Radical Innovation Breakthrough Inquirer
RIBRI

Workshop of key future Global Value Networks (GVNs)
Report

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"Horizon Scanning for Radical Innovation Breakthrough"

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EXECUTIVE SUMMARY

This document provide the results of the workshop of key future Global Value Networks (GVNs), held on 19th March 2018 in Brussels. In the workshop participants from different Member states across EU discussed a set of proposed future Global Value Networks with a view to improving them and to estimating their future importance for Europe.

The expert presentations given in the round table discussions on global value creation structures and a European perspective on Global Value Networks are summarised in Chapter 2. The discussions on the importance of suggested GVNs as well as the reformulations and comments provided by the participants in the world café working groups are summarised in Chapter 3. The set of 23 Global Value Networks, modified according to these results, is provided in Annex V.

BACKGROUND

The RIBRI project (Radical Innovation Breakthrough Inquirer) aims to identify potentially important disruptive innovations that need to be considered in key policy activities in Europe. GVNs are, in part, what we expect to see and what we can imagine, but also normative deliberations about which kind of value creation structures we aspire to build up and to engage in. In the context of the RIBRI project, the GVNs will be used to assess the relevance of emerging Radical Innovation Breakthroughs (RIBs) for Europe based on their contributions to the GVNs.

This report provides the results of the workshop of key future Global Value Networks (GVNs), held on 19th March 2018 in Brussels. In the workshop participants from different member states across EU discussed, improved and validated a set of 23 proposed future Global Value Networks.

The first draft of the set of European GVNs was prepared in Summer 2017, based on 20 Global Value Producing Networks presented in the Finnish Radical Technology Inquirer (RTI) report[1]. This set was modified to represent a wider European perspective in Fall 2017 through a progress of 26 expert interviews with 35 people from 22 European member states and alignment with current EU strategies. The modified set of GVNs provided the starting point for the workshop. At the final stage of the RIBRI project, the set of GVNs will be used to assess the relevance of emerging technologies for Europe based on their contributions to the GVNs.

1 Introduction

Global Value Networks are networks of actors, which are connected by relationships that create value. Relationships can be of exchange (material and non-material), competition, cooperation but also of different forms and nature. The networks are stable over time, akin to socio-technical paradigms or regimes. They are global in their nature, as they serve needs found across societies and communities globally. They form sizeable enough parts of the world economy, to be important for the European Union as a whole. They are not necessarily industries, sectors or companies, although they could be.

The concept of Global Value Networks was coined in a foresight study of the Committee for the Future of the Parliament of Finland in 2013. The purpose of the foresight effort was to assist the evaluation of the relevance of different technological innovations for the future of the Finnish economy. In RIBRI, the objective of GVNs is to provide an instrument of prediction and deliberation about future value creating structures of the world economy, connecting individuals, households, companies and governments, and producing and distributing value around the world. GVNs provide an instrument of strategic analysis, and an instrument of evaluation of research and innovation policy options associated with the pursuit of particular innovation trajectories.

Overall, the workshop addressed the following questions:

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[1] Linturi, Risto, Osmo Kuusi and Toni Ahlqvist (2014) 100 Opportunities for Finland and the World, the Radical Technology Inquirer (RTI), the English edition
https://www.eduskunta.fi/FI/tietoaeduskunnasta/julkaisut/Documents/tuvj_11+2014.pdf

1. How do Global Value Networks compare to other concepts of structures of value creation in the world economy, in terms of their suitability for foresight in R&I policy?
2. How can we transfer future Global Value Network concepts from one context (Finland) to another?

What is the validity of the Global Value Networks defined so far, from a European perspective? How do the proposed future Global Value Networks compare to one another in terms of plausibility and importance?These questions were tackled in the workshop in two main parts:

1. Round table for general discussion
2. Working Groups reviewing the GVNs

The highlights and results of the workshop are provided in the following chapters. Chapter 2 delivers the summaries from the general discussion conducted in the round table. Chapter 3 provides a list of main comments and modifications from the working group phase as well as an evaluation of the importance of each GVN for Europe in 2038. The 23 Global Value Networks, reformulated according to these comments, are provided in Annex V. The set will be used as frame of reference for evaluating the future relevance of emerging radical breakthrough innovations as well as possible directions and missions of EU R&I policy.

We wish to express our sincere appreciation to the participants of the workshop for their valuable contribution to the project.

2 Highlights from the round table discussion

The event began with welcome words from **Nikolaos Kastrinos**. This was followed with a special address by Member of the Committee for the Future of the Parliament of Finland **Ville Vähämäki**. Vähämäki presented the progress of the recent update of the Finnish Radical Technology Inquirer (RTI) study, conducted by the Committee for the Future in the Parliament of Finland. The aim of the study is to identify radical technologies that could provide value and change the Finnish society. The foresight study was conducted for the first time in 2013, and has been developed ever since. The most recent ranking for the 100 most promising technology baskets in 20 value producing networks has just been accomplished. The results of the study indicate that the top three value producing networks, according to the rate of growth of their anticipated impact, from Finnish perspective are 1) Passenger transport, 2) Logistics and 3) Work and income. These three value-producing networks can be interpreted as being under the strongest transformation pressure.

Key technology baskets of the Passenger transport are: Environment scanning & positioning, Transportable batteries and supercondensators, Real time 3D-modelling of environment, Autonomous cars and trucks, Commercial platforms for sharing economy, New power sources for vehicles, Neural networks and deep learning, AI performing local work on global basis, Radical growth in computing power, Light person & cargo transport vehicles, and Hyperloop and other tunnel technology.

Key technology baskets of the Logistics are: Environment scanning & positioning, Quadcopters and other flying drones, Real time 3D-modelling of environment, Autonomous cars and trucks, Transportable batteries and supercondensators, New power sources for vehicles, Neural networks and deep learning, Material scanner – hyperspectral camera and IR, THz and GHz, transmitters and receivers.

Key technology baskets of the Work and income are: Neural networks and deep learning, Speech recognition, speech synthesis and interpreting, Commercial platforms for sharing economy, VR-glasses, MR-glasses and virtual reality, Flipped learning and proficiency demonstrations, 3D printing of things and Memristors and neural processors.

According to Vähämäki, the special characteristic in the RTI study is the combination of the technological push with the marked pull. He explained the work with "technology baskets" and the way the 100 technologies were ranked.

Special attention was given to the new wave of digital/ information technology and artificial intelligence. Ville Vähämäki's presentation slides are provided in Annex I.

Figure 1. Ville Vähämäki discussing the Finnish foresight effort.

2.1 Session 1: Panel discussion on future global value creation structures

The purpose of the first panel was to reflect the concept of value creation in general. **Adrian Curaj** (Institul de Prospectiva, Romania) chaired the session. He presented the RIBRI project in brief. He reminded that the relationship of the GVNs and RIBs functions in two ways. RIBs inform GVNs, and the set of GVNs provide a frame for assessing the relevance of RIBs, that are identified by Institutul de Prospectiva in the project.

Figure 2. Adrian Curaj chaired the session. Photo by Liviu Andreescu.

Andrea Renda (Centre for European Policy Studies, Belgium) discussed the usage of foresight and public engagement for mission-oriented policies in EU. Renda suggested to include a large-scale public engagement in the RIBRI project. He also stated that building strong linkage to regulation and governance choices would enable the acknowledgement of policy choices in a holistic manner.

According to Renda, the starting point for the preparation of a Framework programme in the European Commission needs to be the societal needs/demand side, and in particular in the Sustainable Development Goals (SDGs). On that basis, a mission-oriented pillar should follow with a clear vision of goals to be achieved. This can then be coupled with national sustainable development pathways. His recommendation is to select five to ten missions for the EU (his examples are e.g. plastic-free ocean, decreasing burden of dementia), with clear governance and a portfolio manager to experiment with different tools, approaches, projects - to take some risks even if some of the attempts fail. The role of foresight is to prepare the selection for this. A lot of considerations have to be taken into account to find the "magic formula" for the selection of missions and future R&I. The presentation slides are provided in Annex II.

Barbara Haering (econcept, Switzerland) presented a case study from Zurich region to learn our lessons from elements for successful GVNs. She began the story in 1848, when a decision with long-term impacts was made to found the Federal Institute of Technology in Zurich ("Bern got the government and Zürich the ETH"). Fast forwarding to the year 2018, Zurich region is a flourishing area and a driver of innovation. This has required a strong cooperation of global companies, an internationally competitive university and cross-sectoral individuals with entrepreneurial mind-sets. Yet, despite economic growth, environmental and social sustainability have not been completely reached.

Following the lessons from Zurich region case, she gave advice for successful GVNs. Firstly, the set of GVNs should address the Agenda 2030 and use the Sustainable Development Goals as a

structure for the demand side as well as their mission. She emphasised that foresight should be integrated in impact-oriented governance, for example through backcasting. Furthermore, foresight should be embraced in the whole of governance, in both inter- and trans-institutional levels of cooperation for coherent solutions. Barbara Haering's presentation slides are in Annex III.

Ezio Andreta (CNR, Italy) discussed the business model innovation required for a changing world and set the discussion of GVNs in this context. In his view, it is important to ask which are the criteria for comparing systems. He advised looking for Global Value Challenges. New methods for examining the interlinking of past-present-future are needed as there is in fact "zero distance" between them. Economists often look at closed systems. The problem is that we live in open systems with a permanent unequilibrium and at the same time facing complexity. According to Ezio, the European Strategy should be to connect the future to the present and do a backcasting instead of following many different goals in a linear way. A way to generate big new transitions has to be found, thinking back from big missions (moon shot), big new technologies in an experimental way and mitigating challenges. This might help even with public engagement.

Figure 3. Panel discussion on future global value creating structures.

2.2   Session 2: Building a European perspective on Global Value Networks

The objective of the second session was to elaborate and comment the RIBRI approach specifically. **Philine Warnke** (Fraunhofer ISI) chaired the discussion. **Osmo Kuusi** (Finland Futures Research Centre, University of Turku) presented the process of developing the GVNs to match the European perspective in the RIBRI project. The aim was to widen the perspective of the Finnish RTI study to better match the European viewpoint. Ideally, the set of GVNs will cover all of the key aspects of the socio-technical opportunities of Europe in the future. Kuusi mentioned that the descriptions of the RIBRI GVNs follow the same pattern in order to help their validation. First presented shortly is the general global value promise of the GVN. The anticipated regime in 2038 is described by 4-8 aspects of the GVN. It is important that the aspects are plausible and based on the present evidence e.g. trends and weak signals. For the linking of the evidence to the aspects it is

important that the aspects are well specified. Of course, the evidence concerning a 2038 GVN is never conclusive. For the practical evaluation of the RIBs, the aspects should also describe the key content of the GVNs shortly. The description ends with challenges or barriers that have to be managed in order to realise the GVN in 2038. Kuusi's presentation slides are provided in Annex IV.

Michael Keenan (OECD) commented on the roles of foresight as well as the RIBRI approach in general. Going back to past definitions of foresight, Keenan reminded, how foresight is first and foremost learning through deliberation rather than prediction. He asked about the role of political actors - as there are tensions if the political space is directly involved. There are already a lot of tools in foresight and even evaluation approaches and reminds that it would be helpful to look at the way, companies are performing foresight. The EU perspective is necessary as the European level transforms well, but there is a variety of actors involved.

Keenan also outlined "black boxes" to be clarified in the project RIBRI. The main black box, according to Keenan, is the concept of "value", which is at the core of GVNs, yet, problematic to define. Another topic that requires clarification is the question of who are the right "experts" to be involved in the process. Considering the RIBRI approach and GVNs in particular, Keenan stated that there is a need for a typology that would give a structure for the provided value networks and their promises, in other words, to define, what values really are.

Keith Smith

3 The discussions in working groups

After the panel discussions, the workshop continued with a world café session, the objective of which was review and improve the set of Global Value Producing Networks (GVNs) as a framework for the evaluation of the potential Radical Innovation Breakthroughs from a European perspective.

Figure 4. Group recalibrating a GVN.

The group work was conducted in three world café session rounds with one rotation in each round. During each round, there were seven or eight parallel GVNs each of the participant choose as the most interesting one to work with for 20 minutes. Thus, each participant could choose in total six GVNs to discuss. In each group, a moderator was facilitating the discussion. The GVNs were printed on large papers in a standardised structure.

During each round, participants were asked to evaluate the plausibility and importance of the specific GVN under focus. Comments and modifications were written on post-its, on large sheets of background paper or straight to the GVN description sheets. The importance of the GVN in 2038 was evaluated and indicated with an arrow. In case the GVN was considered to gain importance, the arrow was positioned up. If the importance was seen to stay stable, the arrow was left pointing to right. In case the importance was evaluated to decrease, the arrow was adjusted to point down.
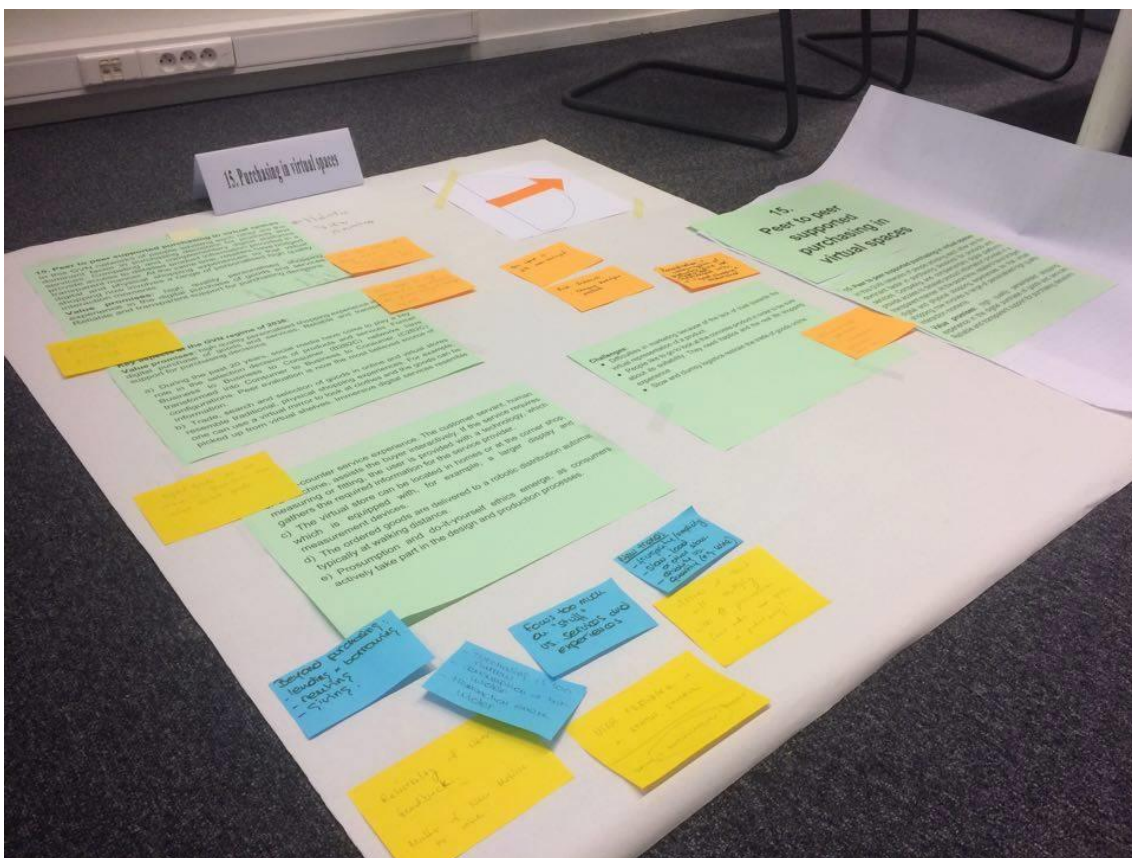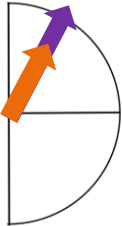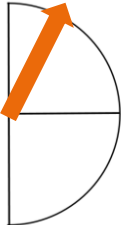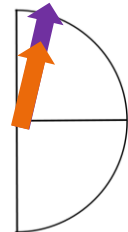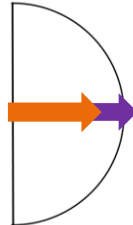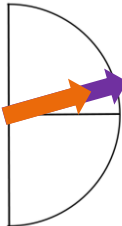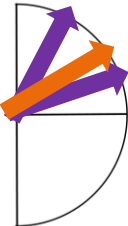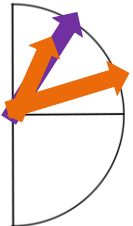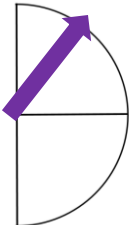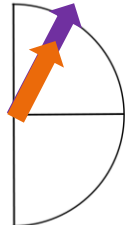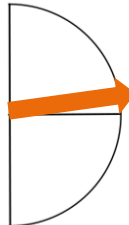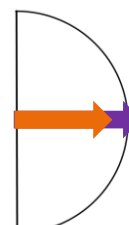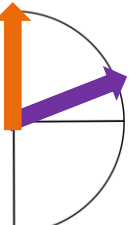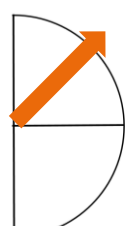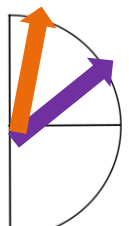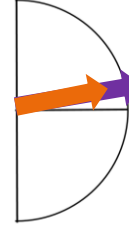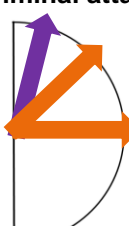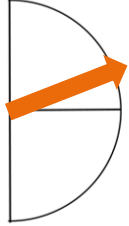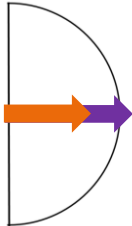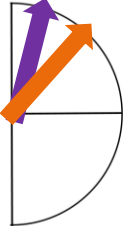
Figure 5. Results of the group work for GVN 15.

As a brief summary of the opinions on the importance of the GVNs, it can be stated, that the importance was expected to remain the same or increase for all 23 GVNs up to 2038. The only exception was GVN 15, the importance of which was evaluated to decrease by 2038 by the first round of participants. The evaluation of the importance for each GVN is provided in Table 1.

Table 1. The evaluation of the importance of the GVNs in 2038. The orange arrows indicate the evaluation made during the first round and the purple arrow indicates the results of the second round.. During some rounds, two differing evaluations were made. In some occasions, no evaluation was given. Not all GVNs underwent two rounds

#1 Urban planning and infrastructure for liveable urban areas	#2 Sustainable energy solutions	#3 Carbon retention and climate change mitigation
#4 Sustainable use of water systems and resources	#5 Sustainable use of materials	#6 Automation of transport
#7 Individualised manufacturing close to the customer	#8 Telepresence and remote control of tools	#9 Sustainable and smart housing

#10 Knowledge co-creation for evidence based decision making	#11 Self-directed individualised learning	#12 Self-care based diagnosis, prevention and treatment of illnesses
#13 Health promoting behaviour	#14 Personal data markets	#15 Peer to peer supported purchasing in virtual spaces
#16 Sustainable food for all	#17 Virtual citizen interaction for entertainment, art and culture	#18 New operating models for self-organising communities
#19 Sustainable tourism	#20 Security network against military and criminal attacks	#21 Decent and meaningful life for elderly people

#22 Global Social Innovation Capacity	#23 Space as a global commons	

In terms of content, all GVNs received comments or suggestions for revisions. The extension of suggested revisions varied, from minor modifications to wording at the very minimum, to more major revisions concerning for example the focus of the GVN. Some more major revisions were suggested, e.g. for GVN 20, it was suggested to split it in two separate GVNs that would concern security from differing viewpoints. Table 2 provides the summary of the comments.

Table 2. Summary of the group work and mofidications accordingly.

Title of the GVN	Summary of the group work comments and modifications
1. Urban planning and infrastructure for liveable urban areas	- The focus needs to be broader; instead of urban planning, also territorial planning as a growing challenge have to be considered - Original GVN has too strong emphasis on technology - Infrastructure is indirectly linked to "human" factors, such as security, health and pollution - Cities are the frontline for realising the of technological innovation - Stronger monitoring may be contradictory with regard to a city's liveableness - Ruralisation of city centers and vice versa ➔ Revisions in the title, background text, key aspects and challenges
2. Sustainable energy solutions	- The global demand of energy will increase - The role of smart grids has to be emphasised - Plausability of the GVN was discussed in the groups with several optional results: 1) Renewable energy cannot become dominant by 2038 or 2) The target becomes plausible as a self-fulfilling prophecy - Overall it was stated that news indicate a plethora of tech solutions that support plausibility ➔ Minor revisions in key aspects and challenges

3. Carbon retention and climate change mitigation	• Stronger focus on carbon retention • Technology have be desgined "green" • Further production of fossil carbon has to stop • Challenges do not reflect potential negative or unintended side effects of technologie ➜ Revisions in the title, key aspects and challenges. Key aspect concerning biorefineries moved to GVN #5
4. Sustainable use of water systems and resources	• Defining a Global Value Network here is difficult, as the management of water resources is national • It should be clarified, that the water problem is one of scarcity as well as of quality • Water is a geostrategic resource, which generates increasingly more conflict • Water needs to be treated as a public good. Yet, the challenges related to the water as global commons should be emphasised • Fishing is also a global political problem • Shared common water resources may help towards the achievement of cooperation across borders • Technology contributes to reducing the pressures on the overuse of water • Access to water-related technologies for all ➜ Revisions in the background text, value promise, key aspects and challenges
5. Sustainable use of materials	• Emphasising the role of top-down incentives in the transformation towards sustainable circular economy • GVN too strongly focused on recycling, other cycles (sharing economy for example) worthy of attention • Circularity is not enough. In the future, this should not be only about the ways generated, but also about reducing consumption. Also, recycling needs to evolve • Some materials become more toxic when recycled • Scarcity of materials, together with Europe strongly leaning towards circulare economy, creates a global competitive advantage. • Regulations vary from city to city ➜ Revisions in the background text, value promise, key aspects and

	challenges. Key aspect added from GVN #3
6. Automation of transport	- Focus on smart transport as a broader category than automated transport - It is unclear if automation of transport might lead directly to shared transport - Automation of transport raises the question of job destruction in transport market ➔ Revisions in the title, value promise, key aspects and challenges
7. Individualised manufacturing close to the customer	- Potential to scale up; personalisation of whole systems - Regulation required for the protection of property, health, safety and security - Elaborating the challenges brought about by individualised manufacturing; increased consumption, change in global value creation (emerging countries with mass production lose value) - Market forces may oppose the change ➔ Revisions in the background text, key aspects and challenges
8. Telepresence and remote control of tools	- Focus could be more on the remote control and interaction - Automation of dull tasks create "space" for new capacity - Interaction between different interfaces should be included in the GVN ➔ Revisions in the title, background text and key aspects
9. Sustainable and smart housing	- Focus on sustainable housing, smartness merely a way to reach the goals - Elaborating the social aspects of smart housing, such as interaction, sharing economy. Decreasing technological aspects - Retrofitting and renewal of existing housing stock a major challenge - Including innovations such as new materials and assembly methods ➔ Revisions in the title, background text, value promise, key aspects and challenges
10. Knowledge co-creation for evidence	- Focus of the GVN needs to be clarified - Evidence alone is not enough for smart decisions

based decision making	• Co-creation of knowledge estimated to increase by 2038 → Revisions in the title, background text, value promise, key aspects and challenges
11. Self-directed individualised learning	• Circular motion: Education is the driver of change & socioeconomic dynamics require change of education • Life-long learning important • Standardisation or customisation of education? → Revisions in the background text
12. Self-care based diagnosis, prevention and treatment of illnesses	• The assumption of people's will to stay as healthy as possible for as long as possible was questioned for several reasons • Not everyone has the abilities required for self-care • Rise of "health-prosumers" → Merged with #13 as one GVN
13. Health promoting behaviour	• Technology does not necessarily lead to healthier population, as it may not be accessible to all • Big data has a crucial role, yet there are privacy issues concerning personal data to be solved → Merged with #12 as one GVN
14. Personal data markets	• Focus on the data that an individual creates when using web based platforms • Income aspect suggested in the original GVN will not play a major role • Becoming a data entrepreneur is easy • Europe's strict and effective regulation would be a competitive advantage → Revisions in the title, background text, value promise, key aspects and challenges
15. Peer to peer supported purchasing in	• Broader focus on consumption decisions instead of the act of purchasing • User feedback as a status symbol

virtual spaces	• Focus on services and experiences too, not only products ➔ Revisions in the title, background text, value promise, key aspects and challenges
16. Sustainable food for all	• Emphasising the need for strong political will as well as the complexity of the topic • Revolution in agriculture, combined with AI and ICT coming • Unequal access to nutritious food and the double burden of famine or obesity • Meat intake will be reduced for different reasons • Fishing and farming models need to be more sustainable ➔ Revisions in the key aspects and challenges
17. Virtual citizen interaction for entertainment, art and culture	• Emphasis on the unwanted consequences of the increasing virtual interaction needed: addiction and isolation for example • Educational purposes, interaction and reconstruction of worlds emerging possibilities • Some of the effects were seen undesirable, yet plausible ➔ Revisions in the background text, key aspects and challenges
18. New operating models for self-organising communities	• Clarification of concepts (i.e. operating models, community) required in the GVN • Building trust, capturing transactional mediums and communality were discussed ➔ Revisions in the title, background text, key aspects and challenges
19. Sustainable tourism	• Emphasising reciprocal benefits and clarifying the roles of different actors as well as inter-sectoral coordination • Sustainability was seen as incompatible with profit-driven industry • Sustainability may also mean limitations on travel frequency and paradigm change in fast tourism practices ➔ Revisions in the background text, value promise, key aspects and challenges

20. Security network against military and criminal attacks (e.g. terroristic and cyber)	• Mismatch between the title and the contents of the GVN • The GVN was suggested to be divided in two: 1) human security and 2) military/criminal attacks • Overall, we need to tackle the reasons for terrorism, and not concentrate solely on technologies • New solutions have a dual role of being solutions and threats at the same time ➔ GVN divided in two separate GVNs with distinctive foci
21. Decent and meaningful life for elderly people	• The opportunity for the aging to stay in working life, if they will, is elementary • There has to be a holistical transformation towards a more elderly-friendly society • Interactive and inter-generational environments and universally accessible solutions required • Neurodegenerative diseases continues to be a challenge ➔ Revisions in they key aspects and challenges
22. Global Social Innovation Capacity	• The GVN links well with SDG 17, Partnerships for the goals • Social innovations do not necessarily translate from local/context related to global context. Mutual learning dialogue needed to improve the exchange • Title misleading ➔ Revisions in the title, additions to key aspects and challenges
23. Space as a global commons	• Privatisation of space and global commons approach are the two prevailing and contradictory trends • International and institutional framework needed for the global commons approach • Military research and space tourism as additional aspects ➔ Revisions in the key aspects and challenges

As presented in Table 1, the group members were not fully consensual concerning the importance of GVNs in 2038. Furthermore, there were differing opinions regarding the contents of the GVNs. In

most cases, the differing viewpoints have been integrated in the remodified GVNs as challenges that will hinder the kind of development described in the GVN. Thus, the new set of GVNs is a combination of the original GVNs, modified according to the comments from the group work by the researcher team. The objective has been to modify the original set to as large extent as possible. However, the comments, additions and modifications have not been adapted to the GVN descriptions one-by-one, in case of contradiction. The revised set of GVNs as a result from the workshop is provided in Annex V.   At the end of the workshop, an experimental online voting was conducted to have a perception if the GVNs are all assessed in the same way or if large differences can be observed between the different GVNs. Indirectly, the discussions should be reflected in the online voting. The online voting took place on an internet platform, which could be accessed through internet link or with a QR code. At first, the participants were asked to choose the GVNs they discussed during the group work. For these GVNs, they were asked to assess on a scale from very important to unimportant:

1. How likely is the GVN to be established in 2038?
2. How important will this GVN be in 2038?

It had been hoped to be able to give instantly valid results of the voting, but for some technical issues this step did not provide reliable results.

4   Next steps

As presented above, the workshop discussed one part of the RIBRI project, the Global Value Networks, Initially derived mainly from interviews, they were discussed and changed during the course of the workshop.

This deliverable provided the results of the workshop of key future Global Value Networks (GVNs), held on 19th March 2018 in Brussels. The results of the workshop contribute to the project objective towards the Europeanisation of Global Value Producing Networks within the Radical Innovation Breakthrough Inquirer RIBRI project.

The next step in the RIBRI project dealing with the GVNs is a reformulation and changes according to the discussions of the workshop (see Annex V). The GVNs will then be matched against the Sustainable Development Goals (SDGs) to briefly assess, which ones may have a substantial impact on the SDGs. Another validation step will be the categorisation of the GVNs according to the NACE classification and in a second step to validate the contribution to the economy (measured in turnover) in these sectors.

The GVNs will be used (as one factor among others) to rank the Radical Innovation Breakthroughs that are identified and filter out those, which do not have a sufficient impact on future value creation. The final iteration of the European Global Value Networks will be provided towards the end of the project. In the final step of the project, the set of GVNs and other criteria will be used to evaluate the 100 most significant Radical Innovation Breakthrougs also identified in the project.

Challenge:

How to forecast technology development?

Our approach:

Ranking system for the 100 most promising technologies

Radical Technology Inquirer (RTI)

- Conducted by the Committee for the Future, Parliament of Finland
- Developed since 2013
- Now 100 technology baskets in the rank
- The first exhaustive ranking in 2016 seems to be on the right track
- The new ranking just accomplished

Special in RTI: Combining Push&Pull

TOP-12 technologies in our top-100 list most potential technologies:

Rank	Technology basket	Total potential value
1	Neural networks and deep learning	955
2	Autonomous cars and trucks	670
3	Enviroment scanning and positioning	651
4	AI performing local work on global basis	636
5	DNA reading and writing (full genome)	630
6	Rapid development of photovoltaics	588
7	Commerical platforms for sharing economy	582
8	Speech recognition/synthetis and interpreting	558
9	Real time 3D-modelling of enviroment	540
10	Material scanner – hyperspectral camera	515
11	Transportable batteries and superconductors	497
12	3D-printing of things	469

TOP-12 Technology baskets by influence

Rank	Technology basket	Genericity score
1	Neural networks and deep learning	3820
2	AI performing local work on global basis	3021
3	Autonomous cars and trucks	2010
4	Material scanner - hyperspectral camera	1854
5	Radical growth in computing power	1760
6	Ubique environment and internet of things	1666
7	Facial / emotion recognition and projection	1598
8	Speech recognition/synthesis and interpreting	1581
9	Memristors and neural processors	1455
10	Commercial platforms for sharing economy	1455
11	Reading and editing thougts from the brain	1445
12	Verbot/chatbot, talking/corresponding robots	1328

TOP-12 Technology baskets <u>by rate of developement speed</u>

Rank	Technology basket	Rate of development
1	P2P trust systems, blockchain	13,8
2	MyData & GDPR	13,0
3	Cultured meat and meat imitations	12,1
4	AI performing local work on global basis	12,0
5	Small particle accelerators, femto&nanolasers	12,0
6	Neural networks and deep learning	11,4
7	LED-farming, robotic farming	10,8
8	Verbot/chatbot, talking/corresponding robots	10,0
9	AR & VR platforms	10,0
10	New separation technologies & circular economy	10,0
11	Cheap small fuel cell and microturbine CHP	10,0
12	Radical waterborn transport	10,0

TOP-12 Value producing networks

Rank	Value-producing network	The rate with which the anticipated impact has grown
1	Passenger transport	6,7
2	Logistics	6,3
3	Work and income	5,9
4	Automation of work	5,8
5	Sustenance	5,3
6	Manufacturing of goods	5,2
7	Built environment	5,0
8	Exchange	4,6
9	Acquiring information	4,1
10	Safety and security	4,1
11	Remote impact	4,0
12	Existential meaning	3,7

Thank you!

Technology basket	Passenger transport	Logistics	Manufacturing of goods	Sustenance	Energy supply	Production materials	Built environment	Exchange	Remote impact	Automation of work	Work and income	Healthcare	Redressing disabilities	Aquiring information	Proficiency & it's proof	Producing experiences	Safety and security	Collaboration and trust	Existential meaning	Power structures	Total potential value	Value level
Neural networks and deep learning	10	10	5	10	3	3	5	10	5	20	20	10	5	20	10	10	5	5	5	20	955	****
Autonomous cars and trucks	20	20	0	3	5	0	10	10	5	10	5	0	10	5	0	5	20	3	3	0	670	****
Environment scanning & positioning	20	20	3	3	0	0	3	0	5	10	3	0	3	10	3	5	5	0	0	0	651	****
AI performing local work on global basis	10	10	5	5	0	3	3	10	20	5	5	10	3	5	20	5	5	10	5	20	636	****
DNA reading and writing (full genome)	1	3	0	20	0	10	0	3	3	0	0	10	5	20	0	0	10	0	5	0	630	****
Rapid development of photovoltaics	5	5	10	5	20	5	10	1	3	3	3	0	0	3	0	0	5	3	3	0	588	****
Commercial platforms for sharing economy	10	5	0	5	0	0	5	10	20	3	10	0	3	3	5	3	0	5	5	5	582	****
Speech recognition/synthesis and interpreting	3	3	0	3	0	0	3	10	5	5	10	3	10	5	5	5	5	10	5	3	558	****
Real time 3D-modelling of environment	20	20	10	5	0	0	5	0	1	5	0	0	3	5	0	5	5	0	3	3	540	****
Material scanner - hyperspectral camera	5	10	5	10	0	5	5	5	5	5	3	10	3	10	1	0	10	5	1	5	515	****
Transportable batteries and supercondensators	20	10	0	0	5	0	5	0	3	5	0	0	5	5	0	10	3	0	0	0	497	****
3D-printing of things	1	5	20	0	0	3	3	3	3	5	5	0	1	0	5	3	3	3	3	1	469	****
VR-glasses, MR-glasses and virtual reality	3	3	5	0	0	0	5	3	5	3	10	1	3	3	5	10	1	3	10	5	468	****
Radical growth in computing powed	10	10	5	5	0	5	5	10	5	10	5	5	0	5	0	10	5	5	0	10	440	****
Quadcopters and other flying drones	1	20	3	3	0	1	5	1	3	5	3	0	0	5	0	1	10	0	0	0	427	****
Personal health diagnostics systems	5	3	0	10	0	0	5	1	3	3	0	20	10	5	3	3	5	3	5	0	420	****
Verbot/chatbot, talking/corresponding robots	5	5	0	3	0	0	3	5	10	10	5	3	0	5	5	10	5	3	3	3	415	****
M2M trade and other online commerce	5	5	3	5	5	1	5	20	5	5	3	0	3	1	0	0	5	5	0	5	405	****
Cloud computing and storage services	3	5	5	5	1	0	0	10	3	3	3	0	0	3	0	3	3	5	0	5	399	****
Ubique environment and internet of things	3	10	10	5	0	3	10	10	5	5	3	3	0	10	0	5	5	5	3	3	392	****
LED-farming, robotic farming	0	5	20	5	3	5	3	3	3	3	3	0	0	0	3	3	0	5	0		384	****
Facial / emotion recognition and projection	3	1	0	3	0	0	3	5	10	10	3	3	3	5	10	10	5	5	10	5	376	****
Smart glasses. AR-glasses and augmented reality	0	5	5	10	0	0	10	3	5	0	5	0	3	3	5	10	5	3	3	0	375	****
Pattern recognition and other AI platforms	3	5	5	5	0	0	5	10	5	10	5	0	0	3	3	3	3	5	0	3	365	****
Global wireless broadband networks	5	5	0	0	0	0	10	3	5	5	3	0	1	5	5	5	5	5	5	5	360	****

Flipped learning and competence validation	5	0	0	1	0	0	0	3	3	5	3	10	0	0	3	20	1	1	5	5	10	350***
Walking robot and walking assists	5	5	5	1	0	0	1	10	0	10	5	3	0	10	0	1	5	5	0	5	0	330***
P2P trust systems, blockchain	6	0	5	5	3	1	3	3	10	5	3	0	0	0	1	3	0	5	5	0	5	330***
Fast and dense memory materials	7	3	3	0	0	0	0	3	3	3	3	0	0	0	10	0	5	3	0	5	3	308***
Cultured meat and meat imitations	5	0	5	0	20	0	0	5	0	3	3	0	5	0	0	0	5	3	0	10	0	295***
Encrypted and anonymous communication	6	3	3	0	0	0	0	3	20	5	0	1	0	0	0	3	0	5	3	0	3	294***
Memristors and neural processors	3	3	10	0	0	0	0	0	5	5	10	10	3	3	10	5	5	3	5	10	10	291***
IR, THz and GHz transmitters/receivers	5	5	10	0	3	5	3	5	0	0	3	0	0	0	5	0	10	5	0	3	0	285***
New robotized services	4	3	0	3	3	1	1	10	5	10	5	5	0	3	3	0	10	3	0	0	5	280***
MyData and GDPR	5	1	3	3	5	0	0	3	10	3	5	0	1	0	5	0	3	5	3	0	5	275***
Lab on a chip	4	5	5	3	5	0	10	5	3	3	3	0	5	0	10	0	0	3	3	0	3	264***
Reading and editing thoughts from the brain	3	3	0	1	3	0	0	5	1	5	3	3	5	5	10	5	20	3	5	5	3	255***
Robotized remote work, AI as superior	3	5	10	3	5	0	0	5	0	10	3	5	0	3	3	3	10	5	3	0	10	249***
Gamification of collaboration and society	4	3	1	0	3	3	1	1	3	0	0	5	5	1	3	10	3	0	10	5	5	248***
Digital art and experience platforms	4	3	0	3	3	0	0	5	5	5	3	0	0	3	3	10	3	0	5	5	3	236***
AR & VR platforms	5	3	3	3	3	0	0	3	3	5	0	5	0	0	10	0	5	1	3	0	0	235***
LiFi networks and other LED technology	6	0	0	1	10	0	0	10	0	0	0	0	3	0	0	0	5	5	0	5	0	234***
New separation technologies & circular economy	5	0	5	5	5	3	5	3	5	0	3	0	3	0	1	0	0	0	0	3	3	220***
Quantum computers and quantum communication	3	3	3	0	0	0	0	3	10	10	0	0	0	0	10	0	0	20	5	3	5	216***
Cyborgs uniting biology and mechatronics	3	0	0	0	3	5	5	0	0	1	3	3	10	20	5	1	5	5	0	0	5	213***
Sensitive robotic fingers and arms	4	0	5	5	5	0	0	3	0	3	10	5	0	1	0	0	5	3	3	3	0	204***
Radical longevity	3	0	0	0	3	0	0	3	1	0	3	5	20	5	0	5	5	3	0	10	5	204***
New power sources for vehicles	6	10	10	0	0	5	3	3	0	0	0	0	3	0	0	0	0	0	0	0	0	204***
Crowd funding, microfinancing	6	1	1	3	0	1	0	0	3	0	0	3	0	1	0	3	0	0	5	3	10	204***
Easier access to space	6	0	0	1	0	0	5	1	5	5	3	3	0	0	3	0	1	1	1	3	1	198***
Genetic editing, CRISR/Cas9	5	0	0	0	5	0	3	0	0	5	0	0	10	5	0	0	3	5	0	3	0	195**
Modular interfaces for robot ecosystems	3	0	10	10	1	1	1	5	3	5	3	3	0	3	3	0	0	5	5	0	5	189**
Light person & cargo transport vehicles	4	10	5	1	3	0	0	5	3	0	3	3	0	5	0	0	3	5	0	0	0	184**
Hyperloop and other tunnel transport	4	10	5	0	0	0	0	10	3	0	0	3	0	0	0	0	1	3	3	3	5	184**
GMO producing substances and organs	4	0	0	3	10	3	5	1	3	0	0	0	5	3	0	0	3	5	0	0	0	164**
Microbiome, metabolism and genetics of cells	4	0	0	0	5	0	0	0	3	0	0	0	20	10	3	0	0	0	0	0	0	164**
Platforms for local sharing & collaboration	4	0	5	5	5	0	3	3	3	0	0	5	0	0	3	3	0	0	3	3	0	164**
New nanomaterials in electronics	3	0	3	3	0	3	3	3	0	0	3	0	10	10	10	0	3	3	0	0	0	162**
Small particle accelerators, femto&nanolasers	4	5	5	3	1	0	0	0	0	3	5	0	5	0	5	0	3	5	0	0	0	160**
Easy 3D-imaging of things	5	1	5	5	0	0	0	3	3	0	3	3	0	1	3	0	3	1	1	0	0	160**
Light and strong or insulating materials	4	5	5	5	3	1	3	10	0	0	0	0	0	3	1	0	3	1	0	0	0	160**
Artificial muscle and artificial skin	3	0	5	3	3	3	5	3	0	5	10	0	0	5	1	0	5	0	0	5	0	159**
Deep learning material for expert AI	3	0	0	0	5	0	3	3	3	0	10	5	3	0	5	0	5	3	0	0	5	150**
Light continuously (24/7) flying aircraft	4	3	3	0	0	0	3	3	3	3	3	1	0	10	0	0	5	0	0	0	0	148**
Grid level energy storage	5	0	0	3	0	20	0	0	5	0	0	0	0	0	0	0	0	1	0	0	0	145**
Motion based and haptic user interface	4	0	5	3	0	0	0	3	0	5	0	5	3	3	0	3	5	1	0	0	0	144**
Simulating living cells, artificial cell	3	0	0	1	5	1	10	0	0	0	1	0	5	0	5	5	1	3	3	3	5	144**
Smart materials and their simulation	4	0	0	5	0	3	5	0	0	0	0	0	0	5	10	3	3	1	0	0	0	140**
Repair of organs, cultivating cells	5	0	0	3	5	0	5	0	0	0	3	1	5	3	0	0	3	0	0	0	0	140**
Cheap small fuel cell and microturbine CHP	5	3	3	0	0	10	0	5	3	0	0	0	0	0	0	0	0	3	0	0	0	135**
Antibacterial and repellent surfaces	4	5	3	5	3	3	3	3	3	0	3	0	1	0	0	0	3	0	1	0	0	132**
Nano- and microbots in mammal body	4	0	0	0	5	0	3	0	0	1	0	0	10	3	3	0	0	3	0	0	5	132**
Curing and preventing dementia	3	1	0	0	0	0	0	0	0	0	0	0	20	0	1	3	3	3	3	10	0	132**
Cryptocurrencies/exchange media bypassing banks	6	0	1	0	0	1	0	1	5	3	0	1	0	0	0	0	0	3	3	1	3	132**
Radical waterborn transport	5	3	5	0	0	3	1	1	1	1	3	1	0	0	1	0	3	3	0	0	0	130**

Technology																						Total
Fresh water production	3	0	0	1	10	1	5	1	1	0	0	5	5	0	0	0	3	3	0	3	5	129*
Nanomaterials as fibers, fabrics and reinforcement	3	3	1	5	0	0	20	5	0	0	0	0	0	0	0	0	3	5	0	0	0	126*
Artificial leaf and synthetic fuels	3	3	3	0	0	10	0	10	5	0	0	3	0	0	0	0	0	5	0	3	0	126*
Power lasers, ray guns, railguns	5	0	1	5	0	5	3	3	0	0	3	0	0	0	0	0	0	5	0	0	0	125*
Production of nanomaterials	5	3	3	5	0	5	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	120*
3D-printing of buildings and constructs	4	3	1	0	0	3	1	10	1	0	3	1	0	0	0	0	5	0	0	1	0	116*
Self organizing and swarm intelligence	3	0	5	5	5	0	3	5	5	0	5	1	0	0	0	0	1	0	0	0	3	114*
Structural materials replacing concrete	4	0	0	0	0	0	10	10	0	0	3	0	0	0	0	0	0	3	0	0	0	104*
Cryogenics of biomaterials	4	0	3	0	3	0	0	0	3	0	3	0	3	3	5	0	0	0	0	3	0	104*
Plasmonics and photonics	3	0	0	0	0	10	5	5	0	0	0	0	5	0	3	0	5	0	0	0	0	99*
3D-printing of organs and biomaterials	3	0	0	3	5	0	3	0	0	3	5	3	5	0	3	0	3	0	0	0	0	99*
Off-Grid & Micro-Grid -solutions	4	3	0	0	3	5	0	3	1	1	0	1	0	0	0	0	0	0	3	3	3	96*
Robotic tailor	3	0	0	10	0	0	0	0	5	3	5	0	0	0	0	0	5	0	0	3	0	93*
Cordless electricity transfer	3	3	5	3	0	3	0	5	0	0	3	0	3	3	3	0	0	0	0	0	0	93*
Capturing/storing solar heat, heat to electricity	4	0	0	3	0	3	3	5	3	0	0	1	0	0	0	0	0	1	0	3	0	88*
Recovery/harvesting of kinetic energy	4	3	3	0	0	5	3	3	0	0	0	5	0	0	0	0	0	0	0		0	88*
Carbon capture and CO2-usage as raw material	3	3	3	3	3	5	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	81*
Small fusion and fission plants	3	0	0	3	3	10	3	5	0	0	0	0	0	0	0	0	0	3	0	0	0	81*
Personal VTOL and other light aircraft	4	5	0	0	0	0	0	3	0	0	3	1	3	0	0	0	1	3	1	0	0	80*
Plant and animal fibers, nanocellulose	4	0	0	3	0	0	10	3	0	0	0	0	0	0	0	0	3	0	0	0	0	76*
Frictionless surfaces and levitation	4	5	3	1	0	0	3	0	0	0	0	0	0	0	0	0	3	0	0	0	0	72*
Robotic insects & other biomimetics	3	0	0	0	3	0	0	1	0	3	3	0	0	0	5	0	3	5	0	0	0	69*
3D-printing of metamaterials and compounds	3	0	0	3	0	5	5	0	3	1	5	0	0	0	0	0	1	0	0	0	0	69*
Cheap efficient storage of hydrogen	3	5	5	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60*
New methods to manipulate substances	3	0	1	5	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	27*

Kondratieff Cycle simulation

| Rank	Value-producing network	Value-producing network technology maturity rate 2023	
1	Logistics	12269	Cycle 1 / 2023?
2	Passenger transport	10544	
3	Built environment	8464	Cycle 2 / 2026?
4	Automation of work	8273	
5	Sustenance	8039	
6	Exchange	6864	
7	Work and income	6564	
8	Manufacturing of goods	6217	Cycle 3 / 2030?
9	Safety and security	6179	
10	Acquiring information	6065	
11	Remote impact	5390	
12	Experiments	3900	

ANNEX II PRESENTATION BY ANDREA RENDA

USING FORESIGHT AND PUBLIC ENGAGEMENT FOR EU MISSION-ORIENTED POLICIES

Andrea Renda

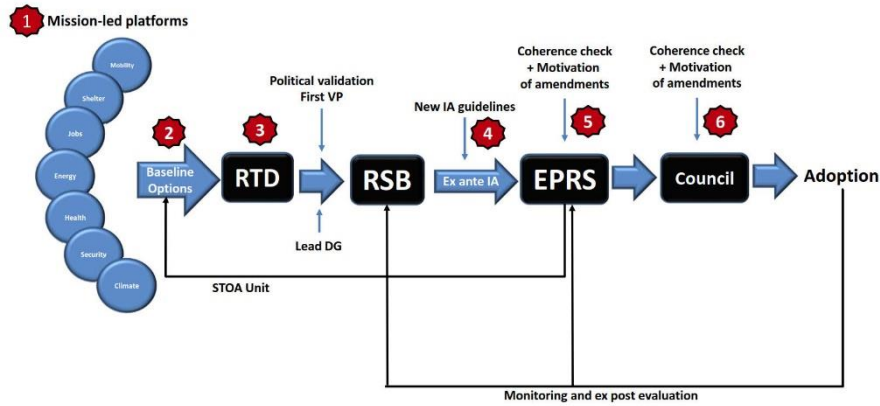CEPS, Duke, College of Europe

19 March 2018

Source: Mazzucato (2018)

Source: Mazzucato (2018)
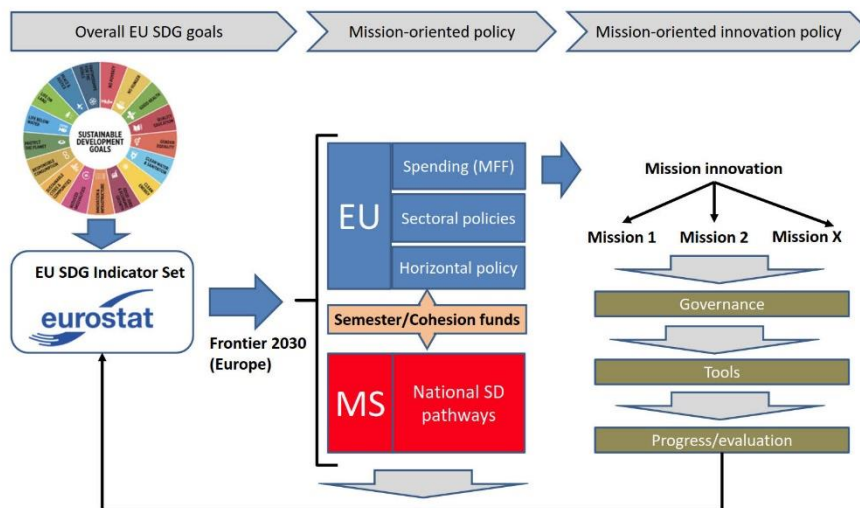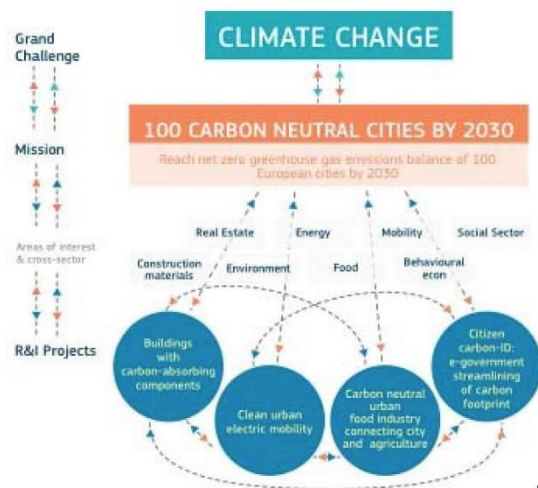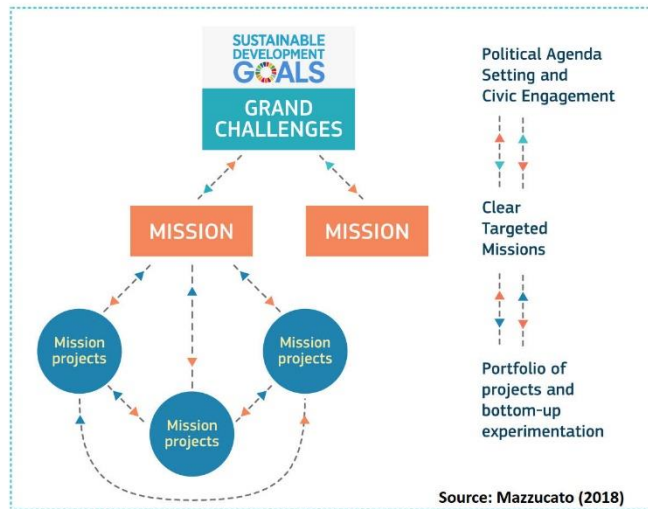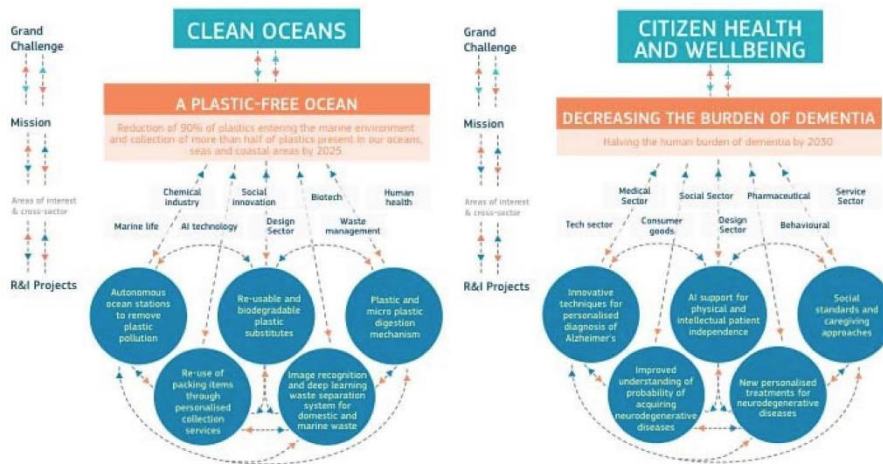
Source: Mazzucato (2018)

Missions: the "magic formula"

- **Accelerators v transformers**

- **Geographic/industrial balance**

- **Inclusive v. selective**

- **Optimal risk-taking and portfolio management**

- **Social v. natural sciences**

- **Global v. European needs**

- **Top-down v. bottom-up ("texturing")**

- **Public-private governance (w/o path dependency?)**

GVNs appear as a very prosing approach – however, it could be strengthened in terms of:

- Large-scale, deep public engagement (texturing)

- Link to regulation and governance choices (whole policy cycle)

Regulation & MOIP: key challenges

USING FORESIGHT AND PUBLIC ENGAGEMENT FOR EU MISSION-ORIENTED POLICIES

Andrea Renda

CEPS, Duke, College of Europe

19 March 2018

ANNEX III PRESENTATION BY BARBARA HAERING

econcept

Forschung / Beratung / Evaluation / Recherche / Conseil / Evaluation / Research / Consulting / Evaluation /

Horizon scanning for radical innovation breakthroughs for R&I policy
EC, Brussels, March 19, 2018
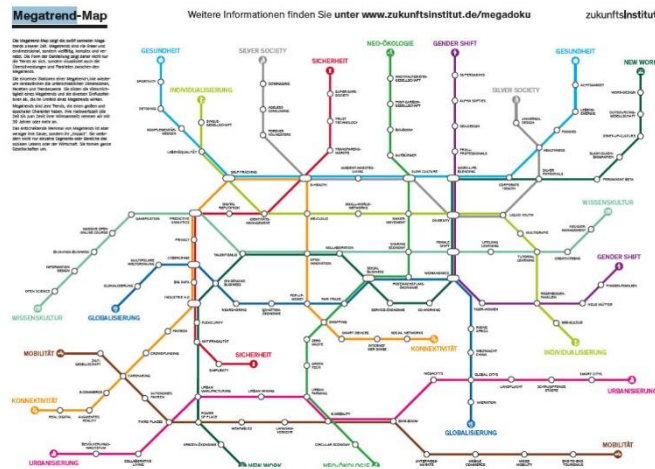
Key Future Global Value Networks:
Setting the Scene

Prof. Dr. Dr. h.c Barbara Haering

econcept

Outline

- Starting point: Global trends and challenges
- The concept of Global Value Networks GVN
- Case study Zurich Region
- Key elements for GVN
- Business Model Innovation for a changing world

Megatrends are complex and non-linear

Challenges challenges are increasingly complex

Challenges are cross-cutting
- disciplines and issues
- institutional responsibilities
- from local to global
- private and public

From trends to policy needs

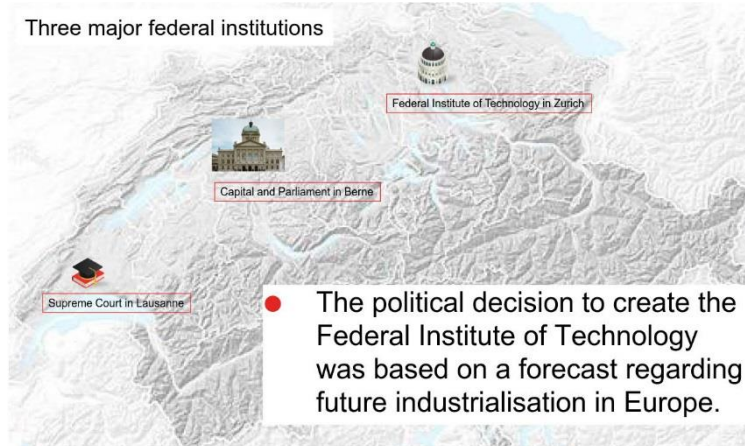|	Trends	Effects	Impacts on Society and Science	Policy Needs
1	Planetary Boundaries	– Climate change with its various impacts	– Conflicts over water, land resources and food – Migration on a global scale	– Reflexion on planetary boundaries – Unbundling of economic growth and resource consumption – Impact oriented policies
2	Digital Transformation	– Acceleration of technological change – Advanced automation – Loss of jobs <-> new jobs	– Structural unemployment – Gap between the «fits and haves» <-> «less fits and haves not»	– Ecosystems of innovation assuring conscious innovation – Concepts for re-skilling and augmented learning – Economic concepts beyond GDP
3	Urbanization	– Megacities – Resource needs – Concentration of innovation	– Innovation hubs: Cities becoming living labs – Smart specialisation of regions based on particular strengths	– New models for societal contributions and rewards in order to assure peaceful societies – Investments in integrated big data infrastructure and in large research infrastructures – Retrofitting cities
4	Globalization beyond Mobility	– Vanishing boarders – Atomisation of structures and institutions	– Diversity <-> fragmentation – Value ecosystems – Transactional boarders	– Reframing the interface of public / private – New regulations and new definition of public and private issues – New Business Models: Working in inter- and transinstitutional ways
5	New Actors	– New values and life styles – Private equity as political actor – Crowd sourcing and crowd funding	– Increase of purpose driven research – Citizen's science and collaborative research – Faster solutions to Grand Challenges? – Less blue sky research?	– Transaction based taxation – Managing the reduced importance of IPR

- **Trends** include opportunities as well as threats….
- **Need** to address challenges effectively and efficiently….
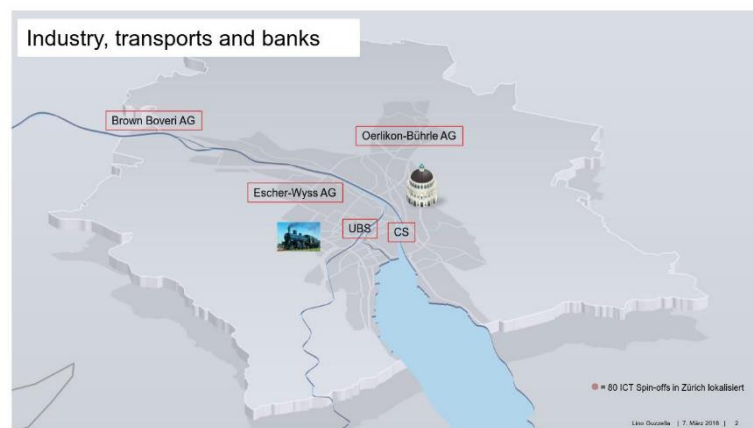
Global Value Network: Concept

- A Global Value Network (GVN) describes an area of technological and societal change based on global demand.
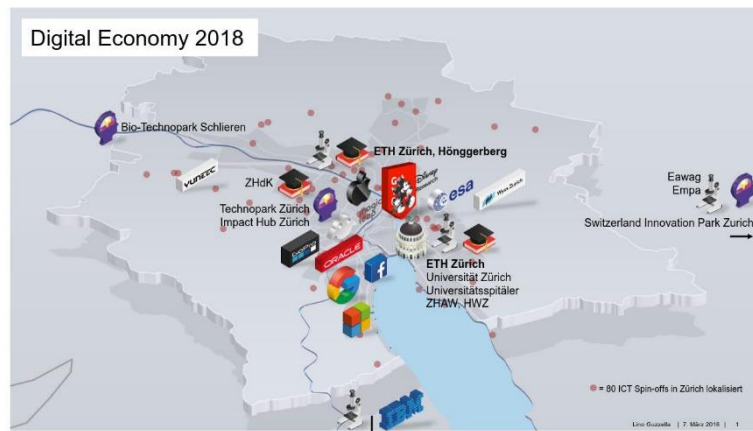

Global Value Networks
based on comprehensive foresight

«Technology **PUSH**»
Expert based view

«Challenge **PULL**»
Policy based view

Hot areas:
Genetics, regenerative medicine, nanoscience, nano and catalytic chemistry

Grand Challenges:
Planetary boundaries, urbanization, globalisation, societal impacts
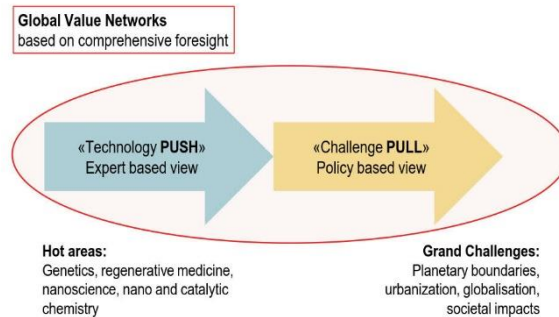
Case Study Zurich Region
1848: Political Decisions with Great Impact

Three major federal institutions

Federal Institute of Technology in Zurich

Capital and Parliament in Berne

Supreme Court in Lausanne

● The political decision to create the Federal Institute of Technology was based on a forecast regarding future industrialisation in Europe.

Case Study Zurich Region
ETH Zurich: Driver of innovation 1855

Industry, transports and banks

Brown Boveri AG

Oerlikon-Bührle AG

Escher-Wyss AG

UBS   CS

● = 80 ICT Spin-offs in Zürich lokalisiert

Lino Guzzella | 7. März 2018 | 2

Case Study Zurich Region
ETH Zürich: Driver of innovation 2018

Digital Economy 2018

Case Study Zurich Region: What it took ….

- ● **A university of global competitiveness….**
  - ○ attracting best faculty, students and global companies
  - ○ offering talents to industries
  - ○ working in networks with industries and authorities

- ● **Global companies…**
  - ○ pushing innovation to the markets

- ● **Public policies open to innovation….**
  - ○ linking science and industry
  - ○ offering high quality public services

- ● **Personalities**…
  - ○ with entrepreneurial spirit
  - ○ working across sectors

Case Study Zurich Region
What it delivered ….   …. and what not

- **Innovation and talents**
  - attracting new and global companies
  - restructruring the economy according to new needs and opportunities
- **Economic growth**
  - copying with financial and political crises
  - supporting high level public services and cultural offers

- **Sustainability**
  - reducing Zurichs global footprint
  - solutions sizable for the world
  - effective and efficient use of innovation
- **Values**
  - regarding planetary boundaries
  - integrating needs and social capital of the «less fits/have nots»

Case Study Zurich Region: What it still needs…

- **Networks cooperating towards SDG**
  - Inter- and trans-institutional cooperation local -> global
  - Bringing together public and private responsibilities
  - Linking science policies directly to sectoral policies

- **Strong public and private investments in science**
  - Excellent universities and research infrastructures
  - Participatory citizen science and living labs
  - Foresight in its double role of impacting while analysing

- **Economic and societal concepts beyond GDP**
  - Unbundling growth and resource consumption
  - Addressing long term (un-) employment issues
  - Sharing economies and better use of social capital

Key elements for successful GVNs

- **GVNs** linking technology-PUSHs and challenges-PULLs in a comprehensive approach to address opportunities and threats effectively and efficiently.

- **Agenda 2030** with its 17 SDG as framework structuring the demand side and mission to be addressed by GVNs.

- **Impact-orientation** throughout the whole governance cycle (back-casting).

- **Foresight** integrated and impacting all phases of the overall and impact-oriented governance cycle.

- **Whole of Governance** approach fostering inter- and trans-institutional cooperation to achieve coherent solutions.
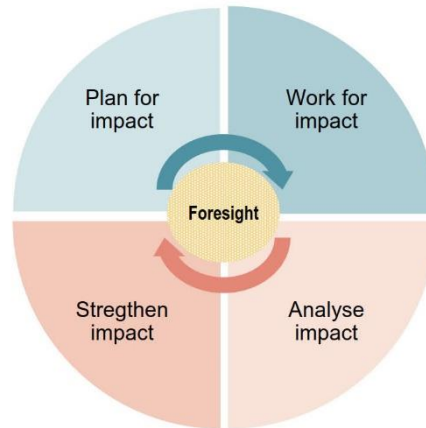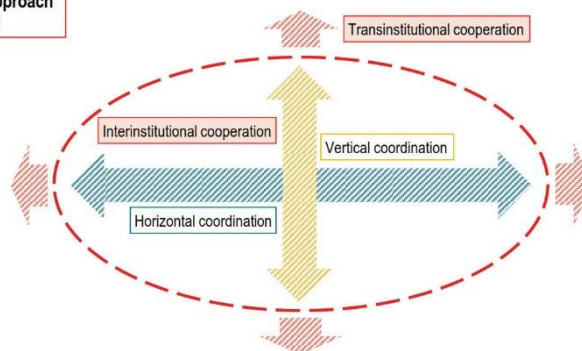
GVNs oriented towards the Agenda 2030
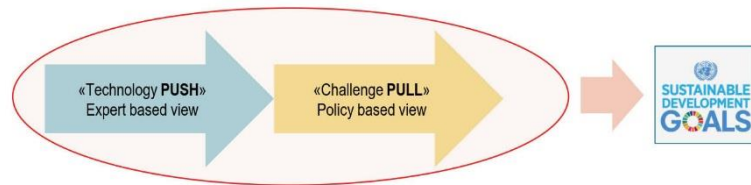
Impact oriented governance integrating foresight

Foresight integrated in a impact-oriented governance

Plan for impact

Work for impact

Foresight

Stregthen impact

Analyse impact

Whole of Governance Approach

Whole of Governance Approach inter- and transinstitutional

Transinstitutional cooperation

Interinstitutional cooperation

Vertical coordination

Horizontal coordination

Business Model Innovation for a changing world

Global Value Networks
based on comprehensive foresight

«Technology **PUSH**»
Expert based view

«Challenge **PULL**»
Policy based view

SUSTAINABLE DEVELOPMENT GOALS

Foresight integrated in a
impact-oriented governance

Plan for impact

Work for impact

Foresight

Stregthen impact

Analyse impact

Whole of Governance Approach
inter- and transinstitutional

Transinstitutional cooperation

Interinstitutional cooperation

Vertical coordination

Horizontal coordination

ANNEX IV PRESENTATION BY OSMO KUUSI

Global Value Producing Networks in the RIBRI project
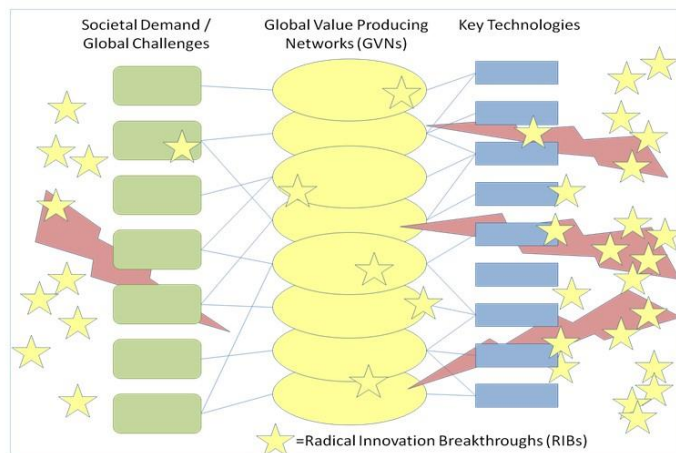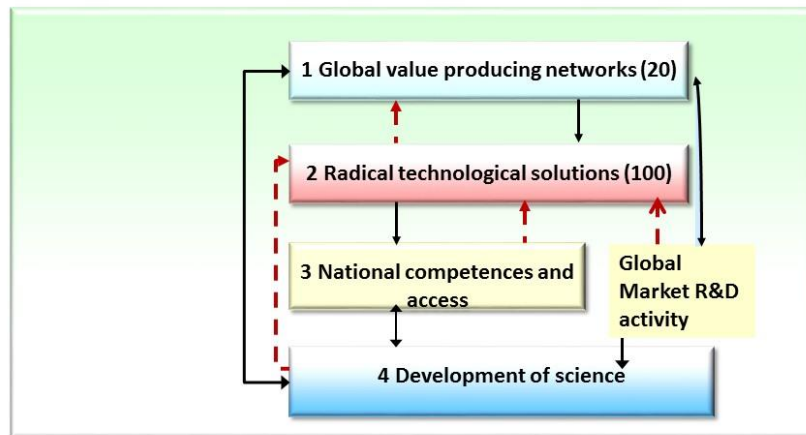
The "Europeanisation" of the Finnish GVNs

- The Finnish team of the RIBRI project has subjected the 20 Finnish GVNs and GVN ideas found from other European national sources to a process of "Europeanisation"

- The "Europeanisation" has happened especially through 25 interviews with 34 people from 22 EU countries mostly visiting in their home countries and using statements of the European Parliament and the European Commission

Themes of the GVN interviews

The background: the national context of the innovation policy and the usefulness of Ribri or the Finnish RTI like tool in it

Comments on preliminary GVNs (15) and GVN ideas (15). What are especially relevant and why on the national and on the European level?

National activities related to the preliminary GVNs

Interviews indicate how important are differing actor perspectives

- Differing national and common EU perspectives on the GVNs (e.g. carbon as an energy source)
- Who represent a "common European interest"? The most plausible source: statements of the European Parliament and the European Commission
- 17 Sustainable Development Goals of the United Nations represent global objectives that the European Union shares.
- For a small European firm, just a couple of the GVNs might be relevant.

Global challenges: SUSTAINABLE DEVELOPMENT GOALS OF THE UNITED NATIONS

1. No poverty
2. Zero hunger
3. Good health and well-being
4. Quality education
5. Gender equality
6. Clean water and sanitation
7. Affordable and clean energy
8. Decent work and economic growth
9. Industry, innovation and infrastructure
10. Reduced inequalities
11. Sustainable cities and communities
12. Responsible consumption and production
13. Climate action
14. Life below water
15. Life on land
16. Peace, justice and strong institutions
17. Partnerships for the goals

Plausibility promoting links between GVNs and Radical Innovation Breakthroughs (RIBs)

- Recent innovations (RIBs) and related trends motivate the Global Value Producing Networks (GVNs) of 2035-2040

Besides the RIBs, the GVNs have to take into account normative aspects from suitable sources

- The GVNs are used in the evaluation of the future promise of the RIBs e.g. for education policy
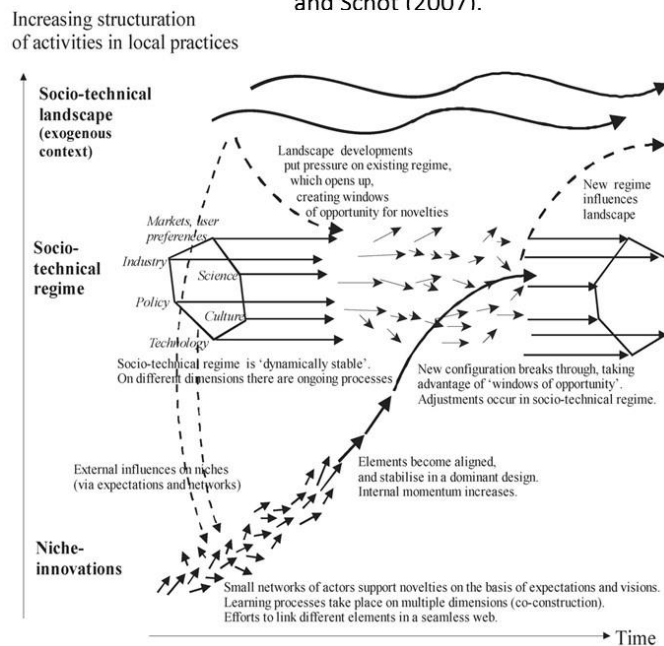
For a covering evaluation, the "whole picture of possible using environments" of a RIB is needed. This whole picture is given by compact 20-25 GVNs

Especially promising RIB baskets of the 2018 Finnish RTI

- Neural networks and deep learning, overwhelming most promising
- Speech recognition/synthesis and interpreting
- Autonomous cars and trucks
- Environment scanning & positioning
- DNA reading and writing (full genome)
- Rapid development of photovoltaics
- Material scanner - hyperspectral camera

GVNs as 2038 socio-technical regimes (e.g. Geels and Schot (2007).

Increasing structuration of activities in local practices

Socio-technical landscape (exogenous context)

Landscape developments put pressure on existing regime, which opens up, creating windows of opportunity for novelties

New regime influences landscape

Markets, user preferences
Industry
Science
Policy
Culture
Technology

Socio-technical regime

Socio-technical regime is 'dynamically stable'. On different dimensions there are ongoing processes

New configuration breaks through, taking advantage of 'windows of opportunity'. Adjustments occur in socio-technical regime.

External influences on niches (via expectations and networks)

Elements become aligned, and stabilise in a dominant design. Internal momentum increases.

Niche-innovations

Small networks of actors support novelties on the basis of expectations and visions. Learning processes take place on multiple dimensions (co-construction). Efforts to link different elements in a seamless web.

Time

Compact description of a GVN

- Very short general global value promise (e.g. sustainable logistics, health or privacy)
- Key aspects (4-8) of the GVN as the anticipated 2038 regime
- Weak signals e.g. RIBs or relevant trends supporting the aspects
- Challenges or barriers that have to be managed in the road towards 2038 GVN

The RIBRI and its GVNs are an instrument of strategic analysis, and an instrument of evaluation of Research and Innovation policy options e.g. for the EU industrial policy
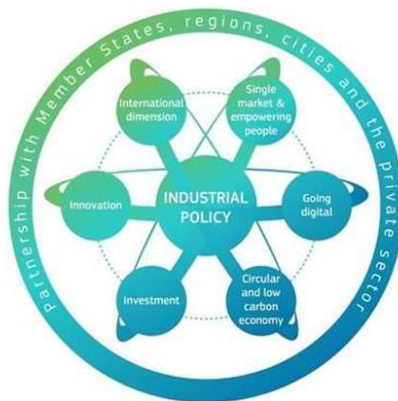
ANNEX V Remodified set of 23 GVNs

1. Planning and infrastructure for liveable human settlements

Background

Urbanisation is a megatrend. It is forecasted that over the next 20 years, the population of the world's cities will increase by more than the population of China and India combined. At the same time, the relevance of sustainable development of rural spaces is increasingly recognized. Cities will be more and more the origins of global problems and the spaces that inspire and create innovative solutions. Urban and territorial planning will increasingly become a global need around which a number of networks will converge. Already, across the globe networks of cities emerge and local political authorities begin to exercise local policies over and beyond national norms in matters that relate to environment, security, economy, education, innovation and quality of life. The value of this GVN will be much broader than the coordination of important local politics, and will include important aspects of governance related technologies, infrastructures and regulations (including "smart", "healthy", "resilient", "green" and "sustainable" cities) as well as urban-rural interactions and relationships that increase the quality of life of urban dwellers and provide increasingly sustainably dense areas that are platforms for innovation and economic competitiveness.

Key aspects of the GVN regime of 2038:

Value promise: Liveable, inclusive, safe and green urban spaces.

a) Coordination between city authorities globally in experimenting and pioneering innovative solutions in i.e. energy and carbon efficiency, air quality and integrated transport.

b) "Urban" is no longer considered on its own, but it is seen as interconnected to the surrounding region. Territorial planning increases the liveability of non-urban areas and sustainable urban-rural connections. The strict distinction between cities and non-cities disappear; urban areas are ruralised and vice versa.

c) Stronger monitoring of city dwellers as a basis for new solutions.

d) Cities enable active lifestyles and provide "urban health advantage"[2] with their infrastructures, planning design and availability of new technologies.

e) Inclusive, safe and green city centres are zones of services and social activities allowing just bicycles and small electric cars.

f) Following the example from i.e. Copenhagen, Utrecht and Amsterdam, the cities are planned increasingly cycle-friendly.

g) Bottom-up and co-designing activities as well as local cooperative knowledge production are increasingly important, when designing more liveable and diverse human settlements. Open public spaces provide environments for interaction.

h) Dense urban areas are rich in growing and evolving culture and innovation. Historical and cultural heritage are also preserved in cities.

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[2] Sustainia (2014) Sustainia Guide to Co-Creating Health. https://issuu.com/sustainia/docs/sustainia_health_sector_guide

i) Using the lessons learned in Europe, sustainable cities are co-created with international collaboration in regions where the pace of urbanisation is fast, like in Africa and Asia.

Challenges:

- Threat of large scale land degradation requires new land use strategies.
- Large-scale corporate buying of buildings and land increase the living costs and *de-urbanise* major cities[3]. Social equity is threatened, as cities become more and more segregated by income.
- Without active measures, the megacities of Africa will generate severe problems and risks for Africa as well as Europe.
- Stronger monitoring of citizens may be counteractive to liveability, as surveillance and big data governance are contradictory to some citizens' values and ethics.
- Social equity is threatened, as cities become more and more segregated by income.
- Hyper-mobility and over-tourism pose threats to liveability. For example, high mobility of people hampers the sense of local communities.
- Family friendly planning is needed to attract and keep people. Demographic policies are needed for diversity and interaction.
- Public/Private urban infrastructure projects are often fail points, and there are currently no policies for unfulfilled promises. Failed projects lower public trust and increase the potential for corruption.

2. Sustainable energy solutions

Background

Under pressure from climate change and with a large number of new energy solutions, energy ceases to be a geostrategic asset and energy policies become economic policies, while trade in energy solutions flourishes and individual customer choice expands world-wide. In the energy mix, affordable low-carbon energy sources largely replace fossil fuels. Politicians, citizens and companies actively promote climate change mitigation and a more efficient energy production and distribution.

Key aspects of the GVN 2038:

Value promise: Affordable, safe, environmentally friendly and accessible energy for all.

a) The new energy mix consists of various sources e.g. solar power, wind power, geo thermal heat, hydropower, biomass, waste burning and safe nuclear power.
b) The energy system is characterised by a systemic integration of novel key element solutions (supply, transport, ICT-supported infrastructure, smart grid, storage solutions, and business

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[3] Sassen, S. (2015) Who owns our cities - and why this urban takeover should concern us all.
https://www.theguardian.com/cities/2015/nov/24/who-owns-our-cities-and-why-this-urban-takeover-should-concern-us-all

models). These new solutions enable highly efficient production, transmission and net "use" of energy.

c) Small-scale, diverse and decentralised solutions together with local autonomy contribute to the resilience of the energy system.

d) Due to the central role of smart grids in the energy system, small-scale energy production is well adapted, integrated into the network, and promotes equal access to sufficient energy.

e) There is an emergence of self-sufficient off-the-grid energy lifestyles.

f) The high share of low-carbon energy sources has been enabled especially by the decrease of prices in solar energy[4] and improved energy storage capabilities.

g) Increasing emergence of self-sufficient off-the-grid energy lifestyles.

h) Battery, hydrogen and fuel cell based storage solutions for low-carbon electricity supply are progressing fast.

i) Converting ambient energy into electrical energy ("energy harvesting") is widely applied.

j) Citizens are well informed about different energy choices and their impacts.

k) Facing the impacts of climate change, many countries cooperate in providing and transporting sustainable energy. International regulations and agreements between interlinked countries enable a more efficient and sustainable energy system globally.

l) The global demand for energy has continued to increase, especially in Africa, due to growth in population, urbanisation and per capita income levels.

Challenges:

- Geo-political challenges, as energy is a complex and politically "hot" issue.
- In some EU countries, mining and burning coal is continued, as large-scale facilities are needed to endure stable energy supplies. Policy makers in these countries are often sceptical about the transformation towards renewable energy sources, and energy futures are dependent on policies.
- For the development of low-carbon electricity supply, energy storage is needed as a buffer.
- The current growth rate of the share of the renewables is not sufficient for meeting the climate goals.
- Novel solutions for storage and grids are still limited and their promotion needs investment, regulation and incentives.
- With a lack of sufficient storage solutions, trade in energy does not necessarily support sustainability.
- Despite the falling costs of renewable energy technologies, the solutions are not accessible for all the people in world.
- Solar and wind energy are not enough to build a sustainable energy system.
- Scarcity of mineral resources, which are needed for e.g. photovoltaics and capacitors, is a bottleneck. Furthermore, the recycling of these materials is an unsolved problem.
- The self-sufficient off-the-grid energy systems may be opposed by classical energy providers.

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[4] On average 5% yearly price reduction for solar energy during the period 2018-2038.

- Nuclear power is a topic with considerably different perspectives, regulation and ideas in the different EU countries.

3. Carbon retention for climate change mitigation

Background

Under pressure from climate change, carbon storage becomes wealth and carbon emissions become leakage. The value of storage and the cost of leakage are based on the concentration of carbon in the atmosphere. A global value network associated with creating and managing "carbon sinks" is built on the strength of a global political agreement for the governance of carbon in the atmosphere with fiscal powers, and on the potential of clean tech and carbon emissions monitoring and management technologies. The fiscal powers are used to shift economic incentives to avoid deforestation, retain carbon dioxide in oceans and recapture waste carbon resulting from human activities.

Key aspects of the GVN regime of 2038:

Value promise: Carbon storage mitigates climate change.
  a) New effective carbon capture and utilisation (CCU) technologies and infrastructure emerge to complement and give momentum to carbon capture and storage (CCS) solutions.
  b) Highly developed sensors allow precise and real-time monitoring of carbon emissions.
  c) Both compliance and voluntary carbon offset markets have grown substantially, and they are an important tool in carbon reduction commitment. Careful management of the market of carbon markets is crucial.
  d) The effective use of genetic engineering have increased the carbon capture of various kinds of plants.
  e) More and more forests are managed sustainably and they contribute to climate change mitigation as carbon sinks. With global agreements, destruction of tropical rainforests has ceased and there are concentrated efforts to grow more forests. The effective monitoring of forests has supported the development.
  f) Special efforts are focused on low-input farming, soil fertility management, nutrition disorders and sustainable non-food crops. Farm-based carbon credits bring economic benefit for environmentally minded farmers.
  g) Production of bioenergy uses biomass residue only.

Challenges:
  - Forests are destroyed for mass production of food.
  - New bioproduction technologies based on genetic engineering are not socially accepted.
  - The management of carbon stocks in the atmosphere is a massive and complex issue with huge economic consequences. Thus, mitigating climate change with carbon retention requires effective global governance.

- European forests may be near in reaching saturation point as carbon sinks.
- Carbon offsets are not a sufficient substitute for considerable cuts in carbon emissions. They are used as an excuse to postpone sufficient action in reducing fossil fuel emissions.
- In order to ensure holistically green and sustainable processes, the technology has to be designed in a sustainable way as well, instead of using cheap solutions with short-term benefits. Sequential engineering may not be a suitable approach for this.

4. Sustainable use of water systems and resources

Background

A territorial governance of water, that ensures sustainability of clean water supplies and sufficiency of water resources, emerges under the pressure from climate change, environmental degradation, pressure of water-related conflicts and overpopulation, helped by abundant energy. Water ceases to be a geostrategic resource. It becomes an abundant, non-privatised and common inheritance of humanity, ensured with transboundary water management and global treaty on water. Global, national and regional public and private actors are able ensure that adequate water supply is provided to all through a combination of easy access to technologies that monitor water condition and use, through water purification and recycling, and through collective governance of water related geo-engineering.

Key aspects of the GVN regime of 2038:

Value promise: Economic value, security and wellbeing promoting use of water resources avoiding pollution, depleted fisheries, and loss of coastal habitats.

a) Safe and good quality water is available for everyone in the world. New efficient desalination and purification processes and greatly improved water use efficiency for industrial as well as individual actors reduce the pressure on fresh water resources. Open access systems guarantee the availability of technologies for all.
b) About half of all fish consumed in Europe is now produced by sustainable aquaculture, and there is a system of global governance for fishing. Alternative nutrition sources, such as seaweed, support responsible consumption of food from the oceans.
c) The plastic and chemical release into the oceans and water systems from European and global coastal areas has ceased. Ocean pollution and acidification have incentivised global action.
d) The undesirable changes in water cycle and systems, caused by climate change, are addressed with collaborative geo-engineering efforts by scientists, companies and private actors.
e) Global water governance has a regional layer. Common water resources shared by i.e. neighbouring countries, help towards the achievement of cooperation across borders.

f) New water harvesting solutions provide self-supplies of water for agriculture or drinking in areas that suffer from low rainfall. They also help mitigating floods.

g) As anticipated in the Manifesto of Bioeconomy[5], European marine and coastal areas are sustainably managed environments of localised, hybrid solutions.

Challenges:
- Together with global warming, water scarcity will continue to generate conflicts.
- Commonly agreed geopolitical paths to solve the geostrategic implications of water scarcity are difficult to establish, as water resources are not distributed evenly between countries.
- Water is governed nationally, and efforts to establish wider networks are minimal. Notions of responsibility for management of water resources – especially at country-level – need to change.
- A large-scale conflict may be needed in order to change the current paradigm of established rights on water.
- "Water barons" who buy up water rights pose a threat to water as a fundamental human right.
- Current water policies are silos, wherein i.e. terrestrial and marine expertise are segregated.
- There are conflicting national and international perspectives related to the use of coastal areas and water resources. Sharing water resources may also lead to conflict, especially when one country controls the water.

5. Sustainable use of materials

Background:

Under pressure from overexploitation of mineral resources and waste pollution, a GVN emerges based on the principles of sustainable circular economy, which take prime position in the practice and teaching of engineering, design and industrial organisation. Next to strong incentives by multilevel decision and policy making, the key driving actors – the demanding customers and innovative companies who provide accessible, easy to use solutions – have changed the scene. Municipal authorities charge the costs of environmental remediation, pushing for material efficiency, reuse and recycling.

Key aspects of the GVN regime of 2038:

Value promise: Material cycles with negative environmental footprint.
a) Finding affordable novel solutions and materials suitable for the sustainable cycle of material use, such as e.g. biodegradable materials, is the core innovation in this GVN. Raw materials are developed and selected for use according to their end-of-life possibilities in mind.

5

https://www.researchgate.net/publication/316751201_Targeting_sustainable_bioeconomy_A_new_development_strategy_for_Southern_European_countries_The_Manifesto_of_the_European_Mezzogiorno

b) Most material and waste is recycled or re-used into valuable inputs with new effective recycling solutions. The recycling strategies for i.e. minerals and metals are different. Technology assists in identifying different materials and separating waste.

c) More and more products are designed and manufactured to be adaptable to changing requirements, durable and easy to repair if necessary. Standardised lifecycle assessment tools are used to evaluate environmental impacts.

d) The most of critical raw materials are recycled.

e) All plastic is reusable and recyclable. Plastic debris and leakage of micro plastics in water and environment have been solved.

f) Principles of a circular economy, adapted widely throughout different sectors of production, have increased the value captured from resources. Production is less dependent on primary materials and the need for virgin material input is low.

g) Social innovations and campaigns have raised circular economy awareness. Overconsumption is avoided. Sharing economy and collaborative consumption flourish.

h) As Europe has been strongly leaning towards circular economy, it is now a global pioneer exporting the recycling technologies.

i) New design approaches, such as biomimicry, enable more sustainable products.

j) Advanced biorefineries, supported with long-term policy instruments, use valuable ingredients effectively and produce food, materials, energy and chemicals. Biomass is processed sustainably and used efficiently.

Challenges:

- Planned obsolescence, practiced still by many companies, wastes resources and energy. Currently, repairing is unprofitable to companies and consumers.
- Local conditions concerning sustainable material use vary considerably. For example, recycling is not equally strong in different countries. Regulations and standards concerning circular economy also vary from city to city. In order to reach a critical mass, there has to be a consistency in regulation.
- Without sufficient support and knowledge on i.e. suitable materials, traditional industries are slow in their transition from accustomed approaches towards circularity.
- There is a lack of investment in novel, more effective recycling and recovery technologies and infrastructure. Current solutions may not offer sufficient results. For example, some materials become toxic when recycled too many times with current methods.

6. Smart transport

Background

Driven by the human need for mobility, trade and the environmental impact of transport a new GVN emerges that goes beyond the existing networks of manufacturers of means of transport, transport companies and insurance markets. New entrants include new power sources, new control and

governance systems, increasingly active public authorities and active citizens. Efficient, automated and multimodal transportation systems unite people and goods with their destinations. Various actors on local, regional, national and international levels collaborate to enable convenient and safe passenger travel as well as smart logistic chains for the transportation of goods and raw materials with minimum environmental footprint.

Key aspects of the GVN regime of 2038:

Value promise: Safe, smart, inclusive and efficient multimodal transport.

a) Strong cooperation on traffic management on regional, national and international levels, together with integrated data from individual vehicles, infrastructure and road networks guarantee a well-matched, efficient and traceable global transportation system.

b) Passenger transportation is supported by robotic, autonomous electric vehicles.

c) Public and private sectors provide service-like mobility solutions through collaborative platforms. Individualised and on-demand services, together with reliable and affordable public transport, have reduced the attractiveness of and the need for privately owned cars.

d) City centres and urban areas are planned in a way that supports non-motorised transport modes, such as walking and cycling.

e) Inter-city transport models like Hyperloop bring down the environmental impact of transport substantially.

f) Joint logistic systems with automated loading, unloading and distribution, are located outside of the city centres and connected first-/last-mile solutions are used for urban freight delivery. This guarantees a systematic and more cost-effective transport of goods, yet most traffic is removed from densely populated areas.

Challenges:

- The lack of standardisation of automated information, communication technologies and protocols.
- Vehicle automation of transport destroys jobs in transportation and trucking industries.
- High level of connectivity of billions of devices makes the system vulnerable to cyber-attacks. Computer controlled systems are prone to viruses.
- Without effective optimisation and planning, automated, autonomous and easy-to-use modes of passenger transportation may actually increase congestion problems. Transportation problems can only partly be solved by automation.
- Prevailing attitudes and trust issues: accepting or getting used to the idea of riding a robotic car will take time.
- Questions of responsibility in case of accidents with autonomous vehicles are in most cases unsolved until now.

7. Individualised manufacturing close to the customer

Background

Scanning and printing in 3D enables local production of goods and equipment and facilitates servicing. Manufacturing and associated value chains become reconfigured. In the new GVN, different kinds of companies, suppliers and individuals produce goods, equipment and material locally, on demand, for specialised needs of individuals and other companies. Users benefit from the tailored products and systems as well as rewarding co-creation experience. Engineering and design knowledge and competence become widely available, supported by public libraries of printable designs for all kinds of goods, machines, materials and components. Intellectual property, health, safety and security are protected with regulation.

Key aspects of the GVN regime of 2038:

Value promise: Availability of efficiently produced fully personalised products with flexible inroads for user interventions and add-on services.

a) Robotisation brings flexibility to production lines. With AI, robots can produce small series or individualised products locally, on demand, which increases cost-effectiveness.

b) Many companies have moved their production back to Europe. The cost of labour is not the primary factor when deciding on the location of a company.

c) Various forms of additive manufacturing and 3D imaging promote customisation. Some of the business possibilities are: a) a company/agent and its customers using their own additive manufacturing tools, b) a regional supplier of 3D prints, c) a regional or global supplier of highly customised 3D prints (e.g. spare parts) or d) 3D printing at home (for a daily supply).

d) The novel modes of manufacturing promote the principles of a circular economy, as the production of spare parts at the location where they are needed makes repairing easy.

e) 3D printing has transformed the healthcare sector with precisely tailored prosthetics and organ transplants. Fast prototyping enables experimentation and flexible testing.

f) A significant proportion of manufacturing is decentralised and carried out by consumers or local businesses. Prosumer models enable new ways of collaboration.

g) Skilful customisation of products requires new type of understanding a variety of different cultural contexts and individual needs.

Challenges:

- There are several technological challenges to overcome for 3D printing to be competitive, concerning i.e. a) the use of 3D printing with different materials, b) combination of printing materials, c) material density/composition scanning and d) the consistent high printing quality.

- Personalised production may be unsustainable due to increased consumption, reduced efficiency or unregulated emissions to the environment.

- Technical progress, cheap transport and efficient logistics may be more favourable for centralised mass scale production.
- The new production landscape may be strongly opposed by the prevailing market forces with more traditional manufacturing processes. The creation of favourable environment for the regime change thus needs active governmental support.
- The shift in manufacturing may increase global inequality. Value creation in emerging countries, which have relied on large-scale production, would diminish. At the same time, these emerging countries possess huge markets for personalised products, which would further deepen the inequality gap.
- The easy access to software for additive manufacturing eases piracy. The current legislation concerning intellectual property rights has difficulties to handle these issues.

8. Remote interaction with people and machines

Background

Distant presence enables controlling things, machinery or processes and interacting with other people from a distance as if they were physically present. The main interfaces are between people, between machines or between people and machines. These modes of interaction has become a core feature of socio-technical networks, making the internet an infrastructure for globalisation.

Key aspects of the GVN regime of 2038:

Value promise: Possibility to interact with people and machines remotely almost in a similar quality to an interaction with physical presence.

a) Experts collaborate to share and co-create knowledge in domain-specific online and virtual communities of practice that extend throughout the world. Reliable communication allows multiplication of skills.

b) Augmented reality and virtual reality together with Artificial Intelligence provide accessible and communication environments. The experience of distant presence are almost identical to those of physical presence, enabling the positive impacts, such as trust, meaningfulness and innovation, of face-to-face meetings.

c) People routinely perform tasks without being at the same location as the utilised devices or tools. Specific diagnosis tools and visual communication programmes support the network.

d) Intelligent machines control other machines and human beings from a distance, using human language if required.

e) As tasks are taken over by autonomous systems, human capacity is released for more meaningful and creative efforts.

f) Telepresence-based models increase work outputs and reduce unwanted or unnecessary travel. People are able to choose their place to live more freely and stay there for longer times, if they wish.

Challenges:
- Cyber security and vandalism are considerable risks brought about by the distant control of devices.
- Savings in commuting time are deemed economically uninteresting by the employers, as organisations have traditionally not been responsible for the commuting of employees. Thus, the change is not necessarily supported by the employers, although it is very attractive to employees.
- In many EU countries, work commuters are subsidised both in taxation as well as in public transportation even though the transportation usually takes place during the rush hours.
- Urbanisation has been much stronger than the appeal of lonely life in lakeside far away locations, using telepresence. People actually like to be near people.
- Remote interaction is not applicable to all contexts. Many are used to be present face to face, and many experience that it is actually necessary to nurture credibility and innovation.

9. Sustainable housing

Background

As population rises across the planet, good housing is a growing need. The construction industry is one the drivers of economic growth across the globe, one of the biggest consumers of mineral resources and one of the most important sources of greenhouse gas emissions in the atmosphere. The environmental impact of housing and our increasing knowledge of the relationships between housing, health and economic productivity drive the emerging global value network. In the built environment, digital and physical worlds are now interrelated throughout the entire lifecycle. Structures and spaces have become functionalised. Built environments support community building as well as the health and well-being of the occupants. The environmental impact of housing is low, land use is efficient, and creative solutions allow it to adapt to changing needs.

Key aspects of the GVN regime of 2038:

Value promise: Buildings with negative environmental footprint that are tailored to the needs of users and promote dignified living.
a) Housing and spaces are designed to promote a sense of community, facilitate interaction and enable social networks.
b) Changing housing needs, caused by i.e. demographic aging, are considered in planning processes and supported with innovative modular and multifunctional housing solutions.
c) Sharing economy models may decrease housing and living costs and provide social benefits and meaningful interaction.
d) Principles of circular economy are followed in construction processes. Smart, sustainable and innovative material (i.e. polymer) or material substitutions are utilised.
e) Ecological functionality of buildings is high. For example, by turning the outer walls and roofs into solar panels, space for energy generation can be used efficiently.

f) Many structures are self-healing, they intrinsically detect their maintenance needs and utilise information technology as well as living materials. Many of the formerly passive materials and infrastructure (walls, streets, furniture, street signs) are interactive or functional (reducing noise, for example).

g) Digital information, artificial intelligence, 3D printing and robots are efficiently used in the planning, assemblying, building and maintenance of buildings. With robotisation, many tasks in casting, moulding, painting, transferring materials, installation and finishing are automated.

h) Due to regulations, old constructions and apartment buildings have been retrofitted and renovated to meet the energy efficiency standards.

Challenges:

● Despite empty property, many large cities have the problem that owning a house is not affordable, even renting is very expensive. This results in social cohesion issues, and requires suitable policies.

● Energy-efficiency has to be planned beyond a focus on single buildings.

● The conservative construction industry adapts to new technologies rather slowly because of existing rigid regulations and standards.

● Unless equipment is designed to be energy efficient, digitalisation of housing may lead to unsmart solutions.

● Increasing digitalisation and Internet of Things enable sustainable solutions. They may also lead in emergence of unwanted issues such as spy programs and viruses, tracking every movement in a house.

● The renewal of existing housing stock is an important question for Europe. It is the one of balance between energy efficiency and aesthetics; is it more beneficial to retrofit or just destroy old houses?

10. Valid information and knowledge co-creation

Background

As information circulates freely and online communities of practice flourish, knowledge co-creation can be practised by anyone interested in doing so. Citizens, scientists, science funders and policy makers across the world cooperate to establish open data available to anyone, and structures that provide evidence-based public advice for decision-making. Artificial intelligence algorithms continuously scan sources of evidence and advice, and customise information to the decision needs of their users.

Key aspects of the GVN regime of 2038:

Value promise: Availability and co-creation of valid information and knowledge as a basis for individual and societal decision-making.

a) Artificial Intelligence supports the transparency of the political and economic decision-making across the EU and many other parts of the world.
b) The production and distribution of fake information is avoided and traced systematically.
c) Up to date and relevant information stemming from various certified sources is easily available for citizens. Equal opportunities for data and media literacy are actively advanced.
d) Media freedom, diversity and pluralism are protected as pivotal factors of freedom of expression.
e) Public, independent broadcasting and free media are the main sources of information. Agile, critical and personalised media sources support the public broadcasting system. Invalid information and fake news are rapidly identified and excluded from discussions.
f) Co-creational activities as well as participatory research and science support decision-making that meets the citizen demands. The quality of information produced by citizens and independent researchers is inspected by trustworthy scientific institutions.
g) Science is open – with few exceptions. The communication of results is instant and clear.
h) The transfer of scientific knowledge between countries is open.
i) Availability of valid and updated information in a relevant form improves the skills and knowhow of European citizens making them interested in science and a scientific way of thinking, which helps solving wicked problems such as climate change.

Challenges:

- Spreading of fake news.
- There is a considerable threat to the role of free media in some EU countries. Furthermore, the activities of critical scientists may be controlled by those in power.
- It is possible to misuse AI against the general European targets. Currently, AI is not yet able to explain how it makes its choices. That implies the risk of manipulation.
- Evidence alone is not enough for smart decisions.
- Commercial interests to keep knowledge secret are considerable.
- "Filter bubbles", which result from algorithms separating any information that is contradictory to or may challenge the person's viewpoint.

11. Self-directed individualised learning

Background

Education is the driver of change and socio-economic dynamics. The global market for education services has been growing, increasingly so due to digitalisation. Globally competitive elite schools and universities continue to be associated with aspirations for success and upward socio-economic mobility. The range of services offered by schools and universities has increased considerably, from global MOOCs to highly selective intensive targeted short courses, and from courses associated with professional accreditation to curiosity-driven education that supports social integration. Open

data, expert advice systems, simulators, online training communities and flexible career structures complement the learning experiences provided by formal education systems, making knowledge and skills available to those seeking to acquire them. All this gives individuals the possibility to decide what and how to learn.

Key aspects of the GVN regime of 2038:

Value promise: Personalised learning trajectories.
a) Besides basic instrumental skills (e.g. reading and mathematics), the focus of childhood education is on social capacities.
b) Teaching is organised in a way that supports the talents and needs of each individual. Teaching is calibrated and partly customised according to each pupil's capacities.
c) An important learning method is problem solving in groups or in shared projects. Many publicly funded schools and universities in the EU and elsewhere in the world have replaced the conventional disciplinary teaching methods with a problem-solving-based pedagogy and curricula.
d) The emphasis in learning shifts from information accumulation to posing new questions and creativity.
e) Individual progress is tested with problem-solving situations simulated by Artificial Intelligence and digital technologies. Artificial intelligence can correct performance and provide enough motivational stimulation for learning. Artificial intelligence and simulators can certify the achieved skills.
f) Emphasis on lifelong learning approaches enable training, personal development and education for people throughout their lives, for meaning and competitiveness.
g) Individual mentoring is increasingly prevalent as a high-end service.
h) National strategies and policies support and inform the reformation and recalibration of education systems that meet the needs of societies, working lives and the world of the future.

Challenges:

- Educational institutions have long traditions and professional independence. Traditional public monopolies in the education sector do not promote the introduction of technological or social innovations.
- In many EU countries, teachers are under-paid and their role is under-rated.
- Quality assurance and certification of the learning trajectories.
- Vulnerability of learning to manipulation (fake news).
- Instead of individualisation of education, standardisation of education is the dominating approach at the moment.

12. Pro-active health and self-care approaches

Background

Health becomes an ever more important value in people's lives. The majority of people have developed an active role in healthcare with the support of a network of healthcare professionals and specialists. The primary goal of all actors in this network is to avoid, detect and cure (dangerous) illnesses. There is a growth in the provision of knowledge, infrastructures and services for activities, which improve and maintain physical and mental health on all sides. People with limited capabilities for active lives are special focus groups. Key elements are patient empowerment and responsibility, prevention and proaction as well as continuous monitoring of symptoms and behavioural advice, supported by responsible and liable professional medical and care companies and providers.

Key aspects of the GVN regime of 2038:

Value promise: Fast and early diagnosis with fast (self) help, immediate treatments, availability of knowledge and capabilities for healthy lives.

a) The preventive and pro-active approaches are based on continuous, active and automated self-monitoring by the patient. Treatment is conducted in an active interplay of a trustworthy health specialist or machine expert and the patient. Different specialists are included in the network if needed.

b) Healthcare is holistic and preventive, focusing on behaviour of the individual, diet, profession and lifestyle. Personal genetic information and peer information from persons with similar symptoms are used for diagnosis and treatment. Experts motivate citizens for an active, healthy way of life.

c) Special support and exemptions are given to groups of people with lost physical or mental capabilities.

d) Many insurance systems require participation in the continuous controlled health monitoring activities focusing on early identification or prevention of symptoms. Monitoring devices, tools and technologies are affordable, accessible and easy to use.

e) Medical professionals and AI systems give decision-support on the activities during treatments to the patient. In comparison with the situation in 2018, many kinds of new treatments of diseases are available.

f) Big data and continuous monitoring have paved the way for customised medicine.

g) New technologies, such as robotic legs, medication dispensers, artificial eyes, housekeeping robots and distant assistants help those with permanently lowered functional capability.

h) AI is paramount in self-care. Each average household has devices for constant monitoring and the first symptoms are detected early.

i) Avoiding and delaying the onset of dementia through active and healthy lifestyles is mainstream culture. (There has been little success in curing Alzheimer disease.)

j) The obesity trend in the EU and other world regions is inverted.

Challenges:

- Without reliable existing knowledge, expert recommendations or AI, self-care may result in wrong decisions or incorrect diagnoses.
- Increase of the so-called medicalisation and non-scientific, inefficient cures because the individuals think they might need it.
- Some may favour quality of life over long-term health benefits and do not adapt to the new prevention-based system (fast food, no sports...) and keep their unhealthy lifestyle. This challenges insurance companies.
- Excessive use of medicine (overdoses or the thinking that more helps more) for purposes that could be cured with pro-active health promotion.
- Digitalised health data requires careful focus on privacy, data protection and standardisation.
- Self-care strategies are not suitable for all, and they may leave behind people without required capabilities, will or economic resources. Minors cannot be subject to self-care.
- There is no agreement on the cost-effectiveness of preventive approaches. More cost-efficient health gains could be brought about by action in other policy areas concerning poverty, pollution and food, for example.
- Unequal access to health promoting lifestyles will deepen the health divide.
- Ethical disputes may arise around more extreme practices of "human enhancement".
- Human dignity of those who have lost their functional capabilities is a difficult ethical issue. If machines support to decide or decide themselves if life is still "worth living", this raises many questions.
- Due to advances in 3D printing and even 3D bioprinting, a development completely opposite to pro-active approaches may take place, as printing new organs or even one's own medicine is easy.

13. User data markets

Background

Data is to this century what oil was to the last one: a driver of growth and change.[6] Especially data arising from the use of digital platforms, services and devices in the internet of things are of tremendous value as the basis for the development of artificial intelligence algorithms. A new value network emerges around data as a "new asset class" with open data markets replacing the data silos of today. Such a data economy may well include individuals who are trading with the data arising from their web activities like with any other asset, as well as intermediate actors who take part in trading activities.. This may multiply possibilities for exploitation of data flows through public and private players. A steady flow of fresh data from individual users is highly valued as the key

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[6] https://www.economist.com/news/briefing/21721634-how-it-shaping-up-data-giving-rise-new-economy

precondition for successfully training artificial intelligence algorithms and for developing advanced private and public services.

Key aspects of the GVN regime of 2038:

Value promise: Privacy respecting, user controlled and advanced utilisation of data flow from use from web platforms and internet of things, which is used for optimisation of public and private services.

a) Online firms are no longer exchanging data for free-services, but pay consumers for the use of their data, which becomes an economic asset to the company. Consumers can opt for different degrees of sharing for different types of data, e.g. more strict strategies with their health data than with their consumption information.

b) Consumers are empowered to become data entrepreneurs and they are well informed on different contracts and regulations and how to work with them. Rules are user friendly and transparent.

c) Technological solutions underpin and support these sharing models.

d) Diverse types of unstructured data flows are integrated by AI algorithms in a sophisticated and meaningful way.

e) There are various practices and regulations related to data ownership, data model contracts, privacy, secure data flows, and transparency of data utilisation.

f) Mechanisms for data pricing and accounting are in place. Public and private data brokers have emerged to enable data negotiations.

g) Europe has formed a data union with high standards of controlled use of web platform user data and a high degree of data harmonisation. This has become a competitive advantage for Europe and challenged former monopolies.

h) Relevant data are no longer stuck in a silo with the platform where they were generated but distributed through the data market to where they are needed. Especially public sector actors can use data to inform their policies and design tailored public services.

Challenges:

● Online companies may be reluctant to change privacy policies without strict regulations. Creating and implementing regulation required for the change is a challenge.

● Contracting and negotiations around data may prove much too difficult for consumers to handle.

● Misuse of the data for purposes not expected by consumers (criminal use, manipulation, advertising).

● Lack of trust of consumers in data brokers and users.

● Integrating different types of data from various sources is challenging.

14. Peer to peer based consumption decisions

Background

In this GVN, networks of people around the world advising each other are the dominant factor in democratised consumption and purchasing decisions for products and services. Competing and complementary digital platforms provide access to detailed product information provided in a transparent manner. At the same time, retailers have bridged digital and physical shopping experiences so that virtual shopping now involves a range of personalised high quality interaction to support the consumption decision making.

Key aspects of the GVN regime of 2038:

Value promises: Reliable and transparent support for consumption, purchasing and transaction decisions. High quality personalised, digital shopping experience in the selection of goods and services.

a) During the past 20 years, social media have come to play a key role in the selection decisions of products and services. Former Business to Business to Consumer (B2B2C) networks have transformed into Consumer to Business to Consumer (C2B2C) configurations.

b) Customer trust is generated through reliable and transparent peer review, rating and reputation systems. Peer evaluation is now the most believed source of information. Due to the increased importance of reputational capital, user feedback is a valuable status symbol for product and service providers.

c) Prosumption and do-it-yourself ethics emerge, as consumers actively take part in the design and production processes.

d) Trade, search and selection of goods in online and virtual stores resemble traditional, physical shopping experiences. For example, one can use a virtual mirror to look at clothes and the goods can be picked up from virtual shelves. Immersive digital services resemble over-the-counter service experience. The customer servant, human or a machine, assists the buyer interactively. If the service requires measuring or fitting, the user is provided with a technology, which gathers the required information for the service provider.

e) The virtual store can be located in homes or at the corner shop, which is equipped with, for example, a larger display and measurement devices

f) The ordered goods are delivered to a robotic distribution automat typically at walking distance.

Challenges:

- Preventing of filtering fake customer feedback is a key challenge for a well functioning and reliable peer review system.
- As user feedback becomes important capital, it also becomes more and more prone to falsification.
- People like to go to look at the concrete product in order to be sure about its suitability. They need haptics and the real life shopping experience.
- Easily comparable evaluation of and information on different products and services may become challenging.

- Issues of trust emerge with prosumer models, as the broader spectrum of makers means larger diversity of product or service quality.
- Counter movements such as slow-food, frugality and minimalism continue to grow as cultural influencers and pose a challenge to digital consumption.

15. Sustainable food for all

Background

With the rising global population, food availability is an important need and an important challenge. The spreading of different lifestyles across the planet and the associated food intake, together with the development of sustainable and healthy food habits and associated public health advice shape the Global Value Network. In this, public and private actors around the world address and reconcile multiple goals, including security and quality of food supply for a growing world population, environmental protection, employment creation and empowerment of communities.

Key aspects of the GVN regime of 2038:

Value promise: High quality, healthy and sustainable food for the needs and tastes of all people.

a) Sustainable agriculture, supported with AI and ICT solutions, provides the main foundation for the food supply system. The increase in human population, the fight against climate change, progressive soil erosion and claims for healthy diets for everyone spurred significant changes.

b) There has been a substantial reduction of meat consumption and a radical increase in land-grown and non-animal protein sources. A wider selection of alternative proteins together with health, lifestyle and sustainability reasons have caused the overturn from meat heavy regime. Flexitarianism, veganism and vegetarianism are trending diets.

c) Emphasis is on less intensive farming, regenerative agriculture and eco-systems support as well as required investments, adjustments to policies and steady efforts to reduce food waste.

d) A focus is local / regional food production catering to the increasing diversity of tastes in all regions. Urban farming, aquaponics, gardening, and customised agriculture in cities are emerging practices. Digital platforms provide new marketplaces to match supply and demand.

e) A diversified range of alternative food production and supply chains have emerged. These started as niche applications for inner city specialised markets. As food prices rose and technology matured, they are a visible part of the food supply chain.

f) The exact nutritional content of products is available and people are able to measure the direct physiological impacts of their individual nutrition on their personal health. Matching food with the genetic information of the eater is a starting point for individualised food production. As a result, diet-related chronic diseases have decreased.

Challenges:

- Lack of sufficient food in many parts of the world may lead to mass migration.
- Equal access to sustainable food for everyone is a complex issue that requires strong international political will, as well as mix of sustainable food production, food literacy, lifestyle, retail and food service industry. The current trajectory is towards the global double burden of famine and obesity.
- Efficient large-scale production with global logistics and established agri-food business incumbents dominate the markets and marginalise the local food production.
- Deep prejudices towards new production methods of food, especially genetic modifications.
- Strong incentives to use sugar and fat in convenience food, consumed by people with less choice.
- The overuse of antibiotics in farming is a major cause for antimicrobial resistance.

16. Virtual citizen interaction for entertainment, art and culture

Background

Online platforms provide intense educational, entertainment and social experiences, so much so that individuals find meaningful relationships in communities across the planet, accessing arts and cultural experiences that transcend their national or regional identities. Online networks support the new emerge of hyperlocal communities.

Key aspects of the GVN regime of 2038:

Value promise: Vastly accessible entertainment, art, culture, education and social interaction.
   a) People spend an increasing amount of their leisure time engaged in online games, simulated worlds and worlds where computer games and the physical world connect.
   b) Digitalised communities and online communication support the self-expression and freedom of speech.
   c) Social information networks provide easy ways to contact other people and help with coping with foreign places and cultures. Free of charge translators assist in real-time translation.
   d) Cyborgs and robots track and recognise motions and gestures of the user and are able to use his or her national language. The experience of virtual reality resembles a face-to-face meeting.
   e) Hobbies and cultural activities lead to the emergence and strengthening of professional contacts as well as learning skills that are important in work.
   f) Online communities harbour an immense diversity and inclusion, and offer meaning and connectivity to users.
   g) Movies are interactive in a similar way as games and they are partly based on real-time crowdsourcing.
   h) Interactive virtual and augmented reality environments are used to reconstruct historical settings or to simulate completely new worlds.

Challenges:

- If people are too immersed to virtual worlds, they are not able to function in the world without information technology. Due to addiction, isolation and disconnection, citizens may lose touch with not just each other but also with the problems of the real world.
- The potential for manipulation grows if people numb themselves with entertainment and distance themselves from physical communities and societal experiences.
- Virtual environments introduce new kinds of security challenges.
- Cyberbullying, cyber harassment and manipulation.
- Questionable or fake information.
- Taxation of virtual entertainment services may prove to be difficult.

17. Enabling mechanisms for self-organising communities

Background

Internet-mediated self-organising communities move beyond hobbyist contributions of leisure time to become global value networks that take on major aspects of the economy, as distributed ledger technologies, such as blockchain, enable peer-to-peer transactions and operating models to replace complex contracting structures, previously internalised in large corporations or in communities of purpose (e.g. Linux).

Key aspects of the GVN regime of 2038:

Value promise: Easy direct transactions between peers at no cost and in real-time.
   a) Platforms that enable trustful and complex transactions that are inherently resistant to data modification at a later point in time are widely available to those wishing to collaborate in value creation activities including social and public goods. A large part of the financial transactions between citizens or citizens and companies is conducted through such platforms without any mediating financial institution.
   b) The platforms provide environments for collaborative value creation including complex contracting mechanisms that protect the rights of all contributors.
   c) Platform based peer-to-peer networks have become a major factor in global value creation systems across sectors. For many people contributing to these networks has become the dominant mode of work.
   d) Many of the platforms are places of communication and learning. They all co-exist, compete and learn from one another.
   e) Complementary regulatory enabling mechanisms for protected open exchange are in place.
   f) Some transaction systems have a sectoral scope (for example, in health, agriculture or legal services) and are tied to major global actors – corporations as well as non-commercial players. Other systems are community-based - or only available in a small group.
   g) Platforms that promote traceability and transparency create new relationships and in that way build trust within local communities.

h) Capturing and interpreting emotional response helps to understand feelings and behaviour related to transactions.

Challenges:
- Financial platform transactions pose huge regulatory challenges and may end up in a "grey area" between legal and illegal.
- The energy consumption of blockchain-like tools is very high, especially if a high number of people participate as in the case of bitcoins.
- Capturing emotional responses to transactions is relevant for functional systems, yet technically difficult.
- Use of the platforms for organised crime.
- The rapid development of artificial intelligence might radically change action possibilities in the internet.

18. Sustainable tourism

Background

Tourism belongs to the world's and Europe's largest and fastest growing industries, supported by the growth of transport industries, the diffusion of lifestyles, growth of cultural empathy and proximity brought by the globalisation of information. At the same time, tourism challenges local communities, depletes local assets and subverts local ways of life. For many regions in Europe, tourism is the main source of income. In the new GVN, tourism industries work together with stakeholders and local communities. All sectors relevant for tourism are included in the cooperation.

Key aspects of the GVN regime of 2038:

Value promise: Sustainable tourism with lasting benefits for both visitors and hosting regions.
a) Tourism has remained one of the leading job creating sectors and a substantial employer in Europe and worldwide.
b) The undesirable impacts of rapid tourism growth are managed through cooperation of governments, business and stakeholders. The concern for sustainability is addressed with strategic planning efforts and is integrated in activities by all actors.
c) Tourism policies and practices are more and more community-driven. Local governments develop their distinct strategies that are suitable for different types of locations.
d) Particular focus is drawn into new low-season opportunities in order to enable steadier inflow of visitors throughout the year and reduce the unwanted impacts of seasonality.
e) Sharing economy offers a model for sustainable and social interaction. When local people share with tourists what they own or what they do temporarily, natural resources are saved and social contacts built between local people and tourists.
f) Important historical sites and cultural heritage in general are preserved and conserved.
g) Globally, sustainable tourism has enhanced mutual recognition of diverse cultures.
h) Virtual reality partly replaces the need of physical experience and excessive rapid tourism.

Challenges:

- Tourism contributes substantially to greenhouse emissions and climate change.
- Destinations suffer from fewer tourists because of intolerable temperatures or weather conditions.
- Socially unsustainable mass tourism may result in radically increasing housing prices and uncontrolled gentrification. This increases negative attitudes of locals towards tourists.
- The dynamics of tourism are highly unpredictable due to economic and geopolitical fluctuations. Visits to unstable countries pose considerable safety problems.
- In order to function well, sharing economy models need to be remodelled and regulated in a holistic manner. Current practices may harm local communities with i.e. rising housing costs.
- Sustainable tourism may not be compatible with the concept of tourism as an industry. In order to reach truly sustainable tourism, profit-driven business models need to give way to alternative economic logics to establish diverse value for touristic destinations.
- Cheap and affordable transportation and prevailing lifestyles that admire frequent travelling encourage fast and invasive tourism. Stricter visitor limitations may be required.

19. Security network against military and criminal attacks

Background

Safety and security are important human needs. Global, European and national safety and security levels are deeply intertwined, and at all levels internal and external security are interdependent and inseparable. As technologies make people more potent, the need for stronger security arrangements permeates more aspects of life. The emerging GVN covers and includes actors from the most essential livelihoods, social safety nets, order management, logistics, national defence and various property security, product safety, environmental damage prevention, risk mapping and even insurance policies.

Key aspects of the GVN regime of 2038:

Value promise: Security against all kinds of risks concerning the welfare of the nations and their citizens; security as a business.

a) Security is seen as a complex issue that requires holistic, multidisciplinary cooperation across all sectors. Special focus is given to preventing threats and reasons for conflicts and wars. Strategies and security measures are planned resiliently according to the evaluation.

b) New technologies have a dual role, as they create both security and risks.

c) One security focus is in complex communication systems and electric grids. Connectivity makes infrastructures vulnerable to attacks. The damage caused with e.g. remotely controlled devices or a virus is maximal without large economical or casualty loss for the attacker.

d) Security by design models are considered and applied from the beginning of planning processes in order to ensure a precautionary and holistic approach to security issues.

e) Security threats are now handled effectively through international cooperation and with means of AI, quantum cryptography and signal listening of information networks. The human being is a weak factor in some of these systems.

f) Tools of foresight and cyber security games are used for anticipating possible risk situations related to security. Advanced and intelligent technologies assist in monitoring the illegal activities at the external borders of the EU and countries all over the world.

g) The regulation of substances and the control of research laboratories is an increasingly important element in prevention of chemical and biological weapons.

Challenges:

- The traditional means of digital security, e.g. pin codes and passwords, become rapidly inefficient because of AI and quantum computing. Quantum cryptography might be a solution, but it is not clear how efficient or difficult to use it will be.
- Many illegal activities that threaten countries and cities worldwide relate to terrorist attacks carried out by local cells or individuals from distributed networks. They are difficult to identify.
- New bioweapons are difficult to perceive and they are able to multiply themselves.
- The competitive nature of security arrangements is a major challenge as communities and nations compete for developing the most potent weapons to guarantee their own security.
- Checks to prevent smuggling illegal substances decrease the efficiency of transport.

20. Human and social security

Background

A Global Value Network emerges based on a holistic understanding of people-centred, globally interlinked and preventive security, adapted to varying contexts of various different livelihoods. At the core of this GVN is the provision of sufficient support against any harmful conditions that may lead to injuries, sickness, poverty, unemployment or death. It is about the protection of the security, dignity and material and physical needs of ordinary individuals in their everyday life. The approach is as much about building resilience as it is about reducing vulnerabilities. When needed, the consequences of the threats are mitigated efficiently. In this GVN, states and national stakeholders, communities, global networks of partnerships, NGOs, business sector and insurance companies cooperate to build objective and subjective security.

Key aspects of the GVN regime of 2038:

Value promise: Security and freedom from all kinds of threats concerning the welfare or the dignity of the citizens.

a) There is a holistic understanding a multiplicity of possible threats and risks stemming from issues related to health, economy, environment, communities and nutrition as well as personal and political topics. Inequality and poverty are considered as main problems.

b) Providing minimum living standards and universal basic education everywhere is acknowledged priority.

c) Prevention and preparedness of environmental disasters and other conflicts has increased globally due to improvement of early warning systems.

d) Minimum health services as public goods and life-saving drugs are available for all people in the world.

e) National, regional and local understanding are equally needed in order to understand multifaceted contexts related to all dimensions of human security.

f) The promotion of democratic principles and participation is a key element that enables trust between individuals, communities and political institutions.

g) Security is not executed merely by authorities, as citizens engage in 'do-it-yourself networks' of surveillance, which strengthens communities and feeling of security and belonging.

h) In security issues, the interest of the people is understood as an integral part of national security.

Challenges:

- Many threats to human security do not respect state boundaries, and thus require efficient and integrated cooperation.
- Furthermore, the conceptions of preferred measures for security may be contradictive depending on the actors.
- Humanitarian interventions may have counteractive consequences.

21. Decent and meaningful life for elderly people

Background

As people live longer, the differences between the generations and the communication and interest gaps increase drastically (we have four generations alive). At the same time, we see a rise in non-communicable diseases and disabilities, which prevent people from functioning in private and from participating in community activities (because of age, lifestyle and other reasons). The emerging GVN connects people to be able to overcome physical and mental impairments, and improve their daily performance. This is as much about providing support, care, entertainment and mutual exchange platforms, as it is about enabling people to be physically and mentally stronger, faster, and more resilient, and to live longer fulfilling lives.

Key aspects of the GVN regime of 2038:

Value promise: New capabilities for people who have lost their functional health, elderly remaining active in social activities and see a meaning in their life

a) A specific age-based definition of "old age" is no more suitable. The majority of people of 65-95 years still have energy and are active. Work-related, voluntary and social activities together with lifelong learning possibilities create meaning for the aged and a valuable resource for the society. The aging are encouraged to stay in work as long as they are able and willing.

b) There is a great demand for elderly health care services and "caregivers" with skills beyond classic physical caregiving: care for people with mental problems, coaches, advisors for daily problems and administrative issues, entertainment, cleaning etc.

c) Improved medical solutions result in longer and better lives. Better-functioning assistive devices increase safety and independence. New treatments and cures are possible.

d) Novel service concepts and social innovations enable the societal participation of senior citizens. Co-created solutions in various areas, such as housing, transportation and urban planning, match the need of older citizens and increase social inclusion[7].

e) Active intergenerational environments provide human contacts and enhance active and meaningful living of physically and socially old people.

f) Age management approaches, executed cooperatively by organisational management, health services and workers, help to maintain work ability of ageing workforce.

g) Age-friendly smart technologies and intelligent machines provide security in homes.

h) Social media, AI-based solutions and social robots can support the daily life people maintaining a high standard of quality of life.

Challenges:

- For a truly sustainable aging Europe and world, affordable and accessible innovations are needed.
- Even though there would be structural flexibility to delay retirement and will to work from the employee's side, the employer's mindset may not be favourable for working longer.
- There is still a lack of solutions for in-home care for mentally disabled elderly people.
- Lack of qualified caregivers, unattractive working conditions in the sector.
- The lack of substantial progress in understanding the nature of and, accordingly, finding a cure for neurodegenerative diseases such as dementia.

22. Global Capacity for Social Innovation

Background

Social innovators develop and implement novel practices that address their own or their communities' needs. Policy makers and researchers increasingly recognise that social innovations generate substantial social and economic value for societies. If social innovators connect globally and exchange on practices and solutions a global value network may emerge around a global social innovation capacity.

Key aspects of the GVN 2038:

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7 https://www.healthcarebusinessinternational.com/hbi-2017-the-future-of-elderly-care-in-europe/

Value promise: A global social fabric with substantial capacity to experiment social innovations as a core element of solutions social needs.

a) Around the globe, social entrepreneurs and innovators are important contributors for solutions to different social needs such as poverty, aging and immigration. As described in the Sustainable Development Goal 17, they engage into a continuous mutual learning dialogue to advance practices and processes through cooperation and global partnership[8].

b) Social innovation and the dialogue around the actors are supported by advanced technological solutions that allow seamless exchange of ideas, tools and concepts, and underpin new modes of governance (YouTube 2.0).

c) Social innovation has emerged partly as an answer to the threat of the "jobless society" posed by automation. It provides a meaningful and rewarding line of activities for people.

d) Teaching relevant skills for social innovation has become an important part of education.

e) The rise of social innovation capacity changes the social fabric within and across communities: New relationships are formed. Trust, connectedness and cohesion rise, social capital and cooperation multiply. Attachment to societal and political institutions grows.

f) Organised responses to disaster are realised locally but global exchange of experience is very important for the development and dissemination of social innovation.

g) Examples of glocal social innovations, such as transition towns, fairtrade and local currency have set the example for operating functionally between local and global contexts.

Challenges:

- Without sufficient funding and broad partnership support, social enterprise networks do not develop.
- Inadequate visibility of the field further hinders mobilisation of the social innovation solutions.
- There is often a tension between global and local in social innovation. The local context is crucial for successful social innovation, and once actors start to operate on global level they often lose touch with people. Thus, it is not easy to exchange experience related to social innovation, as it is difficult to trace context.
- An economic model such as basic income may be needed to make social innovation a sustainable social practice in the long run.
- Supporting social innovation requires acknowledging and fostering complexity without trying to control it. This is difficult for policy makers and many other actors to accept.

23. Space as a global commons

Background

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[8]   http://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-17-partnerships-for-the-goals.html

As a vast resource of materials, as a location for infrastructures, an energy source, a place for depositing waste, a source of valuable knowledge and as a harsh environment for testing technological performance, space offers a new opportunity for the entire humanity. It is an opportunity to overcome the social, economic and environmental disasters of the past and to develop a new culture of global commons, where peaceful exploration and exploitation are regulated by global space governance mechanisms. The GVN of dreamers, explorers and engineers is organised around key actors in the governance of space.

Key aspects of the GVN 2038:

Value promise: Valuable economic resources to complement planetary sources.
   a) Outer space offers prospects for multiple purposes that have the potential to transform the telluric limits. Plans considering space – as spaceflight soon becomes affordable and frequent – address new commercial opportunities for mining scarce minerals, producing affordable solar energy and developing health research and medicine.
   b) Already space serves as a test-bed for technologies and material innovations that will be required in a large scale in the near future when the space exploration becomes more common.
   c) Successfully accomplished manned mission to Mars sets an example for safe long-term space travel.
   d) Space tourism is emerging for recreational and leisure purposes.
   e) Exploring space requires active international and supranational cooperation of public and private actors. The economic and technological challenges have been conquered with multinational partnerships led by international space agencies.
   f) Outer space is utilised for safe disposal of hazardous material such as radioactive waste.
   g) Space is also a resource of affordable and abundant energy. The production has been enabled by utilising a combination of photovoltaic panels and microwave transmission technologies.[9]
   h) Military research plays an important role in using the space as a strategic option.

Challenges:
   ● The high cost of developing the required technological solutions for space exploration.
   ● The lack of regulations to control the use of space resources.
   ● Contradictory goals and aspirations between different nations as well as between private and public investments. For example, private actors may not share the idea of space as global commons. Similarly, military research makes the use of space as a strategic option easier, but their objectives may differ from other actors.
   ● Thus, an international and institutional framework is required before we can consider space as a global common.
   ● Currently, it is debatable, whether space actually offers relevant material for telluric use.

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[9] https://futurism.com/is-space-based-solar-power-the-answer-to-our-energy-problem-on-earth/