MOBILITY ENERGY ENVIRONMENT

The future moves us.

BOHEMIA: future scenarios for research and Innovation policies in Europe

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All views expressed are those of the author and do not necessarily reflect the views of the European Commission

isinova
Innovation for sustainability

**BOHEMIA** – Beyond the Horizon. Foresight in Support of the Preparation of the EU's Future Policy in Research and Innovation

**A strategic foresight study to contribute to the proposal for FP9**
- ➢ Research results of FP have an Impact in society ~5-10 years after its completion
- ➢ Major challenges at the time horizon ~2035 as starting point
- ➢ Taking into account openness and variability of future contexts

**Objectives:**
- ➢ Draw a picture of possible **alternative futures** setting the societal, economic and political conditions and boundaries for EU R&I policy
- ➢ Describe possible future evolution of socio-economic as well as of scientific and technological **challenges, needs and opportunities**
- ➢ Suggest **issues** which **could be addressed** by EU R&I policy and funding
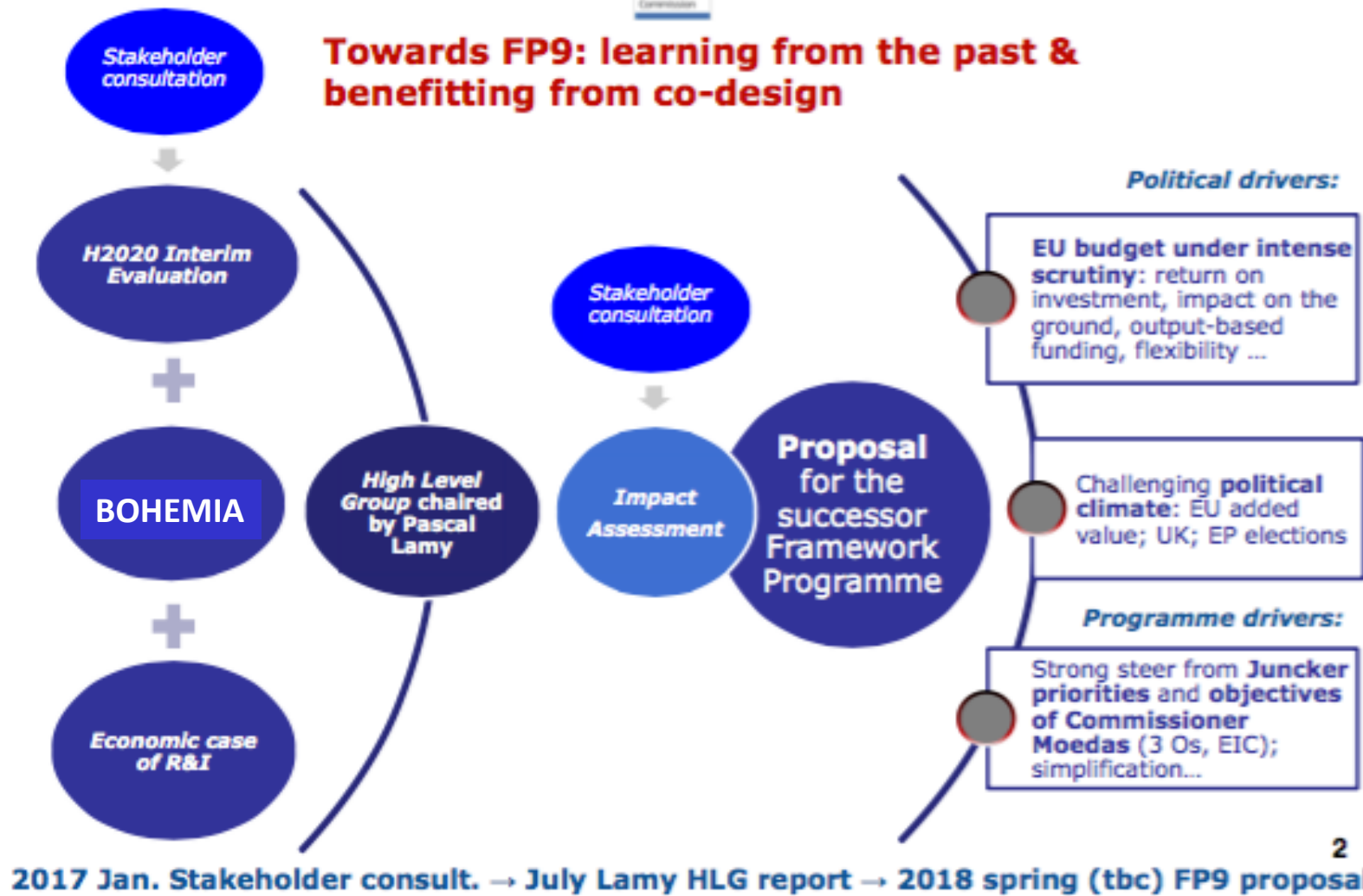
Source: R-J. Smits, April 2017

# BOHEMIA – The phases

- **Phase 1:** Extensive review of available foresight to produce meta-scenarios relevant for Europe and deeper insights in topical fields (published June 2017)

- **Phase 2:** Delphi survey to gain insights on future technologies, societal issues, and R&I practices based on the scenarios (completed in Summer 2017)

- **Phase 3:** Analysis and policy recommendations (ongoing)



**FORESIGHT**

**New Horizons:**
Future Scenarios for Research & Innovation Policies in Europe

The report describes a range of futures we might be facing in the 2030s, and suggests ways how research might create options for Europe to cope and flourish.
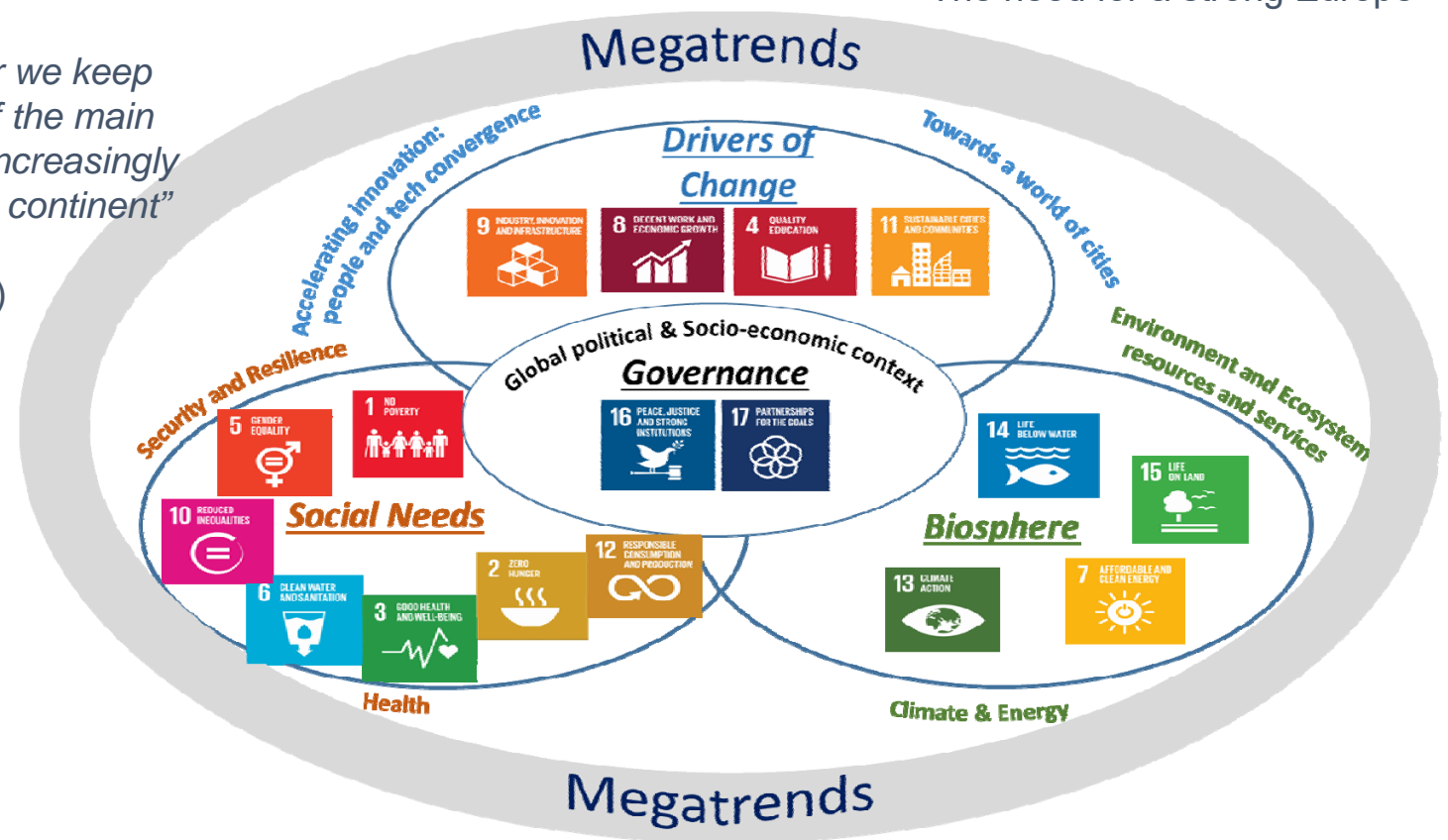
# BOHEMIA, Phase 1: Meta-Scenarios

Analytical context
Global megatrends

Normative context
Sustainable Development Goals
The need for a strong Europe

*"Europe is at a crossroads: either we keep and strengthen the role as one of the main global actors, or we become an increasingly irrelevant outgrowth on the Asian continent"*

(Gonzales Report "Europe 2030")



G.Giuffrè– 04..12.2017

# BOHEMIA, Phase 1: 7 Meta-Scenarios

Two types of scenarios to illustrate the possible transitions:

✓ 'Perseverance Scenarios': current structures and institutions persevere, leading to a continuation of current cleavages

✓ 'Transition scenarios': Europe spearheads the structural transition to 'the future we want'

**7 Perseverance Scenarios**

- Turbulent transitions
- Climate calamity
- The age of over-exploitation
- Health divide
- Security race
- Losing the race against the machine
- Urban jam

**7 Transition Scenarios**

- Transforming our world for the better
- Low carbon transition
- Towards a new well-being
- Towards health for all
- Building societal security
- The innovation revolution for everyone
- Urban bloom

# BOHEMIA, Phase 1: Towards a world of cities Meta-Scenarios

## Perseverance Scenario – Urban Jam

**Global urbanization unabated**

- Fast urbanization of low income groups => more slums
- Sprawl => poor accessibility, car emissions dominate
- Overstretched infrastructure + extreme weather events => congestion, urban decay
- Global vicious circle: insecurity, disease & social unrest
- Megacities's development polarizes investments => limited innovation for improved livelihood
- Cities fail as the engine of growth & employment

**Traditional transport market unfit**

- Overestimated reliance on technological progress alone
- Transition to automated vehicles: technology driven
- No radical change in mobility paradigm & business models
- Decarbonisation but no absolute decoupling
- Innovation (ICT, Big Data) set by new entrants
- EU transport industry suffers, leadership at risk

**What if…**

- Can clogged cities be vibrant, creative and innovative spaces?

## Transition Scenario – New model of urban development

**Smart cities as interconnected systems**

- ICT, sensors, IoT => network interconnection, near-zero maintenance infrastructure
- Collaborative economy, multi-stakeholders integrated strategy
- Compact cities => productivity, accessibility, carbon efficiency
- By 2050, European urban sprawl down by 30 000 km2
- EU experience informs urban space planning worldwide
- (Smart) cities as the transformative power towards SDGs

**New mobility paradigm, service-oriented market**

- Behavioural changes & social innovation drive technological progress
- Connected & autonomous vehicles boosted by shared economy
- Sustainability concerns => internalisation => decoupling (55% less emissions by 2030)
- Virtualisation of freight movement + local economies
- Transport decarbonised (95%) by 2050
- New business models + intersectoral cooperation => EU competitiveness/leadership
- 80% reduction of costs/p.km by 2050

**What if…**

- Urban farming reclaims > 20% of urban space

# BOHEMIA, Phase 2: the Delphi survey

**Delphi is particular type of expert survey**
- Assessment of future development (e.g. time horizon, impact, significance, …)
- Revision of assessments in view of group results
- Argumentative Delphi: Assessments are underpinned by arguments and votes

**147 Statements**
- Statements on developments in S&T
- Statements on socio-economic developments driving R&I

**Assessment**
- Time horizon of realisation + arguments
- Significance for R&I / for R&I policy + arguments

**Interpretation**
- „Likely": Significant and likely realisation by 2040
- „Uncertain": Significant, but uncertain time frame of realisation
- „Wildcards": Unlikely realisation, but potentially high significance if realised

# BOHEMIA, Phase 2: the Delphi survey

**Time of Realization -** *What is the time of realization?*

- until 2020, 2021-2025, 2026-2030, 2031-2035, 2036-2040, 2041 and later, never, gradual development without specific timing, I do not know – with arguments

**Significance of R&I:** *Is R&I significant for the topic?*
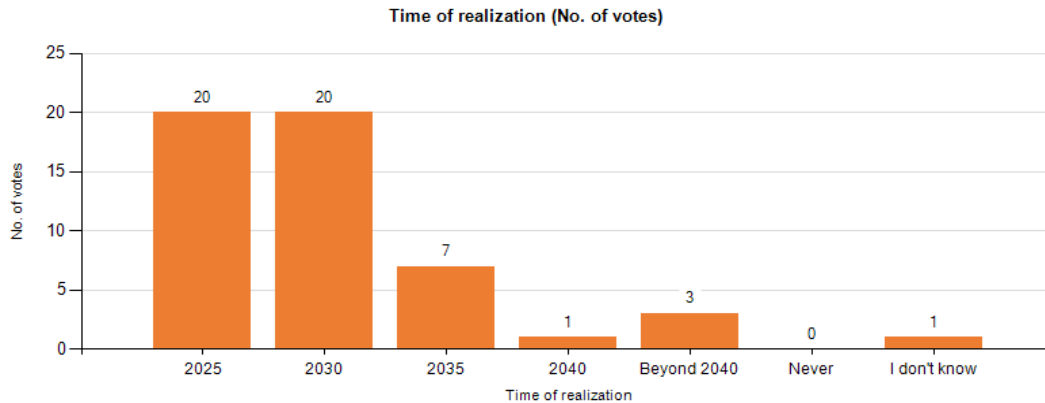
- Very significant to not significant – with arguments

**Significance for EU R&I policy:** *Is the topic significant for EU R&I policy?*

- Very significant to not significant – with arguments

# BOHEMIA, Phase 2: the Delphi survey statement example

**Time of realization (No. of votes)**



*The majority of the EU population use integrated Artificial Intelligence devices and machines in their daily lives*

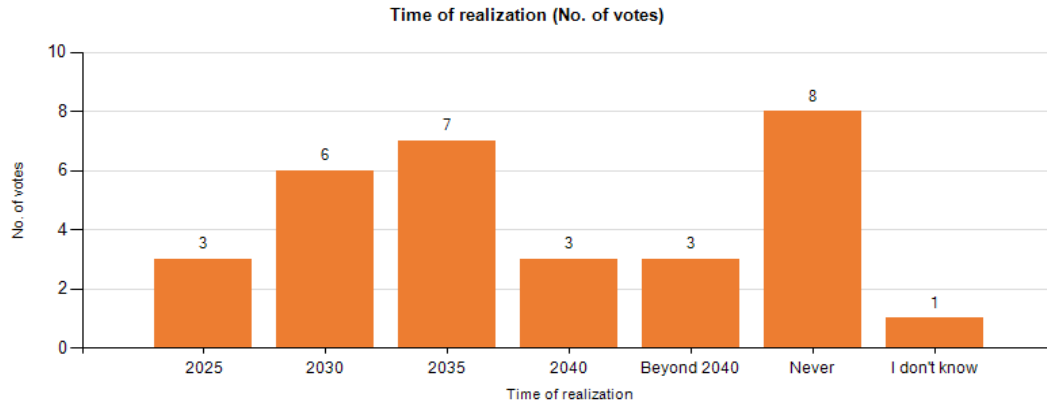| Arguments regarding the time of realization | No. of votes |
|---|---|
| AI technologies will be used to improve analysis and prediction in devices used daily, without being recognised as such by the users (e.g. navigation devices, smart home controllers, smart cars etc.). | 48 |
| Online services (e.g. Google Translate) already employ self-learning AI. | 34 |
| AI (or "synthetic intelligence") will be utilized by most of the pervasive large-scale services (finance, media, social networks, e-commerce), so that people interact with it, for the most part unknowingly, all the time. | 31 |
| Self-driving cars, trucks and busses will be prevalent by 2030 implying daily contact for almost the entire population. Fraud protection in financial systems based on blockchain will be pervasive. | 14 |
| In practice, there are no real AI machines in our daily lives. Service robots like vacuum cleaner robots are not intelligent. | 7 |
| AI has been in development for a long time and we still have problems with language recognition. | 6 |
| It will take time until real AI will be in our housesholds, but if this happens, they might be treated like family members (see Aibo and other pets). | 3 |
| We do it already today. When my TomTom with HDtraffic sees a traffic jam, I follow its advice for a detour. | 1 |
| People will use AI Technology quite frequently if it comes to data related services, e.g. via Internet, but there will be no intelligent machines (robots) in their daily life. | |

# BOHEMIA, Phase 2: the Delphi survey statement example
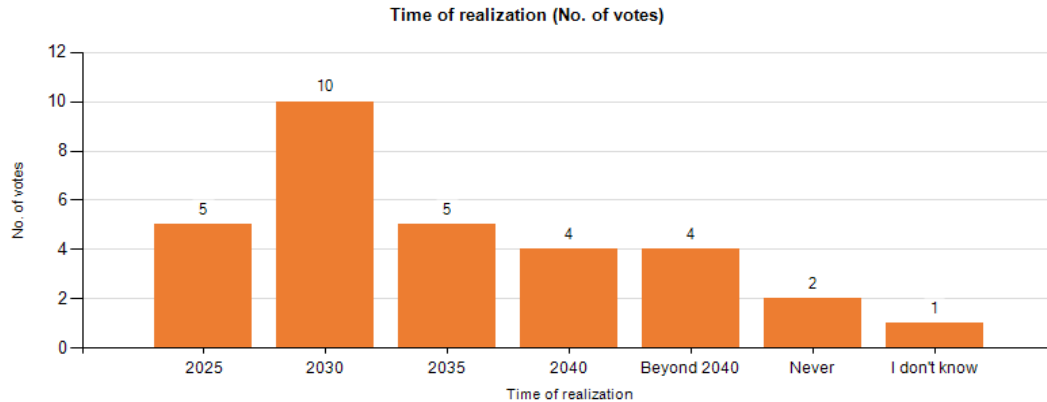


*The use of artificial intelligence and robots causes 30% of current jobs to disappear (jobs that existed in 2016)*

| Arguments regarding the time of realization | No. of votes |
|---|---|
| Other jobs might be created. | 24 |
| New jobs will be created. What we need is more creativity about what people's jobs will mean in the future. | 18 |
| Job titles change very fast already. 30% in 10 years is not unlikely. | 11 |
| Less people in the EU countries means less workpower - robots are a long-term solution. | 8 |
| The problem is not AI or robots, but the marketisation of healthcare, social care and other types of work. | 6 |
| This is the assumption of a well-known study by a consultancy. | 5 |
| What AI can/cannot do can be discussed at length. Usually the future reality is rather different from the images created now. | 3 |
| When AI (bots) and also physical robots take more and more tasks and responsibilities, they will not need public healthcare, education etc. All job markets will be privatized, well, automatically. | 2 |

# BOHEMIA, Phase 2: the Delphi survey statement example
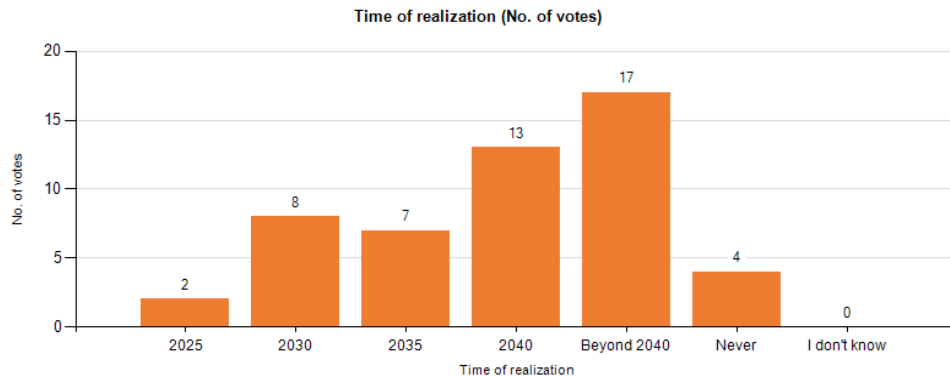


Time of realization (No. of votes)

*In developed countries, the average working time (time spent at paid labour) is 40% shorter than in 2016 due to increased productivity (ratio of output to inputs used in the production process)*

| Arguments regarding the time of realization | No. of votes |
|---|---|
| In fact at least dual systems develop with privileged workers working few hours and being paid well and a new proletariat being overworked and paid below decent pay. | 17 |
| There is a trend to mix working time and leisure time (e.g. citizen innovation). This results in longer working times. | 16 |
| Productivity gains will not be reflected in shorter working time, but rather in increased consumption. | 12 |
| Several studies show that in fact shorter time leads to productivity gains. | 12 |
| Key dimensions of "work" will change. Paid labour may be reduced but entrepreneurship will grow as many voluntary ways of working with indirect benefits. | 11 |
| Political change is necessary to increasingly value off-work activities (e.g., volunteer or community service, parenting, etc.) | 9 |
| The effective working hours may decrease but time at work may increase to include the need of supervising intelligent systems. | 7 |
| Productivity gains will not result in shorter working time as a smaller work force will have to provide for a greater number of inactive people due to demographic change. | 7 |

# BOHEMIA, Phase 2: the Delphi survey statement example
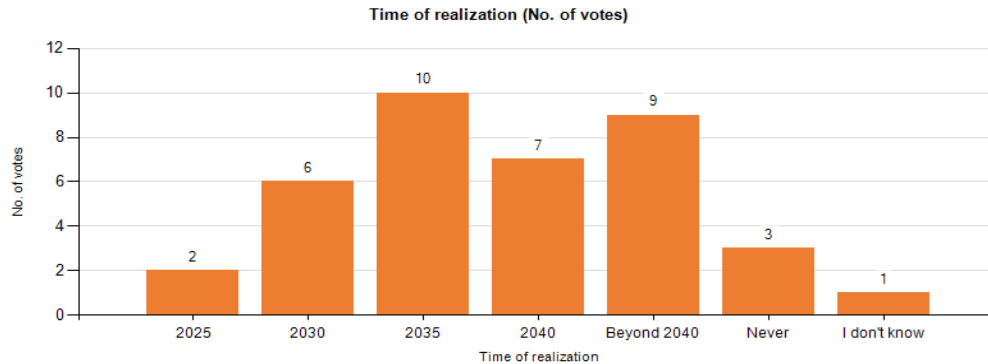


*Time of realization (No. of votes)*

*More than 90% of all materials and waste is physically recycled or re-used energetically in the circular economy*

| Arguments regarding the time of realization | No. of votes |
|---|---|
| Current recycling rates vary widely depending on the waste stream or country. A single figure of 90% may be inaccurate and too ambitious in some cases. | 27 |
| The European Commission adopted an ambitious Circular Economy Package, which includes a common EU target for recycling 65% of municipal waste by 2030. | 26 |
| A high level of recycling requires massive investment. | 23 |
| As consistent progress has been made in life-cycle assessment methodologies, there will be more public pressure to recycle and reuse. | 20 |
| This figure can only be achieved if it includes the reuse and service-life extension of goods, which is not subject to the second-law of thermodynamics and prevents waste rather than manage it. | 16 |
| Large scale utilisation of biowaste is a clear trend. | 11 |
| The main problem will be to curb the current inertia of the free market and the current consumption strategies. | 7 |
| Technically and politically, it is not a difficult target. | 3 |

# BOHEMIA, Phase 2: the Delphi survey statement example



*Metals (for example, aluminium, iron, copper, silver, gold) that are recovered from landfills meet 50% of the EU's demand*

| Arguments regarding the time of realization | No. of votes |
|---|---|
| Arguments regarding the time of realization | No. of votes |
| Landfills have a large potential - but it is costly to recover metals from them. | 33 |
| As we do not have enough space for landfills in the EU, this will also save a lot of space. | 15 |
| The concentration of aluminum in many landfills is higher than the concentration of aluminum in bauxite from which the metal is derived. | 12 |
| Methods have to be put in place to avoid metals getting into landfills. | 8 |
| Why landfills? What is needed are systems to recover metals from the 'urban mine' - the stock of materials at the end-of-life of appliances etc.  New primary resources will still be required. | 2 |

# BOHEMIA, Phase 3:Targeted Scenarios
## ...seeking a trade-off between coverage and overlaps..

### *Drivers of change*

- Future of Knowledge Production
- Nano-to-Macro Integral Manufacturing
- The electro-sphere of sensors
- Ambient Emotional intelligence
- Continuous Cyberwar
- Advanced ICT-based security

### *The Biosphere*

- Low-Carbon economy
- Next-generation bio-economy
- Cheap Renewable Energy Sources
- A self-reliant circular economy
- Making an economic case for nature

### *Social needs*

- Re-construction of the Meaning of Work
- Towards diversified Food Supply: Natural and Novel Food
- Assisted living / Autonomous living
- Human organ replacement
- Precision medicine
- Defeating communicable diseases
- Mobility as a Smart, Sustainable and Intermodal Service

### *Governance*

- Decision-making supported by open expert systems

G.Giuffrè– 04..12.2017

# BOHEMIA, Final steps

✓Publication of the Delphi results

✓On-line consultation to validate the targeted scenarios and their policy implications

✓Developing the targeted scenarios into building blocks

✓Final report with recommendations

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**Thank you**
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