaches, digital medicine and the wireless revolution.

The **Human Genome Project (HGP)** is a great international research effort aimed at sequencing and mapping all of the human genome. The analysis of each person's genome will lead to a very powerful form of preventive medicine, able to predict individual health risks and produce a whole new generation of interventions. Most new drugs based on genetic research are currently in clinical trials. Among other thing, the HGP has opened the way to the **study of effective biomarkers** and the revolution of “**omic**” **medicine**. In particular, the development of CVD biomarkers could provide one crucial tool to better identify high-risk individuals, to diagnose disease conditions promptly and accurately, and to effectively prognosticate and treat patients with disease. **Personalized medicine**, involving the use of genetics and genomics will flourish, thanks also to the widespread use in hospitals of the **Electronic Health Records**. This will help



the development of **personalized health care**, tailored to the unique characteristics of each patient, and **gender-specific care** that addresses total health from a gender-specific perspective. Gene therapy, a set of strategies that modify the expression of an individual's genes or that correct abnormal genes, is a promising treatment option for a number of diseases.

**Tissue regeneration** is probably the most important possible application of **stem cell research**. Under the right conditions, or given the right signals, stem cells can develop into mature cells with characteristic shapes and specialized functions, such as heart cells, skin cells, nerve cells or blood cells. Thus, replacement cells and tissues may be used to treat cardiovascular disease, brain disease, heart disease or insulin-producing cells. Due to advances in biotechnology, genetics, and immunology, **xeno-organ transplantation** now beckons as a viable, long-term solution to the organ shortage. Xenotransplantation is also developed for non-whole organ scenarios such as neurodegenerative disorders, chronic pain control, and ex vivo perfusion events. On the medical side there are a lot of expectations and hopes in **fetal tissue** engineering to help relieve the symptoms, if not cure, many, previously incurable chronic diseases, including Parkinson's, Alzheimer's, diabetes mellitus, hepatic enzyme/factor deficiencies and many more. In the field of organ transplantation, **3D printing** will have a leading role. Researchers at Harvard University are making great progress in bioprinting blood vessels, a crucial step towards printing tissues with a blood supply. An area of research showing a lot of promise is the **human microbiome** which may have a role in a broad range of diseases, including autoimmune, metabolic, gastrointestinal, and brain disorders. Research into the association of the gut microbiota with health and disease continues to expand, and manipulation of microbiota offers new clinical applications. Advances in **minimally invasive and robotically and computer-assisted surgery** have focused on minimizing the invasiveness of surgical procedures, such that a significant paradigm shift has occurred for some procedures in which surgeons no longer directly touch or see the structures on which they operate. Advancements in **video imaging, endoscope technology, and instrumentation** have made it possible to convert many procedures in many surgical specialties from open surgeries to endoscopic ones. On the patient side, a wide range of **healthcare products and wearable technology** for screening and monitoring indicators related to NCDs is already on the market and includes home usage **blood pressure monitors, blood glucose monitors, nebulizers, body composition monitors, pedometers**, etc. and hospital usage blood pressure monitors. The next wave of wearable health tech will focus on gathering the personal data that is most meaningful to a doctor, and sending it directly to his or her office.

### The search for indicators

The cornerstone for the innovation development is specific knowledge in the field. Therefore, *investment in research* has a key role in the development of medical innovations. Three indicators were selected for measuring the importance of research.

*Research and development expenditure (% of GDP)* is the general indicator regarding the topic and data is available in the World Bank database and is list in the SDGs indicator list (World Bank 2016). It includes expenditures for research and development on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, society and the use of knowledge for new applications. It covers basic research, applied research, and experimental development.

*Data of research and development personnel and expenditure* in health sector can be found in OECD database. Expenditure is measured as purchasing power parity US dollars and personnel is measured as a total number of people employed in the sector (OECD2016b).

In order to implement the medical innovations in practice, *population education level* is an important factor to consider. The innovation is in low use if the education level in general population do not meet the expectance of skills needed for the innovation. Two indicators were selected to measure education level: *education attainment of the labour force and education level of students*, both found in OECD database. Education level of labour can be analysed as a share of primary, secondary tertiary education of population. Education level of students can be viewed as enrolment at primary, secondary and tertiary education percentages of population (Organisation for Economic Co-operation and Development (OECD) 2016b).

In conclusion, the following indicators of the megatrend "Innovations in medicine" were selected:

1. Research and development expenditure (% of GDP);
2. Research and development personnel in health sector;
3. Research and development expenditure in health sector;
4. Education attainment of the labour force;
5. Education level of students.

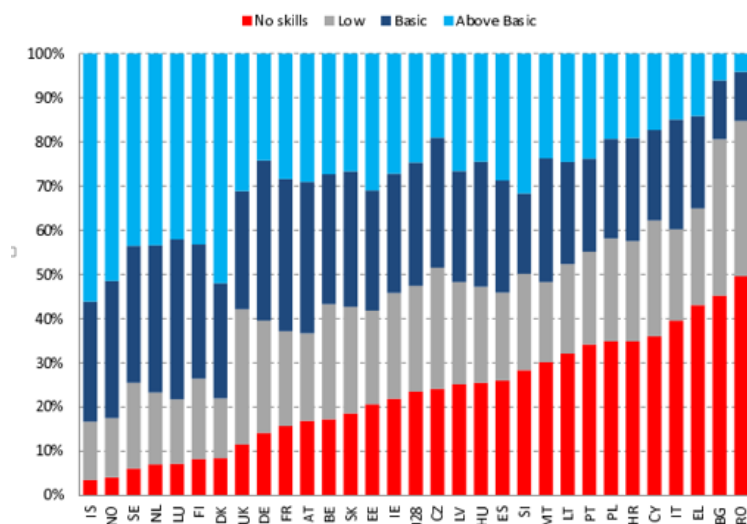


## 1.6. Citizens empowerment

### Citizens empowerment - trend description and drivers

*"As they get empowered, patients may develop a greater sense of self-efficacy regarding various disease and treatment-related behaviors, and may express changes in life priorities and values. As a result of their empowerment process, patients are expected to better self-manage not only their illness, but their lives as well".* Patient empowerment in theory and practice: Polysemy or cacophony?"

The empowerment process implies the enhanced capacity of citizens to make choices and act consequently, promoting self-determined change. The RAND thematic report "Individual empowerment" (2015) recognises four main drivers of this trend: economic growth, access to education, new status/role of women in society and the diffusion of ICTs. Taking a global prospective, EU citizen enjoy a favourable position for experimenting a new attitude toward knowledge, participation and change. Even if there are notable difference between the West and the East, the EU countries have been consistently ranked high in term of **human capital development** according to the UN Human Development Index (HDI). This index provides a combination of indicators that can be considered suitable proxies for individual empowerment: life expectancy at birth, years of schooling and gross national income. Similarly, the Freedom in the World Report (2014) ranks the EU region among the highest level/score for **freedom of speech, internet access and web freedom** even if the region registered a significant drop in freedom of speech in 2013. The Netherlands, Norway, and Sweden were rated the world's top-performing countries but a significant decline was registered in Turkey, which fell into the Not Free category, as well as in Greece, Montenegro, and the United Kingdom. The diffusion of ICT and the ability to navigate critically on the web are the aspects that require more attention. The paper "Measuring Digital Skills across the EU: EU wide indicators of Digital Competence" (EU 2014) reports that 23% of the EU population has no digital skills: ranging from 6% in Sweden to



Source: Commission services based on Eurostat data

Digital skills of the population (% individuals)  
Source: EC based on EUROSTAT data 2012 - Digital Inclusion and Skills

50% in Romania. In ten countries, 30% or more of the population have no digital skills. Considering that to **function effectively in the digital society one needs at least medium level or "basic" skills**, it can be seen that **almost half the EU population (47%) do not attain this level of skill having either "low" or "no" digital skills.**

The **rise of social media and social platforms** has transformed the ways in which citizens interact, collect and share information and has multiplied opportunities for knowledge and networking. "It remains to be seen whether this increased availability of information equals a

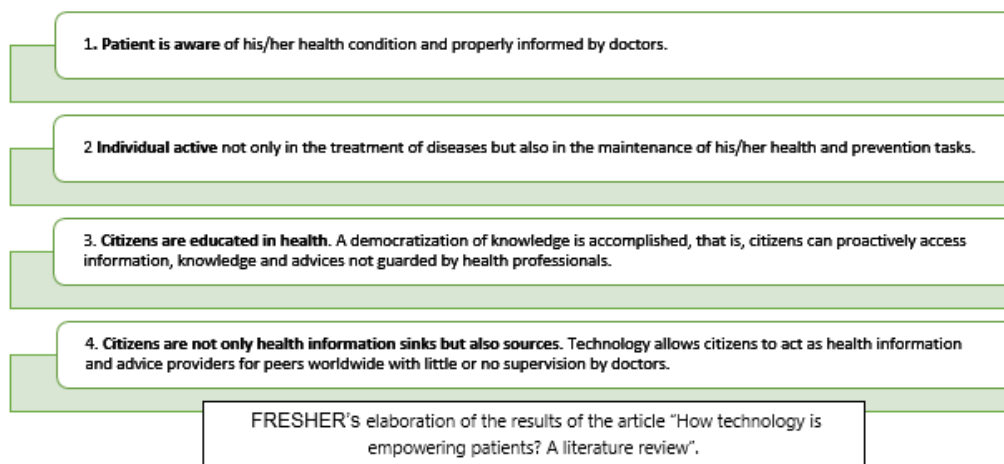
**better-informed** population, or whether the mere flood of information becomes overwhelming and **leads to dilution and manipulation**" (RAND 2014). According to an instrumentalist theory, much will depend on the way these ICT tools are used whereas the ecological view foresees ICTs as a door towards an entirely new, digitally networked space. **Highly empowered citizens and the use of ICTs are also key components of social innovations**, defined by TEPSIE as "new approaches to addressing social needs. They are social in their means and their ends. They engage and mobilise the beneficiaries and help to transform social relations by improving beneficiaries' access to power and resources" (TEPSIE 2014). In times of financial constraints, the wide range of activities, processes and products covered by "social innovations" theme have captured the policy attention for their capacity to realise economic and social results with less resources. Social innovations are relevant not only in the health care sector but also in influencing the factors that affect NCDs.

### Implications on health and NCDs

**Patient Empowerment (PE) covers situations where citizens are encouraged to take an active role in the management of their own health**, transforming the traditional patient–doctor relationship and providing citizens with real management. Empowerment of citizens is gaining momentum among public and private institutions, partly due to the opportunities to provide effective services while reducing health care costs. Out of the 53 members of the WHO European Region, 30 have a national eHealth policy or strategy and 31 have financial support available specifically for the implementation of their eHealth strategy or policy. Providing an overview on national e-health initiatives, the WHO report (2016) also stresses the need for countries to implement more than just the simple acquisition of technology. "A holistic view of the impact and changes required to organizational processes, structures, roles, standards and legislation is needed, as well as consideration of the **specifics of human resources, education, reimbursement and the culture of those who will be utilizing the eHealth services** – any of which can serve to derail initiatives if neglected". (From Innovation to Implementation eHealth in the WHO European Region. WHO 2016). The article "Patient empowerment in theory and practice: Polysemy or cacophony?" examines how the term "empowerment" has been used in relation to the care and education of patients with chronic conditions over the past decade and **recommends the use of ICT**, coupled with the adoption of a **patient-centred approach** and the **promotion of therapeutic educational activities. Community-based participatory (health) research (CBPR)**, can be a key instrument as it signifies improved cooperation between research, health care and engaged citizens to commonly reach new insights in the improvement of public health. (FRESHER 3.1)

In June 2014, the Economist Intelligence Unit conducted a global survey of 144 healthcare leaders working in public and private healthcare, pharmaceuticals, biotechnology and medical devices. Most executives surveyed (64%) believe that the **ability of new mobile technologies and services to provide greater patient access to medical information "could dramatically improve health outcomes"**. A similar proportion (63%) also predicted that "greater patient access to their personal data will allow people to make better decisions about their health". Mobile health could reduce medical costs for individuals (cited by 24% of respondents), offer more effective approaches to preventing epidemics and pandemics (20%) and lower costs for institutions (17%). (Economist Business Unit 2015). In a world where more people have access to internet than to a toilet, the market for **wearable and medical apps** (e.g. more than 40,000 healthcare apps) is rising steeply challenging the health digital competences of citizens as well as national privacy laws and procedures.

The article "How technology is empowering patients? A literature review" (2015) identified four levels of empowerment (summarized in the table below) and states that "the current technology already allows establishing the first steps in the road ahead, but a change of attitude by all stakeholders (i.e. professionals, patients and policy makers) is required. Furthermore, despite motivation, PE strongly depends on accessibility of solutions and interfaces. For a real empowerment of patients, all citizens must be capable of accessing systems empowering them, no matter their digital literacy, economic level, education or disabilities".



Similar conclusions are reached by a survey conducted in 2007 in seven European countries (DK, DE, GE, LV, NO, PL and PT) where the profiles of empowered e-Health citizens resulted situational and country dependent. "In 2007, an estimated 33.9% of the citizens in the seven countries have turned to the Internet to find health information to decide whether to consult a health professional, 25.6% to find health information prior to an appointment and 29.2% to find health information after an appointment, corresponding to estimated mean increases of 9.2%, 5.6%, and 7.0%, respectively, from 2005 to 2007. The highest levels are found in Denmark where, in 2007, an estimated 46.1% of the population report having used the Internet to search for health information to help them decide whether to consult a health professional, 34.1% to find health information prior to an appointment with an health professional and 35.7% to find information after an appointment with health professionals. The lowest levels in 2007 are found in Portugal, with an estimated 18.9%, 15.6% and 17.7%, respectively".

### The search for indicators

*Health literacy* is the main determinant of citizen empowerment in regard to health and NCDs. Health literacy data is not regularly collected throughout Europe, but in 2011 the European Health Literacy Survey (HLS-EU) was conducted in eight European countries (Austria, Bulgaria, Germany, Greece, Ireland, Netherlands, Poland, and Spain) with an overall sample size of approximately 8000 respondents. To measure health literacy, a specific instrument was created based on a conceptual model. The conceptual model integrates three health relevant areas (health care, disease prevention, health promotion) and four information processing stages (access, understand, appraise, apply) related to health relevant decision-making and tasks. In combination, these areas and stages create a matrix measuring health literacy with 12 sub-dimensions, which were operationalized by 47 items. The 47 items were assessed using a 4-point self-report scale (very easy, easy, difficult, and very difficult) to measure the perceived difficulty of selected health relevant tasks. Therefore, the instrument measures self-perceived health literacy and reflects the fit between individual competences and situational complexities or demands (HLS-EU Consortium 2012).

*Patient rights* are another determinant of citizen empowerment. Since 2006, Health Consumer Powerhouse creates every year a Euro Health Consumer Index study. It compares key values in healthcare, taking the patient and consumer point of view and aims to improve the understanding of European healthcare, empower patients and help to address weaknesses. In the Index there are six sub-disciplines, which consist of several indicators. One of the sub-disciplines is called “patient rights and information”, which consists of 12 different indicators. The indicators include topics of health care law, patient organization involvement, access to medical records, web access to health care information, access to medical records, online booking system etc. Each of the indicators are graded on a three- grade scale and added altogether (Bravo et al. 2015, Health Consumer Powerhouse 2016).

Moreover, United Nations has created an indicator of *Human Development Index* (HDI). The idea of the index is that besides the economic growth, country’s development should be measured through people’s competence and capacity. HDI has three dimensions: long and healthy life, knowledge and a decent standard of living. The health dimension is assessed by life expectancy at birth; the education dimension is measured by mean of years of schooling for adults aged 25 years and more; and expected years of schooling for children of school entering age. The standard of living dimension is measured by gross national income (GNI) per capita. The HDI uses the logarithm of income, to reflect the diminishing importance of income with increasing GNI. The scores for the three HDI dimension indices are then aggregated into a composite index using geometric mean (United Nations Development Programme 2016).

Lastly, *the share of people who use mobile phones and internet* is also a good indication of empowerment, as it gives an easier access to information and knowledge acquirement. Both measures are listed in the World Bank database. According to World Bank data description, internet users are measured as the share of individuals who have used the Internet in the last 12 months via any kind of device. Mobile phone usage is measured by mobile cellular subscriptions per 100 people that are subscribed to a public mobile telephone service (World Bank 2016).

In conclusion, the following indicators of the megatrend “Citizens’ empowerment” were selected:

1. General Health Literacy Index;
2. Patient rights and information score in Euro Health Consumer Index;
3. UN Human Development Index;
4. Proportion of individuals using the Internet;
5. Proportion of individuals who own a mobile phone.

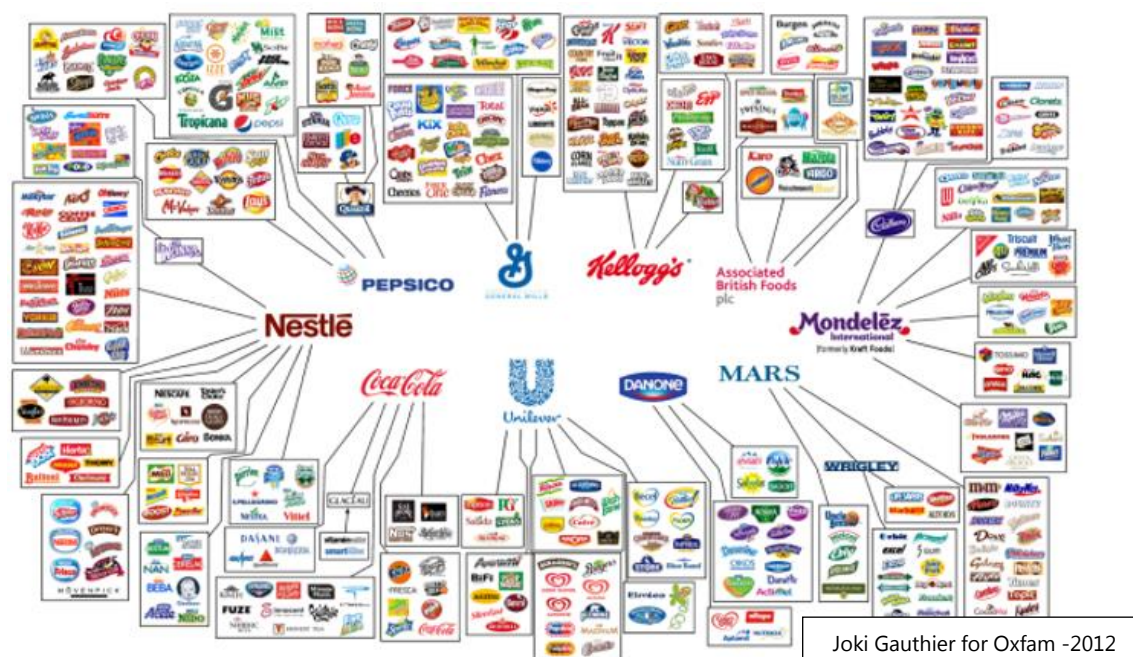


## 1.7. Globalisation and food trade

### Globalisation and food trade - Trend description and drivers

*"These globalizing processes, in turn, have become a major determinant of national, social, and economic policies. Thus, although responsibility for healthcare and public health system remains with national governments, the fundamental social, economic, environmental determinants are becoming increasingly supranational."* - A J McMichael, R Beaglehole (2000) 2000

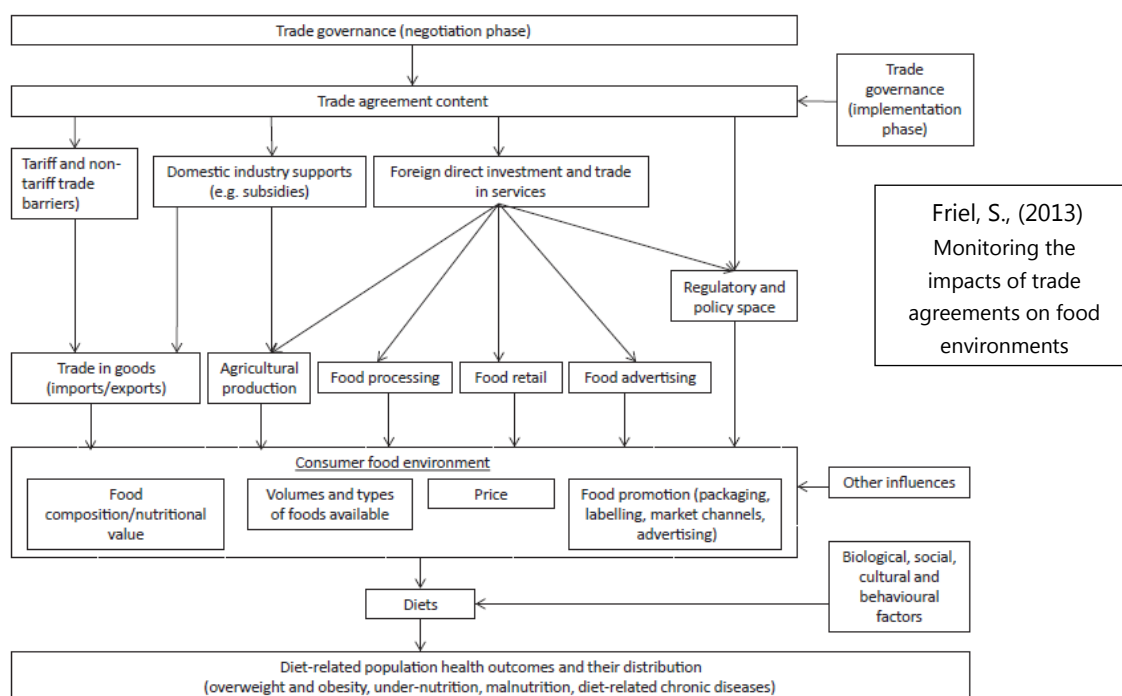
Globalisation is the increased interconnection and integration of world trade, capital and people. Global trade has increased by more than 10 times between 1960 and 2005, a significantly higher progression than that of world outputs since the early 1970s. The European economy is largely globalised. Imports and exports account for around 40% of EU GDP on average. European imports and exports in merchandise and services more than doubled between 1995 and 2007 (AMECO DB, ECFIN 2013). The EU remains the largest investor and recipient of FDI (Foreign Direct Investment). In 2013, FDI inflows to the EU increased by 14% to USD 246 billion compared to 2012 when an exceptionally low volume of inflows was registered (DG Economic and Social Affairs). **The trade of food has changed what we eat, the way we eat and what we expect from food.** Trade agreements (Agreement on the Application of Sanitary and Phytosanitary Measures, the WTO Agreement on Trade and Services) regulate agricultural products and the processed food trade. The global value of trading in food grew from US\$224 billion in 1972 to \$438 billion in 1998; food now constitutes 11% of global trade, a percentage higher than fuel (Pinstrup-Andersen & Babinard, 2001). **This increase has been accompanied by the consolidation of agricultural and food companies into large transnational corporations (TNCs)**



### Implications on health and NCDs

**Globalisation** has had mixed effects on public health. On the one hand, accelerated economic growth and technological advances have **enhanced health and life expectancy in a large share of the population**. On the other hand, certain aspects of globalisation **jeopardise public health via the degradation of social and environmental conditions**, the global division of labour, the exacerbation of the gap between rich and poor and the accelerated spread of consumerism (McMichael A.J., Beaglehole R. 2000). Globalisation directly and indirectly affects the development

of non-communicable diseases. National economic performance influences the globalisation effects through changes in household income, government expenditure, exchange rates and prices. **The increasingly globalised production and marketing of tobacco, alcohol, and other products with adverse effects on health (Beaglehole R., Yach, 2003) illustrate globalisation indirect negative effects.** David Stuckler, in the study "Population causes and consequences of leading chronic diseases: a comparative analysis of prevailing explanations" (The Milbank Quarterly, Vol. 86, No. 2, 2008), highlights the incidence of globalisation-related determinants (economic growth, market integration, foreign direct investment) in long-term changes in mortality rates due to heart disease and chronic non-communicable disease. Stuckler shows the importance of macrosocial and macroeconomic determinants in the demographic explanation of the rise of NCDs in high-income countries over the last 20 years. In a similar way, globalisation improves food availability, accessibility and affordability but it can also exacerbate inequality, the uneven development of unhealthy dietary habits and dietary outcomes. The liberalisation of international trade favours a "nutrition transition" (high fat, sugar and salt) by reducing tariff barriers for certain products, enabling the entry of transnational food corporations (TFCs) and global advertising into the market. Research conducted for the Third Strategic Report of the Mediterranean Diet Surveillance System to examine 43-year time trends (1961/1965– 2000/2004) found that European countries, especially those in the Mediterranean area, have undergone a 'westernization' of their food habits between the two time periods and have experienced a convergence in terms of non-Mediterranean food groups. **All studied regions saw an increase in vegetable oil, sugar and sweeteners as well as meat consumption over the past several decades. (Friel, S., et Al 2013)** **These dietary changes are associated with a rising rate of overweight people, obesity and diet-related chronic diseases like heart disease, diabetes and some cancers (Globalization and Health 2006)**



**Figure 1** Conceptual framework for the direct links between trade agreements, food environments, diets and obesity/non-communicable diseases outcomes. Adapted from Hawkes (p. 37) (72).

## The search for indicators

The most common indicator for assessing globalization and development is a country's annual income level. It is measured by *gross domestic product (GDP)*, which is the sum of gross value added by all resident producers in the economy plus any product taxes but minus any subsidies not included in the value of the products. GDP can be viewed as value per capita, but also as the annual percentage growth rate. Data regarding GDP per capita and annual growth rate of GDP is available at World Bank database (World Bank 2016).

Additionally, a specific index measuring globalization is developed, *called the KOF Index of Globalization*. It has three main perspectives: economic, social and political. In terms of food trade, information about economic globalization would be most valuable. This indicator provides a score for countries based on their sum of exports and imports of goods and services, foreign direct investment inflows and outflows, investment assets stocks and liabilities stocks, and income payments to foreign nationals, all as a percent of GDP. It also includes the presence of trade restrictions, such as hidden import barriers, mean tariff rates, taxes on international trade and capital account restrictions (Dreher, Gaston N. & Martens 2010).

A specific indicator measuring trade is available at OECD database. Trade in goods and services is defined as *change between economies' goods and services*. Besides sales of goods and services it also includes barter transactions or goods exchanged as part of gifts or grants between people. It is measured in million USD and percentage of GDP for net trade and also annual growth for exports and imports (Organisation for Economic Co-operation and Development (OECD) 2016a).

Finally, a measure of *global food loss index* was selected from SDGs indicators. Food losses through inefficiencies in the food production chain and waste are a global problem. Food and Agriculture Organization is currently developing global food loss index, which is based on a model using observed variables that conceivably influence food losses (e.g. road density, weather, pests) to estimate quantitative pre- and post-harvest losses (Sustainable Development Solutions Network, Food and Agriculture Organization of the United Nations 2016).

In conclusion, the following indicators of the megatrend "Urban Development" were selected:

1. Annual growth rate of real GDP per capita;
2. GDP per capita (PPP USD);
3. Economic Globalisation subscale of the KOF Index of Globalisation;
4. Trade in goods and services as a percentage of GDP;
5. Global food loss index.



## 1.8. Inequalities

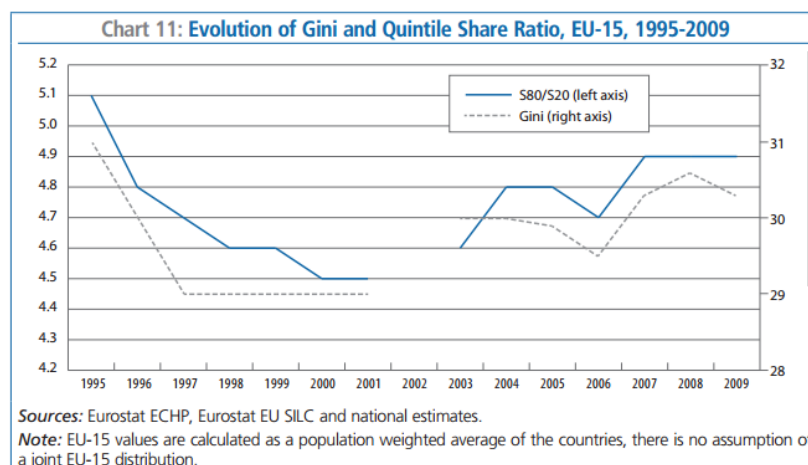
### Inequalities - trend description and drivers

*"These inequities in health are widespread, persistent, unnecessary and unjust, and tackling them should be a high priority at all levels of governance in the Region. Necessary action is needed across the life-course and in wider social and economic spheres to protect present and future generations"* (WHO- Europe, 2013) Review of social determinants and the health divide in the WHO European Region

Policy liberalization, technological progress and productivity increase have led the EU countries to economic growth. However, the last decades had registered a **trend of increase in inequality**, differentiated in EU countries for terms of patterns and timing of changes and worsened in the last eight years following the economic crisis. Among the recognized drivers of this trend are: the growing difference between low and very high earnings, the increasing importance of unevenly distributed capital income, the emergence of long-term unemployment, and job-rich versus job-poor households as well as changes in family structure (Employment and social development Europe – 2011).

Two indicators capture the inequality trend. **The Gini coefficient** measures the extent to which the distribution of equalized disposable income among individuals deviates from a perfectly equal distribution. A value of 0 represents perfect equality, while a value of 1 denotes perfect inequality (i.e. all income in a population accrues to one individual, while the remainder receives nothing).

**Inequality has increased on average across the OECD countries during the period 1980-2010**, with the whole range of Gini coefficients being at a higher level at the end (from 0.23 to 0.37) than it was at the beginning (from 0.20 to 0.33). The high increase of income was experienced in some transition countries: Bulgaria, Estonia, Lithuania, Latvia, Romania and Hungary (GINI Policy Paper, 2013). Another tool to measure inequality is **the income quintile share ratio** the S80/S20 ratio calculates the ratio of total income received by the 20% of the population with the highest income (the top quintile) to that received by the 20% of the population with the lowest income (the bottom quintile). The income quintile ratio highlights the phenomena of the large income growth of a relatively small number of high earners. **"The rise of inequalities due to the rise of the top incomes** has been best documented so far in the US and the UK where incomes at the top started rising steadily after 1979 to either achieve (in the US) or approach (in the UK) century-long highs(..) Since then, the top incomes have risen continuously, while the lower and the middle classes saw their incomes stagnate" (Employment and social development Europe – 2011).



Employment  
and social  
development  
Europe - 2011

## Implications on health and NCDs

Inequality strongly affects the health and well-being of population: income level and security, employment and years of education are among the most important socioeconomic health determinants. Inequalities in health between people with higher and lower educational levels, occupational classes and income levels have been found among and in between all European countries. In addition, many common mental disorders are shaped by the social, economic and physical environments and the social gradient in which people live and work; whereby the greater the social inequality the higher the risk. **People in low socioeconomic groups have at least twice the risk of serious illness and premature death than those in high socioeconomic groups.** (WHO Europe 2015). "Gaining health: the European Strategy for the Prevention and Control of Non-communicable Diseases" stresses how socio-economic disparities affect:





- **Exposure to NCDs:** lower socioeconomic groups are more exposed to tobacco smoke, unhealthy diets, physical inactivity and the excess use of alcohol with consequences for their health outcomes. The report "Review of social determinants and the health divide in the WHO European Region" (2013) contains a number of scientific evidence of this inequality between countries. By the way of example, the graph below indicates the percentage of men that are obese by level of education in selected countries.

**Fig. ES.17**

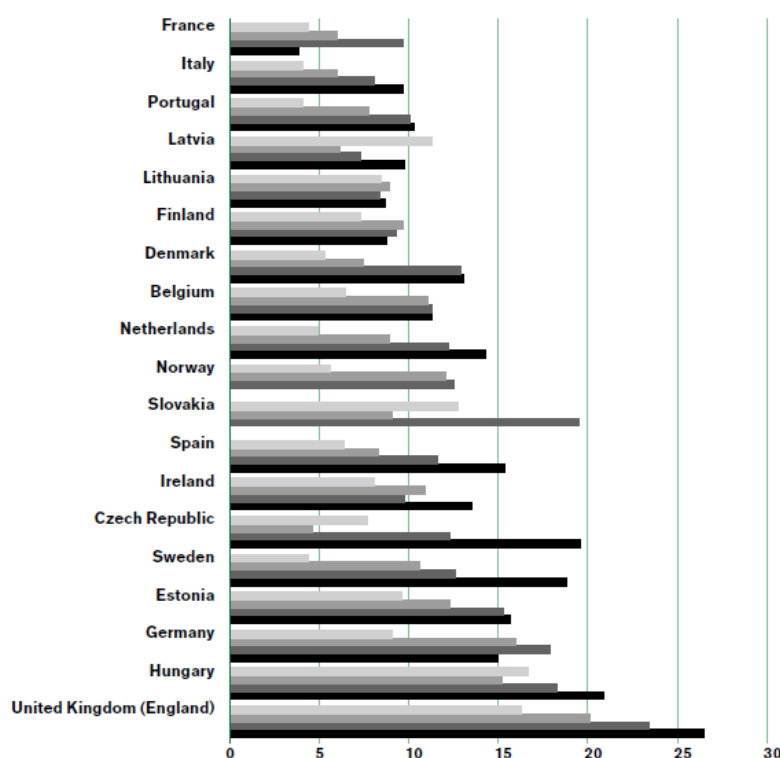
Percentage of the population that is obese<sup>a</sup> by level of education and sex, selected countries, European Region

<sup>a</sup>Body mass index  $\geq 30$  kg/m<sup>2</sup>.

Source: Roskam et al. (37).

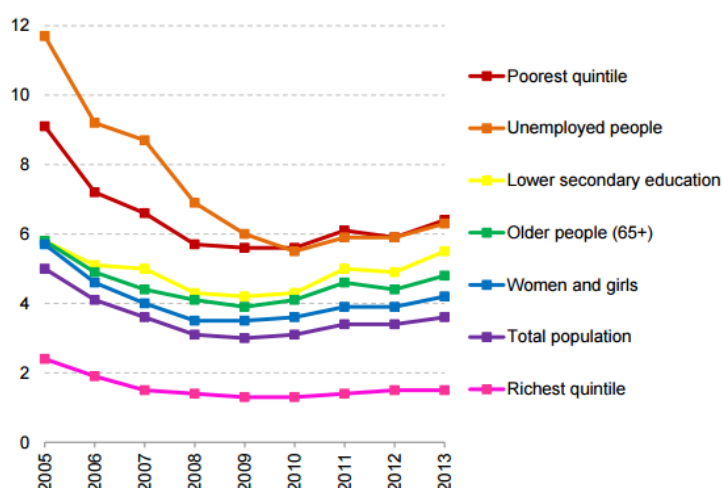
**Men aged 25–44**  
 Highest education  
 Second highest  
 Second lowest  
 Lowest education

Review of social determinants and the health divide in the WHO European Region" (2013)



- **Benefits from health care advances:** higher socioeconomic group have greater access and benefit more from the health interventions. Patients should have reasonable access to healthcare services: they should not have to travel too far or wait too long to access the service they need. There are vast differences in the situation across Europe and margins for improvement in many European countries. In the period 2008–2013, 9 countries recorded an increase of **1 percentage point or more in the share of the population reporting unmet needs for care** and only three countries registered significant improvements in access (Social Europe Aiming for inclusive growth 2014). **Survey data suggest that financial barriers to**

**access are the largest driver of unmet need in the EU.** The figure below shows **how unmet needs disproportionately affect people of lower socio-economic status**, those with greater healthcare needs in general or those who belong to a specific disadvantaged ethnic minority, as well as homeless people and migrants. Moreover, the crisis has resulted in the emergence of new groups that were not previously considered vulnerable due to increased unemployment, especially among young men, and increased household debt problems, particularly for young couples facing housing and job insecurity. (EUROFUND- "Access to healthcare in times of crisis 2014)



Source: Access to health services – summary of preliminary opinion – based in EU-SILC distance and waiting time, EU27, 2005-2013  
Source: Access to health services – summary of preliminary opinion – based in EU-SILC

The **Commission on Social Determinants of Health (CSDH)**, set up by the WHO Regional Office in 2010, has identified the **actions needed** to address health inequities within and between countries across the 53 Member States of the European Region. Based on the evidence assembled, the review grouped its recommendations into four themes – life-course stages, the wider society, the macro-level broader context and systems- and listed **"best buy" priorities in 12 policy areas**. "Progressive steps towards realizing these ambitions should be developed, covering: the life-course – perpetuation across generations, early years, working and older ages; wider societal influences – social protection, communities and social exclusion; the broader context – the economy, sustainability and the environment; and the systems needed for delivery –governance for health, prevention, treatment, the evidence base and monitoring" (WHO 2013).

Inequalities have substantial social and economic costs. The article "Economic costs of health inequalities in the European Union" (Mackenbach et al., 2011) estimated that "Inequality related losses to health amount to more than 700 000 deaths per year and 33 million prevalent cases of ill health in the EU as a whole. These losses account for 20% of the total costs of healthcare and 15% of the total costs of social security benefits. Inequality related losses to health reduce labour productivity and take 1.4% off GDP each year. The monetary value of health inequality related welfare losses is estimated to be €980 billion per year or 9.4% of GDP". EQUITY ACTION, a three-year EU funded partnership formed to advise Member States on practical solutions to reduce health inequalities across the region, estimated in 2016 that "the avoidable cost of health inequalities to European Union Member States is up to €1.3 trillion every year– larger than the entire GDP of the majority of EU countries".

### The search for indicators

The most well-known indicator for measuring inequality is the *Gini Coefficient*. Depending on the measurement methods, the Gini Coefficient ranges between 0 and 1 or 0 and 100; 0 indicating perfect equality and 1 or 100 indicating perfect inequality. It assesses how distribution of an individuals' or households' income differs from a perfectly equal distribution. Data of Gini index/coefficient is available at OECD database and World Bank database. World Bank describes the indicator measurement as follows: "A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality" (World Bank 2016, Organisation for Economic Co-operation and Development (OECD) 2016c).

Additionally, some indicators were added to complement the Gini Index. Income differences in a population could also be analysed by looking at the *share of people living below the poverty line*. This indicator is also included in the Sustainable Development Goals under the first goal "End poverty in all its forms everywhere". Data regarding the proportion of people living below the national poverty line is available in World Bank database (World Bank 2016, Sustainable Development Solutions Network).

In order to get more equitable access to health and to decrease the financial risks related to health, universal health coverage system should be in place. Therefore, it is applicable to look at *the total health care expenditure as a percentage of total public spending*. Data is available at World Bank database, measured as a percentage of GDP. It is the sum of public and private health expenditure (World Bank 2016).

In order to minimize the financial burden of individuals, private spending for health should be minimized. In order to measure private spending in health sector, two more indicators were selected. Share of the *private expenditure in health care expenditure* is measured as a percentage of GDP. Private health care expenditure includes out-of-pocket spending, private insurance, charitable donations, and direct service payments by private corporations. Lastly, one of the most essential factors to decrease inequalities in health is to minimize out-of-pocket payments on health. This is measured as *share of total expenditure on health*, available at OECD database (World Bank 2016, Organisation for Economic Co-operation and Development (OECD) 2016c).

In conclusion, the following indicators of the megatrend "Inequalities" were selected:

1. GINI coefficient
2. Out-of-pocket payments as percentage of total health expenditure
3. Proportion of the population living below the national poverty line
4. Private health care expenditure as share of health care expenditure
5. Health expenditure as a percentage of total public expenditure

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EC, Economic and financial Affairs

[http://ec.europa.eu/economy\\_finance/structural\\_reforms/ageing/index\\_en.htm](http://ec.europa.eu/economy_finance/structural_reforms/ageing/index_en.htm)

EC, Employment, Social Affairs & Inclusion website

<http://ec.europa.eu/social/main.jsp?langId=en&catId=89&newsId=1837&furtherNews=yes>

EC, European Innovation Partnership on Active and Healthy Ageing

[http://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/a1\\_renovated\\_ap.pdf#view=fit&pagemode=none](http://ec.europa.eu/research/innovation-union/pdf/active-healthy-ageing/a1_renovated_ap.pdf#view=fit&pagemode=none)

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EC, Innovation Union website [http://ec.europa.eu/research/innovation-union/index\\_en.cfm?section=active-healthy-ageing&pg=actions](http://ec.europa.eu/research/innovation-union/index_en.cfm?section=active-healthy-ageing&pg=actions)

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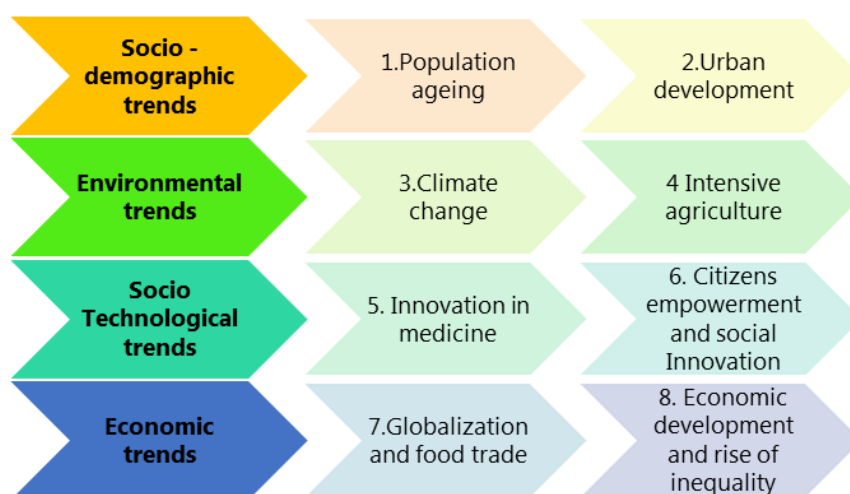
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## **Part II the FRESHER Survey: “What will impact your health the most?” - Questions & Results**

## The Survey's approach

The FRESHER survey “What will impact your health the most?” was launched on the 8th of June 2016 until the 15<sup>th</sup> of July with the aim of eliciting stakeholders’ contributions on the identified trends and their implications for health and NCDs. The survey asked educated guesses from experts in different fields as regards the 8 FRESHER trends.

- **Uncertainty of the trend at 2050** – evaluated according to the scoring system: fully predictable, mostly predictable, predictable, partially predictable, unpredictable trends;
- **Importance of the trend in reducing the incidence of NCDs at 2050** – evaluated according the qualitative scoring system: critically important, very important, of medium importance, of low importance;
- Identify **indicators** that could measure the trend evolution and impact on health and NCDs.



**Figure 3: Trends of NCDs**

The survey was set on-line and disseminated with the support of EPHA, ISINNOVA and AIT. EPHA sent the invitation to the survey to an initial mailing list of 420 experts of the Public Health Community including NCDs representative umbrella organizations, FRESHER Stakeholders Committee, EPHA members, and FRESHER regional participants as well as MEPs & Health attachés from Member States. EPHA also contacted the main European Health Research Projects (CHRODIS-JA, Euro-healthy, ICARE4EU, PASTA, ECONDA) with the request to participate and circulate the survey, which was also shared via social media & newsletter of the EUPHA Section on Health Services Research and via the Health Policy Forum set up by DG SANTE. ISINNOVA distributed the survey among 100 contacts of the foresight community and AIT shared the survey via the Foresight Platform Newsletters.

All consortium partners participated to the survey and the Project Meeting in Vienna (21-22 June 2016) offered the opportunity to discuss the survey approach, the partial results and the subsequent steps of the Scenarios Building exercise.

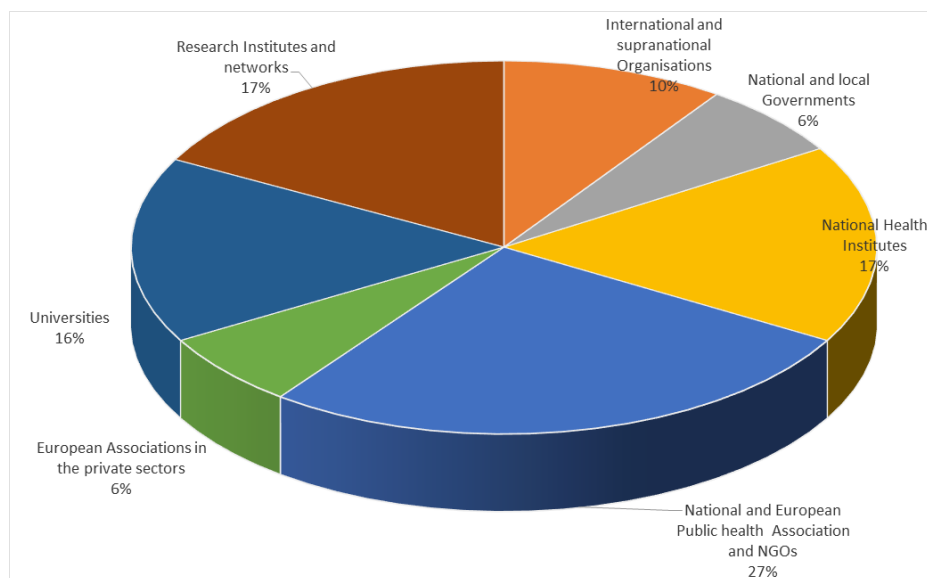
## Who answered the survey?

110 experts with different backgrounds participated to the survey offering inputs and ideas for the ranking of drivers and suggestions for the Scenarios space building. Not all participants filled the whole survey, and for each question between 80 and 90 valid answers were received.

Registered participants mainly included European researchers and academics, policy makers and

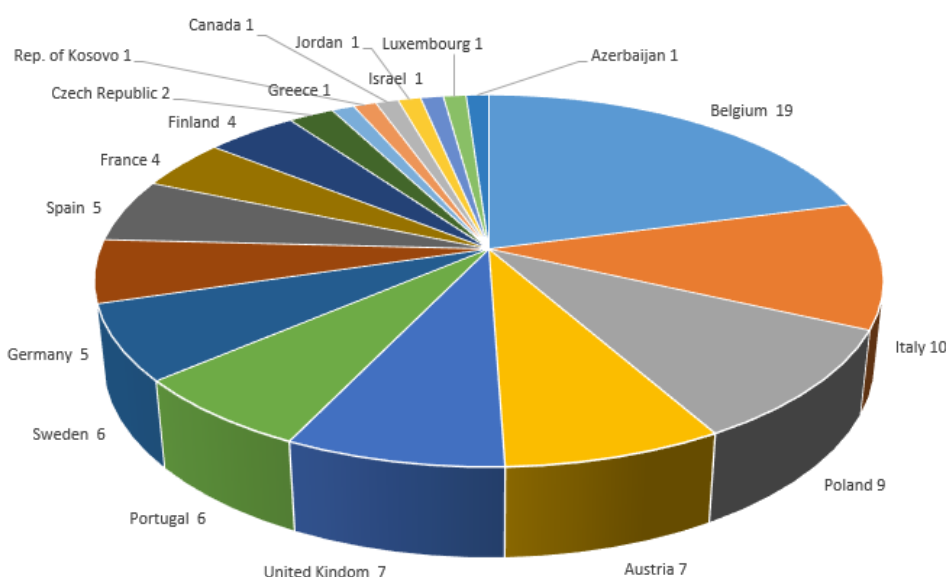


consultants. European and national public health associations and NGOs, with the largest representation, accounted for 27% of the 90 respondents. The analysis indicates that Universities, Research Institutes/Network, and Public Health Institutes accounted for 16%-17% each, followed by International and supranational Organisations (10%), European private health associations and national and Local Governments (6% each).



**Figure 4: Survey's participants by profile**

In terms of geographic origin of the respondents, experts from 15 European countries answered to the survey as well as experts from Republic of Kosovo and four non-European countries (Canada, Jordan, Israel, and Azerbaijan). The different European regions were well balanced with a majority of respondents from Northern Europe (43%) (Belgium, United Kingdom, Sweden, Finland, and Luxembourg), followed by Southern Europe (30%) (Italy, Portugal, Spain, France, and Greece) and Central Europe (27%) (Poland, Czech Republic, Austria, and Germany. ).



**Figure 5: Survey's participants by country**

## 2.1. Demographic change

### When you get older, will you be healthy and active?

European society gets older, and ageing affects all EU countries and most policy areas. By 2025 more than 20% of Europeans will be 65 or over, with a particularly rapid increase in the number of over 80s. Ageing will put additional strain on public finances as a smaller, economically active population is relied upon to provide for the pensions, health care and other needs of the elderly. With over a million refugees arriving on Europe's shores in 2015 alone, migration that has become a top priority on the EU political agenda, can also represent an opportunity rejuvenate our societies. David Stuckler, in a study on the causes and consequences of the leading chronic diseases, analysed mortality rates from cardiovascular and chronic non-communicable diseases in the decades 1960-1980. The population ageing explained 10% of the changes in mortality rates for heart disease and 25% for chronic NCDs, and the rest was attributed to macrosocial and macroeconomic factors. Furthermore, ageing is also associated with an increased risk of a person having more than one disorder. Thus, the rise of chronic disease and multi-morbidity urges a reform of health care systems and the promotion of healthy and active ageing.

Many of the current efforts in different EU Member States revolve around integrated and multidisciplinary approaches, increased use of technological innovations and the strengthening of primary and community care settings for the elderly. While promoting good health has been identified as a key goal of the Europe 2020 strategy, many European countries face the challenge of providing health and long-term care with fewer resources. While people in Europe are living longer on average, their chances of spending these later years in good health and well-being vary greatly between countries and especially between Western and Eastern parts of Europe. The overarching target of the European Partnership on healthy and active ageing has thus been set to increase the average healthy lifespan by two years by 2020.

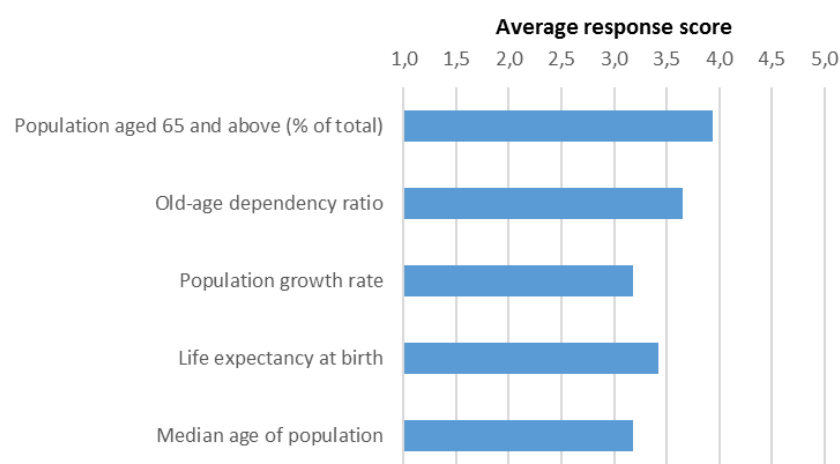
**To what extent is it possible to predict the healthy and active ageing of the European population at 2050? One decimal would be enough in all these tables.**

Fully predictable	Mostly predictable	Predictable	Partially predictable	Unpredictable	Total
1.05%	24.21%	29.47%	42.11%	3.16%	95

**How critical do you think is the promotion of healthy and active ageing for reducing the incidence of NCDs at 2050?**

Critically important	Very important	Important	Of medium importance	Of low importance–	Total
42.11%	40.00%	13.68%	2.11%	2.11%	95

## How relevant is each of the following indicators for measuring impact of this trend on NCDs?



\* Average response score – average of all responses where maximum relevance was coded as 5 down to minimum relevance coded as 1

### Observations:

- Trend considered critically important/very important by 82%;
- Trend considered fully predictable/mostly predictable by 25%;

There is a strong consistency in respondent's comments to this trend around the idea of the key importance of healthy ageing. **The general idea is that the percentage of old people will rise whereas it is uncertain in which conditions and if the society will be able to cover the costs.** One respondent affirms "A target to increase healthy lifespan by two years needs prevention strategies starting early enough (several decades before the age of 65 years). Age and dependency ratios can only predict NCD development ceteris paribus. However, the challenge for NCD incidence and prevalence lies in changes in lifestyle and the (urban) environment as well as healthcare services reform. As the population in industrialized nations continues to age (rather) in good health, the addition of two healthy life years by 2020 is almost guaranteed, irrespective of particular interventions at EU or national level", and another respondent adds "More important than life expectancy is healthy life expectancy. **More years in health promotes well-being and postpones dependency, retirement and health care costs**".

Respondents point out the need for healthy ageing of policies that go beyond "trade or employment" and are able to **promote education, prevention, life style changes, alcohol control among elderly and natural medicine (CAM)**. Three interesting comments offer food for thoughts on health promotion policies:

- "Promotion is important but has to be wise due to high public cost. Promotional campaigns are risk-alerting but indirectly responding to commercial interests **open data would be supportive to better analyses**"
- "The reason I ticked the "medium importance" box on question 3 is the following. The constant emphasis put on health education, health promotion and promotion of healthy individual behaviour has been the overwhelmingly dominant rationality in the context of health policies (especially pertaining to NCDs). Despite lacking results, policies are still stubbornly following this rationale. However, it completely neglects structural causes of NCDs that go far beyond individual behaviour and individual responsibility. **I think changes on a welfare level would**

**be necessary to improve healthy ageing”**

- “How fast the current development will continue is partially predictable. E.g. the case of Glyphosat Shows us very concrete how difficult it is. Everyone wants to be healthy and active aging, but the reality looks quite different, because of the food additives and the ignorance about air pollution. It is not a question of age, it is a question of the place and the circumstances you live with”.

Three respondents underline the need to take into account the **variation of years of healthy life among countries** and the **regional specificity** and possible world’s consequences.

- “The **variation of years of healthy life among countries** is an important (crucial) parameter too, for it helps looking into possible "clusters" of problems. Practice-wise, the reduction of such geographical imbalances should be a priority over the goal to increase the "average" healthy lifespan (which may not, per se, bring about an absolute reduction of incidence of NCDs)”
- “If a population has a median age range of 35 then most of the focus of health care will be directed to the younger population, when this happens the elderly are left out. **Many elderly in eastern Europe depend on their families** for support however with the current migration situation, there is a growing number of elderly living alone in eastern European countries”.
- “I think the ageing affects a to Europe very big problem. If ageing problem in time will not be solved by the population European will grow at the expense of migration of East and Africa”

**As regards the indicators, it was stressed the need to capture the 'active and healthy' aspect.**

“This set of indicators does not capture healthy life years as opposed to DALYs, and it's the gap between HLYs and life expectancy that is most relevant”. One respondent put forward the ideas to include life-style indicators”. The most relevant indicators among the 5 presented for evaluation were two focussing on population ageing, namely proportion on 65+ population and old-age dependency ratio.

## 2.2. Urbanisation development

### Will you be living in a healthy green city?

We live in an urban world and the trend will continue to grow in the future. In 2050, 67% of the world population will be living in cities, with exponential growth of mega-cities and slums in developing countries. In Europe, the proportion of urbanized population was 72.6% in 2010, and is expected to reach 86% by 2050. With more than 80% of global GDP generated in cities (World Bank 2016), urbanisation can contribute to sustainable growth if managed well by increasing productivity, allowing innovation and new ideas to emerge. Economic productivity depends on healthy, happy citizens, who need easy access to education, healthcare, security, food, water, transport, clean air and electricity. The challenge for the future of EU countries is renovating urban space so that the system actually “works” – offering inclusive, safe, resilient, and healthy place for all citizens. Cities’ sustainability require intensive policy coordination, brave investment choices and a multi-disciplinary partnerships between urban planners, parks/recreation officials, transportation engineers, public health officials, and citizens. Beside economic development, sustainable, liveable cities offer social life, and access to services and healthy environment. Healthy environment reduce the risks of NCDs by promoting, as example, active transport mode, ensuring access for all to fresh water, clean air and green space, and encouraging healthy food choices.

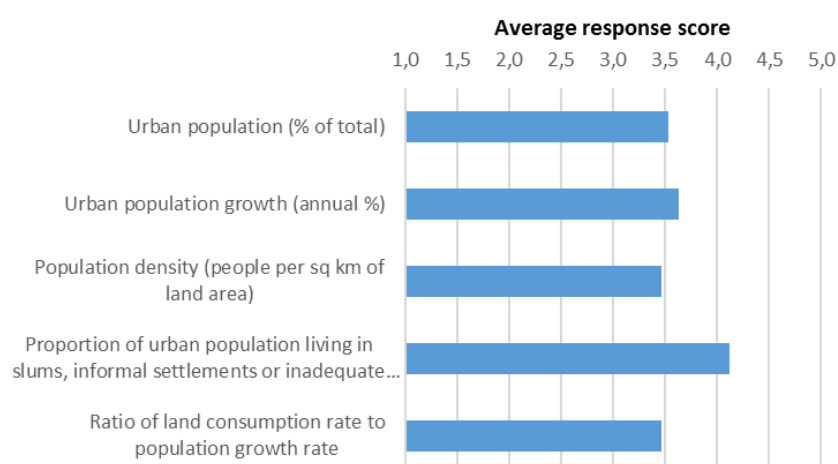
#### To what extent is it possible to predict that European cities will be healthy in the future at 2050?

Fully predictable	Mostly predictable	Predictable	Partially predictable	Unpredictable	Total
0.00%	16.30%	31.52%	44.57%	7.61%	92

#### How critical is for you the movement towards healthy cities in reducing the incidence of NCDs at 2050?

Critically important	Very important	Important	Of medium importance	Of low importance–	Total
27.78%	44.44%	23.33%	4.44%	0.00%	90

#### How relevant is each of the following indicators for measuring impact of this trend on NCDs?



\* Average response score – average of all responses where maximum relevance was coded as 5 down to minimum relevance coded as 1

#### Observations:

- Trend considered fully predictable/mostly predictable by 16%;
- Trend considered critically important/very important by 72%;

There is some consistency on respondent's comments, in the sense that many agree that cities can play an important role to promote healthy environment and life-styles but it is uncertain to what extent it will happen. The increase of population, the land consumption patterns and the provision of healthy food were mentioned as the challenges that healthy cities will face in the next decades. More respondents highlight the role of cities for supporting healthy ageing, guaranteeing equal access to services and for promoting low carbon transition. **Respondents recognise cities as the social and environmental place that can make a difference for individual as well as for collective paradigm shifts.**

However, some comments underline **the 'indirect' impacts** of the city development on the health outcomes. As one respondent puts it "This is clearly an important area but even medium term prediction **can be influenced substantially by policy and economic change**. It is worth monitoring these outcomes but the signal may become 'noisy' in times of social or economic disruption". The latter idea is reinforced by another respondent's statement "Air pollution, noise, living in slums etc. are indicators of NCDs. However, their **effects on the health are mediated mostly by lifestyle factors** (unhealthy diet, smoking, high use of alcohol and drugs). In the long-term, a healthier social environment may increase health. However, promotion of healthier lifestyles (production and availability of healthier food and food products, campaigning for healthier lifestyles) may have a faster impact on the population health"

One respondent calls for taking into account **the type and form of the cities** "Definitions of urbanization vary significantly among countries and the rate of urban population, per se, may not say a lot. Also, urban areas are not, per se, "healthier" (e.g., sprawl does not promote, per se, healthier lifestyles than rural settlements) - the "form" of urban development, and the relation urban/non-urban may be more relevant than the rate of urbanization". In line with this, one stakeholder stressed that "The more the compact living space the higher the risk for illnesses. The population growth, density of land and condition of living area should all be considered especially with the rise of migration".

Two respondents suggested **wild cards** that could release the rate of urbanisation: terrorism, insecurity and environmental disasters.

**As regards the indicators**, proportion of population living in slums was considered to be the most relevant indicator for measurement of urbanisation impact on the NCDs. Several comments and suggestions for further indicators were also made:

- Other indicators needed: % of land use for green spaces, natural environments; % of journeys made by active travel modes; pollution (air quality) data; 'food deserts', etc.
- I would think that environmental contaminants in cities are more relevant than many of these factors: air pollution, heat and extreme weather events, adequate public transport, parks and walking trails, bike lanes etc.
- A critical indicator is "quality of public space", i.e. the norms dominating public space, who has access to public space and what activities is public space enabling.
- Suggestions on Urban population lifestyles which is in great variety across the city areas and producing different impacts. Hotspots on specific behaviours will be helpful and important Customization can tailor better services (circular economy) by focusing health oriented approach: - Natural resources and product consumption that represents an indicator to be



related - Mobility services per area and population -Types of business and local area concentration of business - Quality of services (infrastructure)

## 2.3. Climate change and low carbon transition

### Is climate change the biggest health threat?

Climate change, that is the rise in temperatures resulting from a concentration of greenhouse gases in the atmosphere, is the result largely of human behaviour. A rise in temperature of 2°C will bring about catastrophic effects, in the form of storms, floods, droughts and heat waves. In EU countries, it is estimated that mortality increases by 1–4% for each -degree rise in temperature, meaning that heat-related mortality could rise by 30,000 per year by the 2030s, with 50,000 to 110,000 deaths per year by the 2080s. Interacting with social, economic and demographic dynamics, climate change could influence the quality and availability of land, food, water and ecosystem services in general. Energy is essential for economic growth, but with 70% of all GHG emissions that result from burning fossil fuels for energy, if we want to achieve both economic development and climate resilience we need to decarbonise our energy system and invest in low carbon technologies. A low carbon transition produces multiple positive impacts on health. It would reduce climate-related illnesses such as temperature-related mortality and morbidity, vector-borne and rodent-borne diseases, water and food diseases and shortages, and those induced by air pollution, such as cardiorespiratory disease and lung cancer.

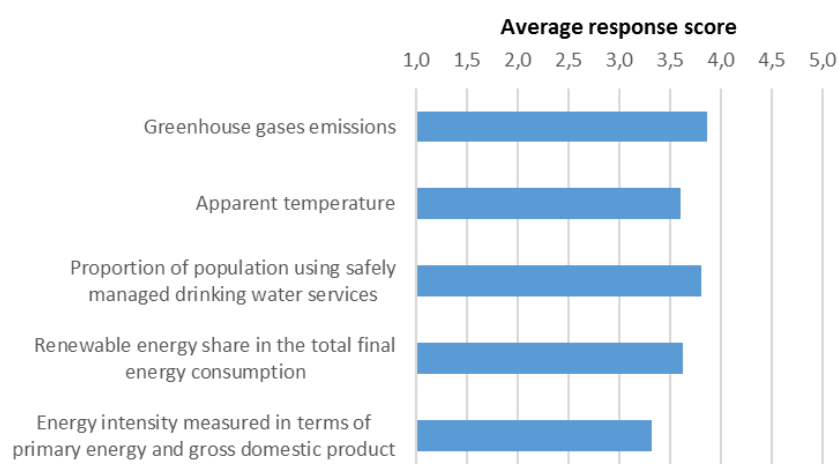
### To what extent is it possible to predict the development of a low carbon economy and society at 2050?

Fully predictable	Mostly predictable	Predictable	Partially predictable	Unpredictable	Total
4.65%	18.60%	37.21%	32.56%	6.98%	86

### How critical is the decarbonisation of our society in reducing the incidence of NCDs at 2050?

Critically important	Very important	Important	Of medium importance	Of low importance–	Total
21.18%	36.47%	27.06%	11.76%	3.53%	85

## How relevant is each of the following indicators for measuring impact of this trend on NCDs?



\* Average response score – average of all responses where maximum relevance was coded as 5 down to minimum relevance coded as 1

### Observations

- Trend considered fully predictable/mostly predictable by 23%;
- Trend considered critically important/very important by 58%;

Besides the limited direct impacts on NCDs, several respondents recognise the low carbon development and the fight to climate change as condition sine qua non for a healthy future. One respondent stresses as "Climate change is the single most important factor - there is no point in 'healthy ageing' etc. when our living environments / habitats become uninhabitable". In this same line, one respondent admits, "that global warming might not be overly crucial for NCDs, but totally crucial for general health and well-being" while another one says that, "An unfavourable climate change has harmful effects of life and health. Its impact on NCDs during the following decades may be small". Conversely, one respondent highlights "Relevant issues, but not only influencing general condition. This is a major political issue that will indirectly affect health either through changes in disease distribution or its economic impact. The more immediate effects on some NCDs will be mediated by air quality which is particularly relevant for respiratory but also cardiac disorders".

A couple of respondents put forward the risk of trade-off between land for food and land for energy in a low carbon economy and the need to take into account the food energy-water-nexus. Two respondents link the uncertainty on this trend to the world leaders' capacity to decouple economic growth from energy consumption. "The most recent studies cast significant doubts on the possibility to limit the global temperature rise below 2 - and basically exclude the possibility to limit it below 1. Moreover, COP21 in Paris ended without any kind of binding agreement. Europe may be capable to restructure its own economic system to a low carbon one; but it's extremely likely that this will not be the case for the rest of the world: I am sceptical of the possibility of achieving a global low carbon economy and society at 2050 - only through a radical change in the global political economy (including the overcoming of capitalism) that may be possible". In addition, one respondent spots some challenges of the transition toward the low carbon economy "This issue requires to change approach in many activities, and requires short term incentives, long term plans and not only imposing duties on behaviours on aged/disabled/poor citizens that are tax payers. The market society is not easily replaced by the circular economy".

**As regards the indicators,** greenhouse gas emissions and availability of safely managed drinking water were considered to be the most relevant indicators for measuring impact of low carbon economy and society on the NCDs among the 5 indicators presented for rating. However, opinions are divergent on the proposed indicators as expected with comments related to the need for better definitions of the indicators in relation to NCDs and to more specific linkages between renewable energy management and wellbeing aspects:

- The share of renewable energy in total energy consumption is probably just a proxy value for the wealth of a society and therefore is likely to be correlated with active and healthy ageing.
- Measuring particulates in the air in urban areas is a relevant means to assess exposure to pollutants. Renewables have the potential to clean the air but so does the better management of the burning of fossil fuels (road use restrictions, more care with industrial processes etc.). When we favor clean energy technologies we need to do so in a way that promotes activity and well-being if we want to maximise the impact of these technologies on NCDs. Otherwise, we could have a cleaner environment and less healthy people at the same time
- Re. renewable energy share - should be defined according to whether (air) polluting (combustible biofuels), non-polluting (solar, wind, etc.) or other (nuclear) to be relevant to NCD impacts.
- Renewable energy has to be defined (and possible also re-defined) according to technical progress.

Among the other comments:

- There is a need to limit the number of internal combustion vehicles.
- I am assuming water, temperature and air quality are important in this order

## 2.4. Industrialised agriculture

### What future for agriculture and health?

Modern, intensified agriculture has led to abundant food production, even over supply, but with serious impacts on ecosystem degradation and biodiversity loss, air pollution and GHG emissions increase. Intensive livestock, antibiotic overuse in veterinary medicine are closely linked with the infections caused by antibiotic resistant bacteria while the increased use of pesticides pose threats to farms workers. In addition, agriculture production determines our food environment, the choices we have and the nutritional components of various vegetable. Policies designed to increase greening and make agriculture more sustainable could be beneficial to the environment and to human health. Aligning health and agricultural policy presents a number of challenges, but also brings significant benefits.

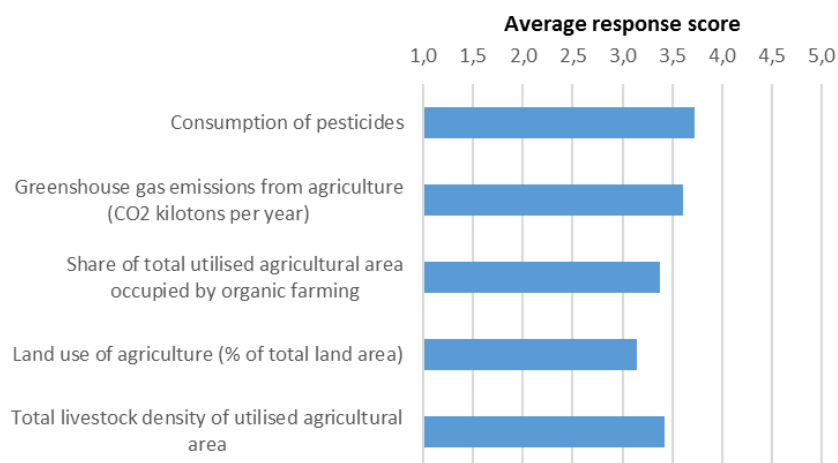
#### To what extent is it possible to predict an integration of health and agriculture policies at 2050?

Fully predictable	Mostly predictable	Predictable	Partially predictable	Unpredictable	Total
3.57%	19.05%	26.19%	45.24%	5.95%	84

#### How critical is the role of integrating health and agriculture policies for reducing the incidence of NCDs at 2050?

Critically important	Very important	Important	Of medium importance	Of low importance–	Total
28.57%	36.90%	23.81%	7.14%	3.57%	84

#### How relevant is each of the following indicators for measuring impact of this trend on NCDs?



\* Average response score – average of all responses where maximum relevance was coded as 5 down to minimum relevance coded as 1

#### Observations:

- Trend considered fully predictable/mostly predicable by 23%;
- Trend considered critically important/very important by 65%;

Opinions are divergent on this issue; respondents have opposite opinions on the relative importance of the agriculture reform for NCDs. Taking a policy perspective, the comments reflect

opposite views on the extent by which the food choices should be regulated and on the role of economic growth and/or government will play to steer the change.

- “I would think that it is very important to improve the nutrition of food consumers to impact upon NCDs and therefore it is a mix of both agricultural and industrial policies that would be needed - as well as voluntary/stakeholder agreements to encourage shifts in food availability that benefit industry, agriculture and consumers. Therefore a possible indicator would relate to the diets of the population and how we might shift them in future toward unprocessed vegetables, fruits and sustainable proteins and away from chemicals and sugar”.
- “I think radical changes in the food system are crucial. Healthy diet promotion focused on individual choice/responsibility and behaviour are useless (even worse than useless I would say actively detrimental to some social strata) as long as agricultural (and trade) policies are in contradiction with health policies. I am a firm believer in the "Health in all policies" agenda”
- “The current mass production and its circumstances are responsible for the most NCDs”
- “For NCDs prevention, more plant-based diets are crucial. To that extent indicators about livestock and the type of agriculture conducted on land used for agriculture are crucial”.

While others consider the shift toward healthy agriculture policy relatively less important in comparison to others policies:

- “Again, the change towards "green agriculture" is of course a very important, necessary and welcome one. However, it usually correlates simply with the level of wealth in a society that has decided it wants to afford more expensive but more sustainable agriculture”.
- “I set agricultural policies as 'low importance' in question 15 as relative to other factors that I see as more important, e.g. tobacco control, alcohol control, sugar tax, locations of fast food shops near schools, urban spaces that promote physical activity (e.g. cycling) and clean air etc.”.
- “Again, I think NCDs is a too narrow concept for agriculture policy, similar to global warming”.

Similarly, respondents have opposite views as regard the pesticide. “A balanced Earth-human approach is to be addressed in short term. Progress into new pesticides will not be the only solutions. A systemic monitoring could be foreseen through big data systems for risk reduction beyond insurance”. While one respondent “think pesticide use is the greatest contributor to at risk production. Organic farming will reduce the health risk factors and should be greatly considered”.

A couple of respondents recall the need to refer to antibiotic resistance “The most direct impact on health will relate to the rise in antibiotic resistant organisms which will have particular impacts on the ability to treat pneumonia and other forms of acute sepsis. Agribusiness is related to the growth of obesity but managing this requires a broader approach to health and behaviour so numbers suggested here will not really capture that issue”. In addition, “antibiotic resistance is a topic that should be mentioned in this respect”

As regard the opportunity for a transition, one respondent highlighted that “this is one sector in which a change is more likely to happen even in absence of systemic change - technology, global wealth increase and market demand may be crucial”

**As regards the indicators,** use of pesticides and emission of greenhouse gases from agriculture were rated as the most relevant among the 5 presented for rating under this trend. Additional comment provided raised the question whether indicators under this trend should also capture nutrition aspect of food supply, e.g. fresh vs processed foods.

## 2.5. Innovations in medicine

### Innovation: a new technological wave?

According to *"Surfing the sixth wave. Exploring the next 40 years of global change"* published by Finland Futures Research Centre (2012), we are experiencing a 'socio-technologic paradigm shift', described as the shift from ICTs (1970-2010) to intelligent technologies (2010-2050). The new wave would primarily be driven by resource efficiency because of environmental strains and increasing scarcity of natural resources. The development of new technologies, such as biotechnology and nanotechnology, combined with exponentially growing ICTs (NBIC) would become the major driver of the 6<sup>th</sup> wave. The new wave opens up a world of opportunities in the medical field such as genomics, stem cells, new pharmaceuticals, medical devices, imaging and diagnostic devices, new surgical approaches, digital medicine and the wireless revolution. The technological change is foreseen as more rapid and multidisciplinary than before, which has led to the question of how best to prepare human capital to surf the next technological wave. These new solutions may also exacerbate existing tensions regarding class disparities, increase privacy protection issues exponentially and create new, unexpected cultural threats.

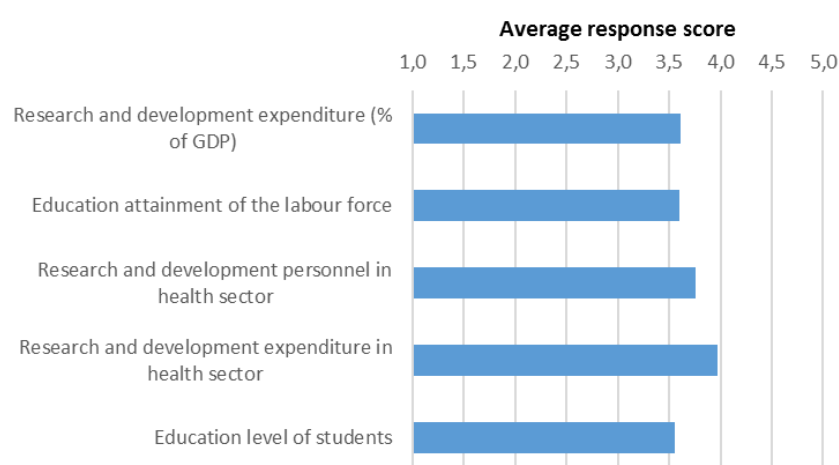
#### To what extent is it possible to predict a new wave of medical innovations at 2050?

Fully predictable	Mostly predictable	Predictable	Partially predictable	Unpredictable	Total
1.20%	20.48%	26.51%	40.96%	10.84%	83

#### How critical is the role of medical innovations in reducing the incidence of NCDs at 2050?

Critically important	Very important	Important	Of medium importance	Of low importance–	Total
23.46%	34.57%	22.22%	14.81%	4.94%	81

#### How relevant is each of the following indicators for measuring impact of this trend on NCDs?



\* Average response score – average of all responses where maximum relevance was coded as 5 down to minimum relevance coded as 1

#### Observations:

- Trend considered fully predictable/mostly predictable by 22%;



- Trend considered critically important/very important by 58%;

While all respondents recognise the importance of (disruptive) innovations for treating NCDs, several cast doubts on the relative importance of these innovations for controlling and preventing NCDs, especially in comparison with educational policies. In addition, one respondent puts forward the questions related to who will own the patents of the technology advancements and to the extent by which society will be able to benefit from them.

- “I personally do not think that medical innovation (despite its undeniable crucial importance in other domains) is an important aspect in NCD reduction. In my opinion, reducing inequalities, improving the welfare state, focusing on accessibility of quality primary care as well as accessibility of education is important. Also, making agricultural and trade policies more health sensitive would improve health on a far larger scale than expensive high tech medical improvements, that ultimately would only widen the health gap”.
- “Also in this field, significant (technological) disruption is likely to happen even in the persistence of the status quo. However, it is crucial the level of public spending (basic research, which is unlikely to be carried out by private actors); and the extent to which the society at large will benefit (while trends for the privatization of health systems, the UK being a case in point, suggest the opposite). Finally, I am not sure (but have no specific competence to judge) whether the investment in technological devices is more efficient, to promote healthy living, than redistributive policies to attack the structural reasons connected with NCDs - this is why i don't deem this field among the most important”.
- “The basic factors driving healthy lifestyles are already known today. Medical innovations may in the future help us tackle modern "plagues" such as diabetes, but they will not in themselves promote active and healthy ageing”.
- Medium-to-low importance as NCDs are preventable so most efficient focus should be on avoidance and prevention, rather than treatment.
- The crucial is education, especially young people.

One respondent points out that the type of innovation that are more likely to influence NCDs prevention are related to real-time monitoring and health and genetic data-base:

- “If question 19 was about the role of innovation in reducing the impact of NCD's then I would have chosen critically important because innovations such as personalized medicine, 3D printing of human tissue, nanobots, etc. are likely to improve prognosis **while innovations in real-time health monitoring may allow for earlier detection/diagnosis and also improve prognosis**. I would look at medical patents and trends in the size and scope of sectors such as **medical device, pharmaceutical, biotech**. Also interesting is the number and focus of clinical trials that are underway and the general growth in electronic health data, genetic databases and the processing power of computers”.

Two respondents stress the need to accompany the technological innovation by investments for upgrading the competences and skills of researchers and medical workers. “Evidence based practice is essential for effectiveness. If there is a low percentage of researchers and developers, it will negatively impact the growth of improvement technology”. In the same line “It is not about the education level of students or health professionals but about their ability to use ICT and innovative tools for the benefit of patients and to provide quality care. There are too many degree programmes of low quality, and graduates often lack basic skills, including research skills”.

While two respondents highlight the aspects related to the access to medicine and the need of major investment in research and innovations "Access to safe medicines and control over sales of medicines is also extremely critical. Companies and universities should also be given incentives to innovate". "If the potential of these new approaches are to be realized (a big 'if' in my view) then investment in Europe in these research areas is essential for both medical and economic reasons".

Finally, several respondents call for a recognition and integration of complementary and alternative medicine:

- This trend does not appear to include at all the role in general health literacy, in healthy maintenance, in motivation of and support for healthy lifestyle change provided by complementary and sustainable healthcare, CAM in the prevention and more sustainable treatment of NCDs.
- Natural Medicine should be studied further in order to maintain a healthy condition by active prevention.
- The most relevant indicator would be the shift of paradigm: 50% Conventional Medicine and 50% Complementary and Alternative Medicine.
- Tricky. If you had included alternative and natural medicine, I would say research is extremely relevant. It is, in my view, a great missed opportunity to narrow innovation to "genomics, stem cells, new pharmaceuticals, medical devices, imaging and diagnostic devices, new surgical approaches, digital medicine and the wireless revolution."

**As regard to indicators,** research and development expenditure was considered the most relevant indicator of measurement of potential medical innovations and their impact on NCDs. However, a cautionary comment was also provided that measurement of "innovations" may be difficult and may only be done retrospectively.

## 2.6. Citizens empowerment

### Will people have the power?

The empowerment process implies the enhanced capacity of citizens to make choices and act consequently, promoting a self-determined change. Taking a global perspective, EU citizens are in a favourable position that allows them to increase their knowledge and participation and to inspire change. EU countries have been consistently ranked high in terms of **human capital development**, according to the UN Human Development Index (HDI), and for **freedom of speech, internet access and web freedom** following the Freedom in the World Report. However, the lack of digital skills – 47% of European citizens have no or little digital skills – could hamper their effective participation in tomorrow's digital society and e-health.

**Patient Empowerment (PE) covers situations where citizens are encouraged to take an active role in the management of their own health**, transforming the traditional doctor-patient relationship and providing citizens with real management. Empowerment of citizens is gaining momentum among public and private institutions, partly due to the opportunities to provide effective services while reducing health care costs. Countries are setting eHealth strategy, plans and initiatives (out of the 53 members of the WHO European Region, 30 have a national eHealth policy) and public and private stakeholders are investing in new mobile technologies. However, there is also an increased need for educational and organizational solutions and effective communication, without which the new technology could create a new divide.

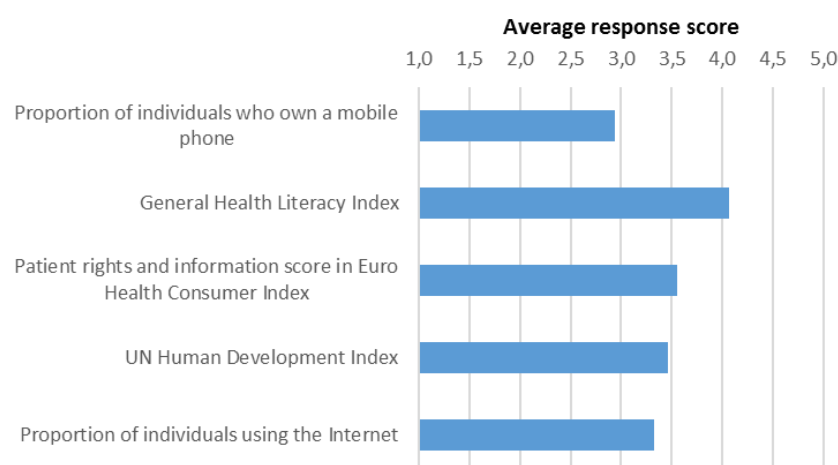
#### To what extent is it possible to predict citizen empowerment at 2050?

Fully predictable	Mostly predictable	Predictable	Partially predictable	Unpredictable	Total
1.23%	11.11%	25.93%	50.62%	11.11%	81

#### How critical is the empowerment of citizens in reducing the incidence of NCDs at 2050?

Critically important	Very important	Important	Of medium importance	Of low importance–	Total
25.93%	30.86%	30.86%	9.88%	2.47%	81

#### How relevant is each of the following indicators for measuring impact of this trend on NCDs?



\* Average response score – average of all responses where maximum relevance was coded as 5 down to minimum relevance coded as 1

## Observations

- Trend considered critically important/very important by 57%;
- Trend considered fully predictable/mostly predictable by 12%;

Most of respondents recognise the importance of citizens' empowerment and the role of internet and mobile device for supporting this process.

- "Indeed, citizen empowerment can play a "direct" role. More importantly, citizen empowerment is crucial to trigger those structural changes that, through reduction of inequalities, can improve dramatically the overall health of European societies. The possibility for a real, holistic empowerment to happen is interlinked with the political transformation Europe is undergoing - and it's hard to predict whether democratization of authoritarianism will prevail".
- "I would say patient empowerment is very important because ultimately the success of therapies depends upon lifestyle changes, appropriate care and the patient's close monitoring of their symptoms/progression. Technology will increasingly help patients to monitor their care and to share results with their health care teams but such effort first requires engaged patients. I suggest changing the first item to mobile smart device - it may not be a "phone" in a few years' time. Access to high-speed internet services is extremely relevant to effective use of monitoring devices as well as access to patient portals, relevant information and providers. If find "using the internet" is less important because if you don't have a high quality internet connection at home, it would be difficult to participate in the digital society".
- "High levels of health literacy are certainly important to tackle the challenge of chronic diseases. Mobile phone ownership and health system indicators such as the one by the Health Consumer Powerhouse cannot in my opinion provide meaningful indications for future NCD trends".
- "Mobile technologies offer a great chance to healthy people and patients' empowerment".
- "If people do not have internet access, it would reduce service user empowerment".

However, health education, self-awareness and digital health literacy skill are a precondition for surfing on the information available and making the best of the health opportunities offered by the new devices.

- "Access to mobile phones and internet only relevant if person has digital health literacy skills to be able to fully use the opportunity to access and use health information."
- "The language of 'empowerment' is often overused. Accessing information alone does not empower anybody, and even the ability to take health decisions independently does not lead to long-term empowerment. Technologies etc. can help people access information and cope better, but they are not a panacea for reducing NCDs."
- "The skill in searching for professional medical information in websites may result in improved self-awareness of health problems."
- "Citizens empowerment only focused on digitalization is nothing. Empowerment is more, getting a feeling and access to my own body. Internet access and electronic devices could support. But the feeling and access to my own body is first. This has to be taught. Teaching responsibility for the natural status of life should be started at school."
- "Health prevention and empowerment should be part of the basic school system and education".

- “Though not sure empowerment can or should be narrowed down to ... digitalisation?”
- “The vision for citizens should aim to develop a good status of mind. Avoid to create the “patient society” with continuous energetic needs, the status of ill or scaring people.”

Two respondents put forward the risks that, without a proper internet regulation and health education, the net can be a trap where “commercial interests prevail” leading the citizens to “self-medication and self-diagnosis”. While another respondent spots the risk that focusing on citizens’ empowerment as instrumental for shifting public responsibility toward citizens’ health at individual level. “Education (education in general, including health education) is of most crucial importance, and of course empowerment is a very positive improvement. But obstinately focusing on individual responsibility is dramatically missing the point. It follows a neoliberal rationality aiming to discipline individuals into health conscious citizens while subtly justifying a decrease of State intervention. It does not help in reducing inequalities and fails to acknowledge structural causes of NCDs”..”

One respondent calls for a more comprehensive vision in which citizens’ empowerment is part of health care paradigm shift direct to educate and maintain citizens’ health, not just cure them. “eHealth tools are only a support for the development of self-empowerment for health. Emphasis on them here misses the core point that health services and interventions are currently predominantly reactive to poor health. A paradigm shift to restructure health care in terms of maintaining health and providing the education necessary to all citizens is the key to empowerment. Why is this not included here?”

In the same line, two respondents highlight that citizens’ empowerment will not happen without a more general shift in the society toward a more community and social networking life.

- This remains a very uncertain area. There is a difference from seeking information on the internet and doing so as an adjunct to a traditional medical consultation. The impact of wearable apps is still unclear and often driven by commercial hype rather than by evidence of improved clinical outcomes. The fact sheet does not take account of the impact of social networking which will change the way people get information and advice about disease and its management.
- This is NOT just about individuals. It is not just about citizens. Citizen empowerment is about public space - its quality, openness, inclusiveness; citizen empowerment is about social networks - trust among community members, participation in community affairs, and the diversity of networks. Social interactions in diverse and enabling social networks thrive in public spaces that are NOT dominated by corporations, but by the communities themselves - this is a major but disregarded factor in health, well-being and NCDs prevention.

**As regard to indicators,** the General Health Literacy index was rated to be the most relevant among the 5 indicators presented for rating for measurement of citizen empowerment impact on NCDs. From the comments section, one stood out: “Access to internet might be more important as source of information than owning a mobile phone. UN HDI seems to be closely connected to Health literacy index.”

## 2.7. Globalisation and food trade

### Do you choose what to eat?

Globalisation, or the increased interconnection and integration of world trade, capital and people, has skyrocketed over the past forty years, with global trade increasing exponentially and the global value of the food trade nearly doubling. Globalisation has had mixed effects on public health, with accelerated economic growth and technological advances enhancing health and life expectancy for some, and deteriorating social and environmental conditions and the exacerbation of income inequality worsening health for others.

Globalisation directly affects the development of non-communicable diseases through economic changes, such as household income, government expenditure, exchange rates and prices, and indirectly affects it through the increasingly globalised production and marketing of tobacco, alcohol, and other products that negatively affect health. While globalisation has improved food availability, accessibility and affordability, it has also led to increased consumption of foods high in fat, sugar and salt, which have contributed to rising rates of obesity and diet-related chronic diseases like heart disease, diabetes and some cancers.

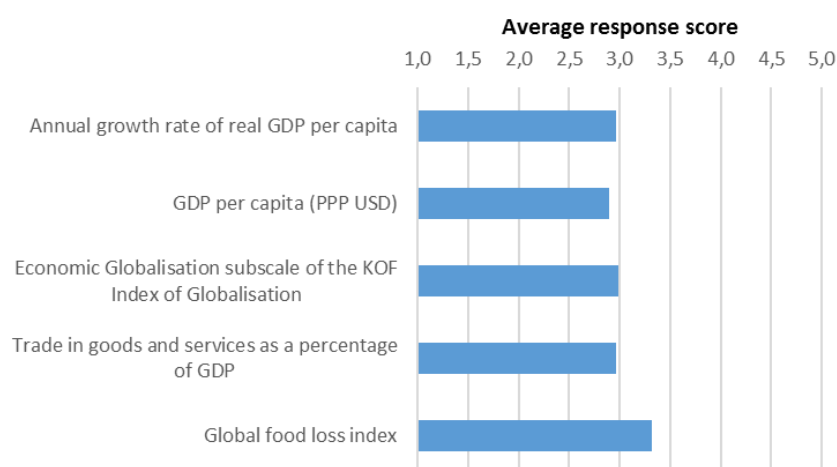
#### To what extent is it possible to predict an integration of health and food trade policies at 2050?

Fully predictable	Mostly predictable	Predictable	Partially predictable	Unpredictable	Total
3.66%	23.17%	26.83%	35.37%	10.98%	82

#### How critical is the role of integrating health and food trade policies for reducing the incidence of NCDs at 2050?

Critically important	Very important	Important	Of medium importance	Of low importance–	Total
34.57%	37.04%	18.52%	8.64%	1.23%	81

#### How relevant is each of the following indicators for measuring impact of this trend on NCDs?



\* Average response score – average of all responses where maximum relevance was coded as 5 down to minimum relevance coded as 1



## Observations

- Trend considered critically important/very important by 72%
- Trend considered fully predictable/mostly predictable by 27%

Respondents agree on the importance of globalisation, in general, and food trade, in particular, for prevention of NCDs. A couple of respondents consider this trend predictable in the sense that political could frame globalisation in a public health way.

- "Globalised trade can occur in a public health friendly way if there is political will to do so. Not in the current economic climate, however."
- "Food trade is highly policy driven; therefore it is highly predictable in case the policy makers are willing to talk with you about that. On the other hand it is depending on safe trade streets and therefore on the global politics, which are not well predictable".

Conversely, other two respondents link the food trade with economic activity and its unpredictability:

- "Clearly this underpins health as it measures global economic activity. Its predictability remains less certain ... as economists have known for the last 150 years."
- "Also, this is a field of high unpredictability. The TTIP is a point in case: in case it was approved, the result could be dramatic, especially for quality of food in Europe; but the recent EU referendum in UK may have halted its approval and dramatically change the future prospects."

The role of the country and the region to promote healthy food supply is stressed in the following comments:

- Trade is connected also with domestic industrial policies regarding the food supply. I don't see one without the other. It seems it would be relevant to investigate the degree to which a country is able to supply its population with healthy perishable foods which should enable food to be fresher and of better quality for consumers. If healthy foods are imported then they might cost more and have a lower nutritional value due to the need to preserve them over long transportation times (early picking, gassing, radiating). I suggest examining trends in the prices of healthy foods, the prices of fast foods and the prices of unhealthy snack foods (candy, pop, chips). Where I live, the price of fresh food has gone up a lot within the past 12 months and the price shock has surely affected upon consumption of fresh fruits and vegetables.
- There is no hope. The global food trade of today is part of the problem. The future is in the regions...

Among the policy actions list by respondents for promoting a healthy food trade system are the "implementation of restrictions on the content of salt, sugar and sweet" and the fight to fraud and alterations. "The food industry is definitely important. There is difficult to track the quality due to frauds, alterations, origins, treatments etc. The quantity aspects of artificial ingredients and processes are relevant at individual level. Inflammatory and membranes effects are generated through foods and drinks that looks ok. Young and middle age citizens are not fully aware and are used to".

**As regard to indicators,** global food loss index was rated the most relevant. However, the overall ratings of indicator relevance were quite low compared to indicators under other trends indicating less-than desirable fit of the indicators with the trend description. This is also reflected in the comments section:

- The above indicators are measuring aggregate values of an economy as a whole. These values are proxies for the aggregate wealth of a population. But it is difficult to imagine how they can help us measure the future development of NCDs.
- Indicators would be needed on trade in certain kinds of food stuffs, including health-harmful commodities, especially sugar, high-fructose syrups, highly processed foods incl meat products, foods containing transfats, highly sweetened cereals, sodas, alcoholic drinks, etc.
- For NCD prevention and achievement of the SDGs, there needs to be a NEW measurement of economic productivity. Growth and GDP are outdated. The Social Progress Index MUST be an indicator. Another indicator ought to be WHAT is actually being traded. Is the West exporting Big Macs or will the share of goods traded become bigger with regards to plant-based diets?
- The quality of food products and the proportion of healthy food-products on the market may be the best indicators for measuring impacts of food trade impacts on the trend of NCDs. Given the crucial relationship between globalization (or, to be more precise, neoliberal globalization), global patterns of equality/inequality and health attainments, there is a need to go beyond national economic indicators to understand the future patterns in this field - e.g. GINI and other economic polarization indexes, maps of socio-geographic distribution of wealth, indicators of levels of regulation at the national and global level.

## 2.8. Inequalities

### Will the future be fairer?

Policy liberalization, technological progress and increases in productivity have led the EU countries to economic growth. However, recent decades have seen a trend of increased inequality, worsened over the last eight years by the economic crisis. Two indicators, the GINI coefficient and the income quintile ratio, clearly show an increase in inequality among EU countries, differentiated in EU countries in terms of patterns and timing of changes. Inequality strongly affects the health and well-being of populations: income level and security, employment and years of education are among the most important socioeconomic health determinants. People in low socioeconomic groups have at least twice the risk of serious illness and premature death as those in high socioeconomic groups. (WHO Europe 2015). Socio-economic disparities affect people's health by: Increasing exposure to factors causing NCDs: lower socioeconomic groups are more exposed to tobacco smoke, unhealthy diets, physical inactivity and the misuse of alcohol with consequences in their health outcomes;

Limiting access to and benefits from health care: lower socioeconomic group have greater unmet healthcare needs due to financial barriers. The Commission on Social Determinants of Health (CSDH) has identified the actions needed to address health inequities within and between countries across the 53 Member States of the European Region. Based on the evidence assembled, the review grouped its recommendations into four themes – life-course stages, the wider society, the macro-level broader context and systems - and listed "best buy" priorities in 12 policy areas. The actions would lead to social benefits as well as economic ones. Inequality has a high cost in terms of social cohesion and healthcare, labour productivity and social security. Mackenbach et al., 2011 estimated that losses due to inequalities accounted for 20% of the total costs of healthcare and 15% of the total costs of social security benefits in EU countries.

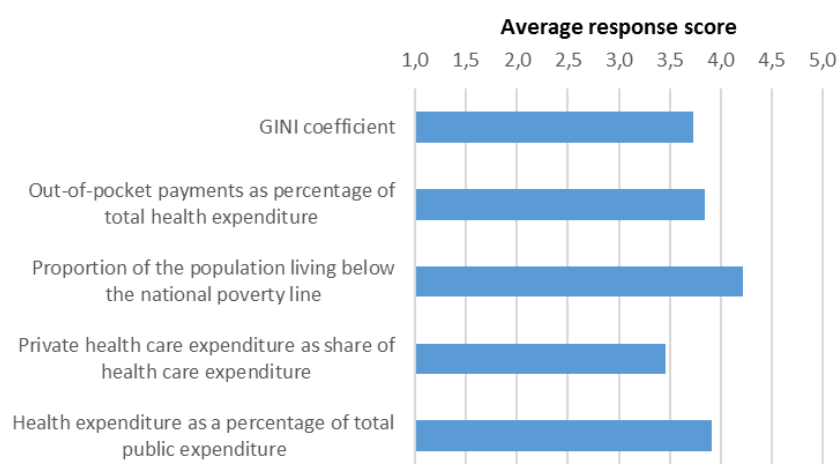
#### To what extent is it possible to predict a more fair and equal Europe at 2050?

Fully predictable	Mostly predictable	Predictable	Partially predictable	Unpredictable	Total
0.00%	8.64%	24.69%	50.62%	16.05%	81

#### How critical is the role of fighting inequalities in reducing the incidence of NCDs at 2050?

Critically important	Very important	Important	Of medium importance	Of low importance–	Total
37.50%	38.75%	21.25%	2.50%	0.00%	80

## How relevant is each of the following indicators for measuring impact of this trend on NCDs?



\* Average response score – average of all responses where maximum relevance was coded as 5 down to minimum relevance coded as 1

### Observations

- Trend considered critically important/very important by 76%;
- Trend considered fully predictable/mostly predictable by 12%;

The majority of respondents agree on the importance of equality for preventing and treating NCDs as well as on the unpredictability of this trend due to the current economy stagnation, the linear cuts and policy tensions:

- “It is certainly possible to look at long-term trends in inequality but it is difficult to forecast the future in this regard as there are tension within the EU that threatens its long-term stability and therefore the ability of individual countries to sustain healthy economies that permit addressing inequalities. I would think that this question requires producing a forecast under different scenarios (economic growth, economic stability, and economic disruption/instability). Inequalities in incomes and in access to care are noted above but missing are inequalities in health status/healthy-life expectancy that are related to education and income.”
- “This area is important for welfare of society in general. Linear economic cuts are not right and savings require in some country optimization or total new approach of health & solidarity such as city medical centres or mobile doctors' units. There is a need to better monitor and provide understanding of local and micro level of citizens needs to prevent deterioration. New services (Huber like) may support a change in this direction.”
- “Economic inequalities will determine fair future the most.”

One respondent suggests to use equity as transversal “lens” for reading all the other trends analysed “I can hardly see this as a topic “equal” to the others, but as one of the necessary (methodological and conceptual) lenses to understand the other topics. My suggestion would be to include issues of equity and inequality in every topic”.

While another respondent hits on the challenge of managing effectively healthy services in order to grant fair access to all “Most of the poorer population in the Balkan region do not have access to quality health care. Because of corrupt practices, they are forced to pay for better services, for which most do not have the means to do so. This is a crucial topic to be addressed”.

**As regard to indicators,** proportion of population living under national poverty line and proportion of health expenditure from total public spending were considered most relevant for measuring equity in health sector and its impact on NCDs. The comments additionally highlighted other possible indicators for this trend as well as indicating possible difficulties in

- The most relevant is the amount of money spent per capital.
- Two key indicators missing here are poverty indices and health literacy indices.
- though these options will mean very different things depending on the details... and the underlying assumption, which I do not share, is that health is about money and access to paid services. Quality of life may go a long way?
- The main issue here is standardising for different ways of providing health care and so some of the indices are very sensitive to that and hence less useful.

## **Part III Preliminary analysis for the FRESHER Scenarios Space**



## Summary on survey results: variables' level of uncertainty and importance

The table below reviews the level of importance of each of the considered trends/drivers, derived from the answers to the introductory question. To facilitate the reading the ranking has been classified from 1 (trends considered highly important or important by  $\geq 80\%$ ) to 4 (trends considered critically important or very important by  $\leq 50\%$ )

	Considered critically or very important by:	Importance
Healthy and active ageing	82%	1
Equality	76%	2
Integration of health and food trade policies	72%	2
Healthy European cities	72%	2
Integration of health and agriculture policies	65%	3
Low carbon economy	58%	4
New wave of medical innovations	58%	4
Citizens empowerment	57%	4

**Table 1 Trends level of importance**

Similarly, the ranking of the uncertainty has been classified from 1 (trends considered unpredictable or partially unpredictable by  $\geq 60\%$ ) to 4 (trends considered unpredictable or partially unpredictable by  $\leq 40\%$ )

	Considered unpredictable or partially predictable by	Uncertainty
Healthy and active ageing	45%	3
Equality	67%	1
Integration of health and food trade policies	46%	3
Healthy European cities	52%	2
Integration of health and agriculture policies	51%	2
Low carbon economy	40%	3
New wave of medical innovations	52%	2
Citizens empowerment	62%	1

**Table 2 Trends level of uncertainty**

A preliminary disaggregated analysis of the survey results - where respondents are categorized by origin and affiliation - shows that answers are largely consistent across respondent groups. Some disalignments/divergences however appear, and will be further analysed to feed into the refinement of the scenario characterization.

	Importance	Uncertainty
Healthy and active ageing	1	3
Equality	2	1
Integration of health and food trade policies	2	3
Healthy European cities	2	2
Integration of health and agriculture policies	3	2
Low carbon economy	4	3
New wave of medical innovations	4	2
Citizens empowerment	4	1

**Table 3 Trends level of importance and uncertainty**

**Stakeholders considered the ageing trend as the most important trend as well as the most predictable.** One trend for which reliable forecasting data are available. Comments considered the target of improving HLY of two years by 2020 at hand also in Business As Usual scenarios. Higher unpredictability is attached to the extent that public authorities will be able to promote policies for healthy ageing that go beyond “trade or employment” and are directed to promote education, prevention, life style changes, alcohol control. Greater challenges for the ageing trends are then considered the reform of the welfare system, the restructuring of health care systems and the formulation of effective and innovative policies for supporting living well and long, taking into account the regional and socio-economic gaps.

**Inequality stands out as one of the most important as well as unpredictable trends.** The last decade of economy stagnation, the linear cuts and policy tensions pose a threat to the EU countries capacity to sustain healthy economies that permit addressing inequalities. Inequalities between countries and among countries relate to incomes, education and access to care. New services and technologies could offer the opportunities for reducing the inequality in resources constraint future but require a key change toward effective, participatory and transparent management that is perceived as highly uncertain.

**The cities development is considered very important and partially unpredictable.** Respondents recognise cities as the social and environmental place that can make a difference for individual as well as for collective paradigm shifts. Stakeholders assessed this trend as very important, as the urban environment is able to mediate life-style changes and offer social and environmental conditions that influence health outcomes. A long term, global perspective must take into account the increase in population, the rise of megalopolises and the challenge of food production.

**Integration of health policies into trade and agriculture policies are considered important and partially predicable.** Respondents put forward that either a political movement or a market demand could promote a shift toward the inclusion of health clauses into international trade agreements. While others underline the role of national and regional policies to support the development of healthy food supply. For both sectors, stakeholders underline the opportunity for

a change even without a paradigmatic shift. Policy developments, technological innovations or economic growth/citizens awareness could lead to a shift toward a healthier, sustainable agriculture policy.

**Low carbon transition is assessed as important and predictable**, maybe because most of stakeholders consider it as the condition sine qua non for imagining health policies at all. Even if the impact on NCDs might be indirect, the agreements to fight global warming are essential for population' health and well-being.

**Stakeholders view the trends of medical innovation and citizens empowerment with relative less importance but with higher degree of unpredictability.** For medical innovation, several respondents cast doubts on the relative importance of these innovations for controlling and preventing NCDs, especially in comparison with educational policies. In addition, one respondent puts forward the questions related to who will own the patents of the technology advancements and to the extent by which society will be able to benefit from them. Education is also mentioned as key enabling factor for citizens empowerment together with the development of 'social and community' net.

### Summary on survey results: Matrix of relations

Based on the survey comments and analysis, was conducted an analysis of the relations among the identified trends, summarised in the table below. The "X" in a given cell of this table indicates the existence of a causal relationship between row (cause) and column (effect). Direct and indirect effects have been included. The number of "X" is rather high, illustrating the complexity of the interplay between driving forces and the numerous feedbacks.

	Healthy and active ageing	Healthy European cities	Low carbon economy	Integration of health and agriculture policies	Innovation in medicine	Citizens empowerment	Integration of health and food trade policies	Inequalities	Total
Healthy and active ageing						X		X	2
Healthy European cities	X		X	X		X		X	5
Low carbon economy	X	X		X			X	X	5
Integration of health and agriculture policies	X	X	X					X	4
New wave of medical innovations	X	X				X		X	4
Citizens empowerment	X	X	X	X			X	X	6
Integration of health and food trade policies	X	X	X	X				X	5
Equality	X	X	X	X	X	X	X		7

Table 4 The matrix of relations

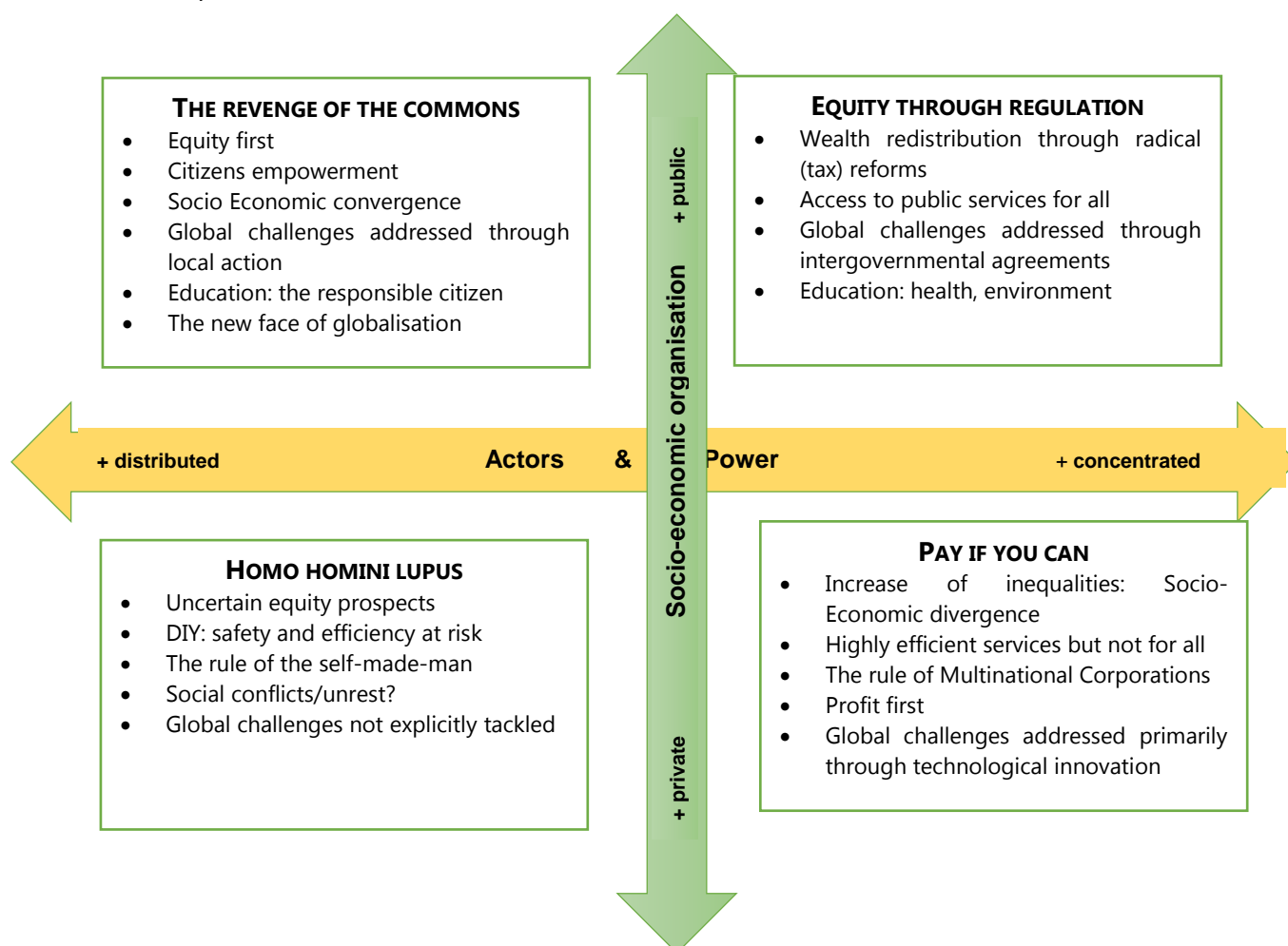
## From critical trends to Scenarios Spaces

The analysis of the survey's results highlights two major trends with high impact on the future of NCDs and the highest degree of uncertainty: *inequality* and *citizens empowerment*. The trends were reviewed in order to assume the role of 'critical uncertainty' on which the FRESHER Scenarios could be built upon. Acting as axis of the Scenarios, the two trends were reformulated to become the "lens" through which imagining the future of NCDs and the evolution of the other trends and drivers.

A preliminary FRESHER Scenarios space is then built upon:

- the **socio-economic organisation axis** (vertical axis) featured by higher public intervention pursuing the goal of equity and socio-economic convergence ("more public") on the top and increasing private and corporate self-regulations on the bottom ("more private").
- the **actors and powers axis** (horizontal axis), featured by few, global, concentrated powers ("+ concentrated") on the left and distributed, local and shared powers on the right side ("distributed").

These key uncertainties constitute the foundation of the two axes (public/private, distributed/concentrated) that compose the 2x2 scenario grid in which the four different first draft of FRESHER scenarios are placed:



**Figure 6: Draft FRESHER Space**

The proposed Scenarios Space will be discussed and refined in the upcoming months in collaboration with the FRESHER Consortium and in consultation with the stakeholders. Attention will be dedicated to ensure a development consistent and supportive of the FRESHER Microsimulation model.

### **From Scenarios Space to inputs for microsimulation model**

At the moment, initial literature review for finding indicator candidates that could be used to translate the trends into impact on NCDs, has been performed. These indicator candidates have been put to validation and relevance assessment in the survey with a wide range of international experts from various public health and non-communicable disease areas. This information is used as an input for further literature review which will be conducted to scope for impact factors (e.g. relative risk information) that would allow to quantify how changes in the indicators used to describe the trends correspond to changes in NCD incidence, prevalence and mortality. These impact factors linking trend indicators and NCD status are necessary as such impact factors are used extensively in all parts of the FRESHER microsimulation model to calculate population composition and its disease status throughout the lifecycle of the model population. The initial literature review already conducted gave a first indication of scarcity of the needed impact factors in published literature and thus an expert panel and survey can be used to elicit the needed impact factors based on aggregation of expert assessments of the impact that changes in trend indicator levels have on different aspects of NCD incidence, prevalence and fatality. As a result of these activities data on levels of trend indicators, on their impact on NCD epidemiology and variation of trend indicator levels for the main foresight scenarios will be provided as inputs for the microsimulation model.