



**CASI: Public Participation in Developing a Common Framework
for Assessment and Management of Sustainable Innovation**

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CASI

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Strategic Outline of Public Engagement in the Development of Sustainability Research Policies and Programmes

Findings of the CASI Project

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In Brief about this Paper

CASI (“Public Participation in Developing a Common Framework for Assessment and Management of Sustainable Innovation”) is supported by the Science In Society Programme of FP7, Theme SiS.2013.1.2-1 “Mobilisation and Mutual Learning (MML) Action Plans: mainstreaming Science in Society actions in research”. The duration of the project is 42 months, from January 2014 until June 2017. CASI involves 19 partner organisations from 12 EU countries.

CASI’s major objective is to develop a methodological framework for assessing sustainable innovation and managing multidisciplinary solutions through public engagement in the research, technological development and innovation (RTDI) system.

This paper provides insights and input for the last cycle of strategic programming of Horizon 2020 (2018 – 2020) and demonstrates the added value of public participation when looking for solutions to societal challenges and sustainability concerns. To that end, it presents some of the major results and insights gained from the implementation of two particular engagement approaches within CASI, namely citizen panels in 12 EU countries and an online survey with relevant experts and stakeholders.

CASI Citizen Panels

The CASI citizen panels took place in two rounds between April and October 2015 in 12 EU countries. The **first round of citizen panel meetings** aimed to develop citizen visions for a sustainable future. Within CASI, a vision refers to a picture of a desirable future, which is based upon hopes and dreams, concerns and fears within 30–40 years from now, as elaborated by a group of lay citizens. Overall, 50 visions were produced from the citizens in the 12 countries. These visions were used as an input to an **expert workshop** where experts produced a list of 27 research priorities on sustainable future in Europe, as well as related to them policy recommendations. The **second round of citizen panel meetings** was organised in order to validate and rank the research priorities developed by the experts.

The citizens’ visions were analysed using a three lens approach: 1) Cross-linkages between GSC5 and the other GSCs were sought in order to identify new research areas and areas of citizens’ concern; 2) Citizens’ visions were mapped against the research priorities elaborated by the experts. The discrepancy between citizens’ and experts’ assessment of research priorities highlighted the importance to engage citizens in policy and programme development in order to ensure that their interests and expectations are met as well as to broaden the scope of available policy alternatives and develop criteria to choose between these alternative; 3) Citizen visions were mapped against the research areas of Grand Societal Challenge 5 (climate action, environment, resource efficiency and raw materials), which highlighted a need for participatory practices in eliciting key topics that could potentially reinforce the H2020 sustainability agenda, so that it better reflects citizens’ general alarms, concerns and hopes for the future.

CASI Online Survey

The results of the online survey confirmed the relevance of sustainable innovation in addressing the challenges related to GSC5. Sustainable innovation is considered particularly well suited to contribute to protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems, as well as enabling the transition towards a green economy and society. Mobilising relevant actors in the innovation processes is needed to bring in interdisciplinary expertise and consider the various possible impacts of the particular research project or innovation.

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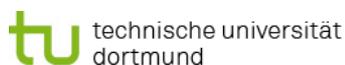


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Executive Summary

This paper provides insights and input for the last cycle of strategic programming of Horizon 2020 (2018 – 2020) and demonstrates the added value of public participation when looking for solutions to societal challenges and sustainability concerns. To that end, it presents some of the major results from the implementation of several engagement approaches within 612113 CASI project (citizen consultations, experts panels and an online survey with experts), as well as the insights gained from implementing these methods in a multi-actor, multi-disciplinary, cross-national endeavour.

CASI is an EU FP7-funded project, involving 19 partners from across Europe, entitled “Public Participation in Developing a Common Framework for Assessment and Management of Sustainable Innovation”. Its major objective is to develop a methodological framework for assessing sustainable innovation (SI) and managing multidisciplinary solutions through public engagement in the research, technological development and innovation (RTDI) system. One of CASI’s ambitions is to produce a set of research priorities based on citizens’ concerns and visions for sustainable future. This methodology combines citizens’ input and experts’ insights.

Based on the analysis of the findings, we propose a set of policy and research programme advice with the intention to bolster efforts in aligning Research and Innovation (R&I) policy agendas with societal needs:

- **Multidisciplinary and cross-sectoral research should play a bigger role.** Discussing sustainability implies taking into account its behavioural, social, cultural and economic aspects, as well as its physical and systemic elements, and requires combining different disciplinary domains, methodologies and levels of analysis. A truly interdisciplinary approach would provide for a deeper understanding of the complex interrelationships between sustainability systems.
- **Human and social sciences should underpin any sustainability research policy.** The participatory aspect of sustainability research may be seen to involve humanities and social sciences as well as the meaningful engagement of societal actors, and as such is best positioned to analyse the deliberative processes that inform sustainability decisions. In this sense, the scientific and integrative approaches of the social sciences and the humanities are instrumental in reaching an understanding of the different views, purposes and practices held in society with regard to an issue and develop the knowledge or solutions needed in response to such concerns.
- There is a need for assuming a **multi-actor approach in R&I policy and programme development**, whereby dialogues between different groups are encouraged. In sustainability issues, it is particularly important to endorse joint problem definition between scientists from various domains (particularly natural and social scientists), between scientists and the public, as well as between both of these groups and policy and decision makers. Citizen engagement in the process of defining research objectives should be bolstered to rectify linear/silo approaches to sustainability research.
- **Encouraging market-based technological innovations is not sufficient to attain sustainable development.** Often technology is contextualised as an external factor that shapes the wider socio-ecological system by means of opening new possibilities for alternative socioeconomic practices that can be of benefit to both people and the environment. Though integral to policy, technological aspects of sustainability need therefore be viewed in relation to other systemic solutions.
- Research agendas should focus more directly on **issues of broader social change and provide the means for empowering citizens as drivers for sustainable future.** Greater attention should be paid both to the role of the public as a major agent of change and in its ability to give rise to alternative sociotechnical spaces where new ideas and practices can be developed. Embracing a participatory

citizen-based model of broader change is bound to contribute to the development of comprehensive research policy solutions.

- **System-wide societal transformation is needed.** Broader socio-economic issues must be reconciled/considered jointly with technological ones in order to address people's sustainability expectations more fully. Among other things, a strong emphasis should be placed on how best to bring eco-efficiency considerations into the social economy and use the social economy to advance environmental and equity concerns within sustainability. Exploring the potential for public-wide transformation is critical for achieving value-based commitment to structural change.

In line with those observations, a trend emerges that could be of great importance to sustainability as it implies a rethink (re-organisation) of the way concrete solutions are being developed and tailored to specific social contexts. The majority of topics of primary concern to citizens are multi-layered and appear to interplay with one other. Rather than envisaging the sustainable future in linear terms, citizens address sustainability in a compound manner that warrants **targeted policy intervention spanning a number of individual Grand Societal Challenges (GSCs)**. More specifically, their inputs contribute to a conceptual framework for the design of complex solutions that simultaneously address imperatives as diverse as the environment, individual and societal well-being, resource use, health, human development, or the economy, among other things. Sustainability emerges as a long-term societal goal entailing important **socio-economic aspects and requirements for wider social change as complementary, if not integral, to technological and environmental improvement targets.**

Misalignments between expert- and wider civil society-based evaluations of potential sustainability solutions offer further insights for the improvement of the policy formulation process. The research topics elaborated by the experts that were consulted in the CASI involvement/engagement process seem to highlight the application of currently dominant sustainability approaches associated more closely with technological innovation, rather than with broader issues of social development. Specifically, while their perspectives appear to underscore sociocultural concerns, they exhibit specific abstract characteristics pertaining to the fields of production, resource management, and economics. Central to the citizens' assessment of sustainable development, on the other hand, is the theme of experimenting in social life through the development of workable, alternative solutions that are tangible and more practical. In this line of reasoning, the citizens seem to give higher priority to research themes in pursuit of socially-driven responses to some of their most pressing individual or community needs. Their perspectives differ in that they seem to focus on issues of wider societal relevance (health, food security, agriculture, etc.) and propose actions that integrate otherwise narrow approaches to sustainable innovation. Rather than emphasizing on the need for technical corrections in the surrounding environment, the citizens tend to raise topics linked to the sustainability of consumer culture and the reformulation of business-as-usual economic models.

Importantly, the divergence in priorities on the part of the citizens and the experts is indicative of the various ways in which sustainability issues may be approached. The gap in perspectives validates the participant-driven method of eliciting sustainability concepts and themes, and points to the need for a meaningful consensus-based policy regime that aims to reconcile the values and knowledge of a wider group of participating actors. In fact, citizen participation at all stages of the research policy consultation process may expand the potential for meaningful engagement, the recognition of co-benefits of proposed topics and ideas, and ultimately a deeper understanding of the interdependence of sustainability systems. Involving citizens in the making of research priorities is further apt to raise novel topics to the research agenda and can successfully enrich or disrupt established forms of expert-based development of R&I programmes.

Lastly, the need for a continuous negotiation between policy makers, on the one hand, and scientists and the wider public, on the other, once again comes to light when comparing the citizen and expert-elaborated research priorities to the official EU sustainability agenda. An aggregated conclusion from the citizens' and experts' consultations, is the trend to reconcile technological innovation, new business models and alternative economic principles with models for inclusive societal development which envisage the active participation of citizens as drivers for change. In this regard, it is particularly noteworthy that the three top priorities across Europe, as assessed by the citizens, focus on different ways to enable citizens to live and act more sustainably (producing food closer to their home; education on how to live a more sustainable life; assisting citizens with producing renewable energy themselves). **This focus on empowerment appears to be insufficiently highlighted in official H2020 research programmes, which could be further enhanced if due attention is paid to the citizen-level perceptions, sentiments and ideas about desirable sustainable futures.**

In conclusion, the following table links GSC5-related issues (Climate action, environment, resource efficiency and raw materials), identified in the CASI citizen consultations, with the other Grand Societal Challenges, revealing that **citizens' sustainability concerns and visions typically span over a number of Grand Societal Challenges. The identified issues and cross-linkages between the GSCs, in turn, may contribute to new research areas as well as highlight areas of public concern.**

GSC5 cross-linked with	Issues – new research areas/areas of concern
<p>GSC1 Health, demographic change and well-being</p>	<ul style="list-style-type: none"> • Air pollution and wider changes in eco-systems and their impacts of human health • Healthy and sustainable lifestyles that mitigate the environmental footprint • Physically active population, which contributes to mitigating environmental challenges (e.g. through developing and utilising technology for transforming kinetic to potential energy) • Production of nutritious food (GSC2) and promotion of healthy diet
<p>GSC2 Food security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy</p>	<ul style="list-style-type: none"> • Sustainable agricultural practices • New sustainable agribusiness models (e.g. urban farming) • Sustainable and nutritious food production • Water ecosystems and impacts of human health (GSC1) • Small-scale agribusiness models
<p>GSC3 Secure, clean and efficient energy</p>	<ul style="list-style-type: none"> • Growing scarcity of resources • Growing energy demand • Employing new business models (e.g. based on 'shared resources') • Improved energy and material efficiency in major sectors • Low-cost, low-carbon renewable energy supply • Green energy solutions • Small-scale energy projects and resulting health benefits (GSC1) • Access to clean and reliable energy and energy services
<p>GSC4 Smart, green and integrated transport</p>	<ul style="list-style-type: none"> • Reducing car fleet • Integrated transport environment • Introducing ICT technologies • Sustainable business models in transport (e.g. shared transport) • Green transport • Using low-carbon fuels
<p>GSC6 Europe in a changing world - inclusive, innovative and reflective societies</p>	<ul style="list-style-type: none"> • Change of individual values and patterns of consumer behaviour in view of optimising the use of resources and achieving long-term sustainable development • Distributive justice for essential resources • Socially responsible, eco-friendly, innovative and efficient business models • Reconciling human behaviour with the technological potential of new socially and environmentally friendly products • Developing sustainability indicators which reward compliance to social and environmental imperatives • New ways of organising society that promote solidarity and a shift to sustainable

GSC5 cross-linked with	Issues – new research areas/areas of concern
	<p>lifestyles</p> <ul style="list-style-type: none">• Holistic forms of education and curricula that integrate the principles of inclusiveness, citizens' participation, respect for the environment and social/cultural differences• Spatial planning that fosters social cohesion and limits environmental pollution• New ways of organising society that promote solidarity and a shift to sustainable lifestyles
<p>GSC7</p> <p>Secure societies - protecting freedom and security of Europe and its citizens</p>	<ul style="list-style-type: none">• International cooperation in the management of natural resources founded on the principles of solidarity and fair distribution of and access to essential resources

Introduction

In the past couple of decades European societies have been facing challenges and uncertainties of an unprecedented scale. Without a doubt among the greatest ones today are climate change and a myriad of issues pertinent to it – how to decouple economic growth from the ever growing greenhouse gas emissions, how to move towards a more sustainable lifecycle of products and build a resource-efficient and sustainable economy, how to advance bio-economy in Europe and promote sustainable consumption. Besides these environmental concerns, various other issues related to, among others, improving the social inclusiveness and cohesion of the European societies and strengthening economic growth and competitiveness, become ever more urging, especially in light of the ageing of populations, migration, and the impacts of new technologies and digitalisation on the social and legal systems in Europe. These are only some of the issues which policy makers in Europe strive to address through various policy instruments at European and national level.

In order to effectively tackle these challenges, however, cooperation needs to be sought with the other societal stakeholders - businesses, civil society and the academia, which endeavour finding common solutions through re-defining actors' roles in the process of developing services and products that address existing needs. Citizens are an important part of this constellation and nowadays more actively demand that they be part of the process of evaluating and co-developing public services and policy instruments, rather than being mere observers and a target group of decision-making, which affects their lives.

Apart from STI policy and decision making, citizens' and other stakeholders' inputs can also contribute to research and innovation (R&I) programme development, project conceptualisation and activities. Owen et al. (2013¹) aptly describe how engaging citizens and stakeholders in the field of R&I: i) mobilises science in solving societal challenges and makes sure innovators consider the environmental, economic and social impacts of their products and services, thus improving the quality and sustainability of R&I outcomes, and ii) modulates the direction science takes so as to be responsive to societal needs, concerns and aspirations, and reduces the ethical, legal and societal concerns which come with scientific advances. Public participation in R&I activities also improves public confidence in science and innovation due to better societal understanding of the rapidly advancing scientific developments and discoveries, and social acceptability of the R&I outcomes.

Only such participatory approaches to science and innovation can tackle societal challenges and contribute to achieving smart, sustainable and inclusive growth, as elaborated in the Europe2020 Strategy. **Sustainable innovation is at the centre of this effort as it considers the environmental, financial and social impacts of innovations in close collaboration with relevant stakeholders.** Sustainable innovation is at the heart of CASI, which aims to promote it by using a wide range of participatory approaches to integrate societal interests and concerns into science and innovation programming and policy making.

The following discussion presents the results and insights gained from the implementation of major engagement activities which took place within the CASI project. This paper is the first one of a sequence of three strategic papers that, respectively, present the voice of **citizens**, the main lessons obtained from **innovators**, and the key messages extracted from current SI **policy** discourses. Through this *trilogy*, CASI aims to provide policy makers with a strategic SI big picture and a consistent vision of European sustainable innovation practices.

¹ Owen, R., Stilgoe, J., Macnaghten, P., Gorman, M., Fisher, E., and Guston, D. (2013). "A Framework for Responsible Innovation". Responsible Innovation. John Wiley & Sons, Ltd.

The advice presented herein is based on analysis reflecting i) CASI citizen panels, involving citizens from 12 countries and developing citizens' visions for sustainable future and research priorities for the European and national level research agendas. The corresponding section of the paper presents in more detail the results of a three lens analysis of the citizens' visions, mapping these against the H2020 Grand Societal Challenges, the expert-based research priorities, developed as part of CASI's methodology, as well as the H2020 GCS5 priorities; ii) CASI online survey on sustainable innovation, gathering the responses of 1700 experts from across Europe. The key findings drawn from these activities are brought together in the final chapter of the paper.

CASI Citizen Panels Demonstrate the Need for Participatory Approaches in Programme Development

This section is based on the analysis of 50 visions² developed by 230 citizens from 12 European countries at citizen panel meetings³ that were conducted as part of the CASI project, as well as the research priorities elaborated on the basis of these visions by experts from across Europe. In CASI, we took a three-fold approach to analysing the results of the citizens' panels. *First*, we analysed citizens' visions in order to identify new research areas and areas of concern for European citizens related to the Grand Societal Challenges. The analysis revealed that many of the issues brought forth by citizens cut across the seven grand challenges in Horizon 2020. *Second*, we looked at how the citizens' visions map against the research priorities elaborated by the experts involved in CASI. The discrepancy between citizens' and experts' assessment of research priorities highlights the importance to engage citizens in policy and programme development in order to ensure that their interests and expectations are met. Additionally, engaging citizens broadens the scope of available policy alternatives and provides additional criteria for selection between these alternatives. *Third*, citizen visions were mapped against the research areas of Grand Societal Challenge 5 (climate action, environment, resource efficiency and raw materials), which showed that citizens' expectations are more concerned with climate action than the other areas. This finding highlights a need for participatory practices in eliciting the key topics that could potentially reinforce the H2020 sustainability agenda, so that it better reflects citizens' general alarms, concerns and hopes for the future.

Citizens' Visions vis-à-vis Grand Societal Challenges

A content analysis of the citizens' visions against the Grand Societal Challenges, as specified in Horizon 2020, identified a number of cross-sectoral issues, which link the thematic areas covered by each challenge. **Recognising these cross-linkages and taking them into account during the strategic programming cycle of Horizon 2020 can contribute to further enhancing the H2020 approach in addressing these complex global challenges.** The importance of interdisciplinary cross-cutting solutions has been emphasised in Horizon 2020 as necessary in order to contribute effectively to achieving the objectives of Europe 2020 Strategy and the "Innovation Union" flagship initiative.

² Within CASI, a vision refers to a picture of a desirable future, which is based upon hopes and dreams, concerns and fears within 30–40 years from now, as elaborated by a group of lay citizens.

³ The CASI citizen panels took place between April and October 2015 in 12 EU countries. The **first round of citizen panel meetings** aimed to develop citizen visions for a sustainable future with a time horizon of 30-40 years ahead. Overall, 50 visions were produced from the citizens in the 12 countries. The visions produced as a result of the first citizen panel meetings were used as an input to an **expert workshop** where experts produced a list of 27 research priorities on sustainable future in Europe, as well as related to them policy recommendations. The **second round of citizen panel meetings** was organised in order to validate and rank the research priorities developed by the experts.

The messages that emerged from the citizens' visions often cross with priorities within **GSC5**, as well as within **GSC1 and GSC2**. The environmental and human health problems tend to be associated with current food production practices and traditional (industrial) agriculture. Certain visions address the often unsustainable forms of mainstream agriculture that depend on expensive inputs from beyond the farm (e.g., pesticides and fertilisers), many of which generate wastes that equally harm people and the environment; the use of large quantities of non-renewable fossil fuels; and the tendency toward concentration of production, driving out small producers and undermining animal welfare. Alternatives in the form of sustainable agricultural models (such as urban farming) are put forward which gives due consideration to long-term interests (e.g., preserving topsoil, biodiversity, and water systems), acknowledges limits on economic growth, and encourages fair distribution of resources, by way of mitigating hunger and food insecurity, for the wider public-health benefit of communities. Bioeconomy, being regarded as one of the most effective responses to the environmental challenges of today, is another theme which has been linked to GSC5 by the citizens, emphasising the importance of utilisation of bio-waste, sustainable and responsible production and consumption, reduced demand for raw materials and establishment of eco-friendly, innovative and efficient industry, eco-production of goods, reducing food waste along the supply chain.

A great number of visions approaching sustainability from different perspectives (such as energy generation and consumption, food availability and quality, green transport, etc.) appear to give rise to a number of socio-technological themes. Strong cross-linkages and areas of thematic overlapping emerge from the citizens' perspectives, with regards to topics within **GSC5** and **GSC1**. People's health and environmental health are perceived to be mutually dependent and reinforcing each other. More specifically, the citizens express their concerns of deteriorating ambiance for healthy living, which comes as a result of air pollution and wider changes in eco-systems caused by climate change. Improved ecological sustainability is thus believed to have enormous positive effects on human health and well-being.

The topic of transport (**GSC4**) is embedded in some of the visions in combination with **GSC5** and **GSC1**. Common aspirations among the citizens related to transport are that fewer cars should be used where possible, that the car fleet would best be replaced by hybrids or environmentally friendly vehicles and integrated transport environment should be established. Promoting green transport and optimising the use of transport vehicles through, among others, introducing ICT technologies and new and more sustainable business models in transport, are thus expected to improve the health and well-being of European citizens, and at the same time reduce carbon emissions. Furthermore, the increase of recreational spaces in the highly urbanised areas is associated with better health conditions and quality of life.

Flexible spatial planning concepts aimed at promoting not only sustainability in technological terms, but also social sustainability, human behaviour, health and residents' lifestyles are especially visible in the visions that deal with public space/infrastructure developments, and traffic optimisation in cities. Espousing the theme of 'sustainable accessibility', citizens point toward the need to re-design the existing urban infrastructure by focusing on developing places with high accessibility, whereby key city functions, services and facilities (i.e. hospitals, schools, supermarkets, etc.) are within a reasonable distance, in order to allow for an effective and more eco-friendly public and private transport system, a better road network and connectivity, and improved integration of green spaces.

Of particular note is also the fact that several visions expressed support to the idea of capitalising on a potentially significant trend away from the conventional paradigm of individual consumption towards one of shared practicality (functionality) in urban environments. A few visions suggest that 'urban farming' could substantially reduce environmental impact (not least due to the cutting down on urban mobility and CO₂ emissions generated by car traffic), improve economic efficiency and reduce overall space

requirements (in places where space is at a premium), while simultaneously promoting societal well-being and the production of healthier foods.

The citizens' visions make multiple references to topics from both within **GSC5 and GSC3** in highlighting the challenge of increasingly scarce resources, growing energy demands and a need for a mitigating climate action. The perception is that sustainability requires actions to decouple economic growth from resource use by employing new business models (e.g. those based on sharing resources) and achieving radically improved energy and material efficiency in major sectors, such as construction, manufacturing and transport. Other visions tend to focus on the need to introduce low-cost, low-carbon renewable energy supply, mentioning the need for *"identification and utilisation of renewable energies at global level, assuring its rational use while also preserving all living things and their ecosystems"*⁴, thus, making a link to biodiversity as well.

The ideas generated by citizens combine themes closely related to **GSC5, GSC3 and GSC1-derived issues**. It is most visible in considerations of small-scale energy projects, which would generate less emissions and would be of health benefit to those most sensitive to air pollution. Indeed, some visions specifically address the lack of access to clean and reliable energy and energy services as a major source of public health risks, considering the current levels of fossil fuel use and the attendant accumulation of greenhouse gases and pollutants in the atmosphere. As underscored by the citizens, the need has arisen to transfer technology throughout the world so as to reduce the risk of climate change and to ensure that people's urgent health and development needs can be met without further contributing to adverse health and environmental effects at local and global levels. In this regard, new green energy solutions, which are at the same time propelled by, for example, physical activity and healthy lifestyles (e.g. producing electricity from the kinetic energy generated by people), make up a central component of the larger process of socio-ecological transition, according to the citizens, which would expectedly have a positive effect on people's health, as well as on the environment.

One major cross-cutting area between domain-specific issues was observed at the intersection of **GSC5 and GSC6** topics. Areas which touch upon these two societal challenges abound. These include, but are not limited to:

- change of individual values and patterns of consumer behaviour in view of optimising the use of resources and achieving long-term sustainable development;
- distributive justice for essential resources;
- reconciling human behaviour with the technological potential of new socially and environmentally friendly products;
- improving business efficiency and introducing new business models (e.g. sharing economy) that are socially responsible, eco-friendly, innovative and efficient, some also with a specific focus on the local economy;
- developing sustainability indicators which reward compliance to social and environmental imperatives;
- new ways of organising society that promote solidarity and a shift to sustainable lifestyles;
- flexible and holistic spatial planning that fosters social cohesion and limits environmental pollution.

A more subtle theme touching upon the demand for sustainable goods/services, which is correlated with consumers' values and social/environmental awareness, can also be detected in terms of proposed product development strategies, informed by visions of quality, ecologically and/or socially responsible alternatives

⁴Content in italics refers to direct quotations from the citizen-developed visions.

to goods and services, as well as sustainable consumption practices. These findings offer clues to a sustainable way of life that enhances both personal and collective well-being by way of bridging ecologically responsible behaviour, dispositional mindfulness, happiness and individual (intrinsic) value orientation. Citizens' perceptions seem to cut across topic areas within **GSC5**, **GSC6** and **GSC2** especially when promoting self-sufficiency and small-scale agribusiness models operating in a local circular economy. As mentioned above, when discussing such notions the citizens emphasise on reduced use of artificial pesticides and fertilisers, as well as on sustainable and responsible food production. With that in mind, urban farming perhaps best illustrates the named interrelation.

Themes pertaining to **GSC5**, **GSC6** and **GSC3** are jointly considered by the citizens in their views about the future. Empathy is key to building cohesive society, which also translates into care for the common good and for the environment. Promoting shared responsibility by "*enhancing the awareness of belonging to local communities*" and enhancing public participation in the management of resources is expected to contribute to the more efficient use of energy resources, as well as to people's "*opening towards green technologies*". Similarly, there is an emphasis on the need for collaboration among networks active in the field of environmental protection and low-carbon energy sources, which would foster the exchange of knowledge and ideas among involved parties and will improve their capacities to act and make an impact.

The ideas that embrace the use of low-carbon energy and fuels, as well as those that urge for urban (spatial) development plans to contain and optimise traffic (see above), correlate closely with topics from within **GSC4**. Their link to **GSC6** is also evident when talking about small-scale community entrepreneurship and neighbourhood initiatives to produce and exchange goods and services within a confined area. Those notions also point to a trend away from the conventional paradigm of individual consumption toward one of sharing, and there appears to be potential for extending this model to many other spheres of people's lives.

Issues pertinent to **GSC7** and **GSC5** are also linked in a few visions where the citizens express their concerns that finite natural resources and exhausting raw materials might be a trigger for global instability and conflicts. International cooperation founded on the principles of solidarity and fair distribution of and access to essential resources has been pointed out as of prime importance for the long-term security of Europe. These problems also relate to topics within **GSC6** as they articulate the message that distributive justice for essential resources would eliminate inequalities, migrants' integration, peaceful co-existence, tolerance and openness to others/outside. Promoting the global "*exchange of knowledge, competences and skills*" is considered a means to achieving "*conflict free distributive justice*". Topics which relate to community cohesion (**GSC6**) also intersect with societal concerns about living in harmony and in peace with others. Social cohesion and inclusion are claimed by the citizens to contribute to strong, fair and just societies, arguably enhancing trust and reciprocity between residents and contributing to the sense of community and security within a certain place.

What emerged from our analysis is that many of the topics of primary concern to the citizens are multi-layered and appear to interplay with one another. In this sense, a better integrated approach to addressing certain topics that exceed the scope of individual Grand Societal Challenges may prove more beneficial when solutions to common societal problems are needed. Assuming a truly multidisciplinary and cross-sectoral approach would address existing discrepancies and fill any research gaps that ensue.

Certain **horizontal issues** came up as a result of the visions' analysis as well. These are common topics of discussion among citizens across the participating countries and are present in visions related to different GSCs as factors of positive change, which need to be fostered in order to cope with the challenges of today.

Public participation is key among these topics. It has been recognised as highly important by the participating citizens across Europe and in regard to a number of thematic areas (e.g. energy, food and environmental protection). Besides citizens’ participation, the role of civil society in this transition has also proved to be a common theme raised by the majority of citizen panels. Civil society’s (both organised and non-organised) more active engagement in the governance of areas, which are important to sustainable development (as an actor to check and monitor governmental actions, but also as a collaborator in the design and provision of public services), has been highlighted in general, but also in relation to concrete topics, such as distributive justice, education and environmental protection.

Another topic present in the majority of visions regardless of the thematic area is **education**, both formal and informal, which according to the citizens plays a critical role for a more sustainable future by raising awareness on sustainability and its different aspects, such as sustainable consumption, sustainable energy, and sustainable food production. It also contributes to value and behavioural changes which promote sustainable lifestyles – both ecologically and socially. Developing holistic forms of education and curricula that integrate the principles of inclusiveness, citizens’ participation, respect for the environment and social/cultural differences would therefore be of prime importance for tackling sustainability challenges in Europe.

A number of other horizontal issues emerged from the analysis, which are listed below. While these are not within the scope of the current analysis, they reveal an important hint as to where citizens see solutions of current societal challenges across themes and disciplines.

- Sustainable lifestyles
- Sustainable consumption
- Empathy
- Personal and shared responsibility
- Collaboration among different socio-economic networks
- The role of local communities for sustainability
- Social cohesion
- International cooperation and coordination for sustainability
- Distributive justice
- New business models
- City-resilience models
- Culture (values)

The following table sums up the **cross-linkages and areas of thematic overlapping between GSC5- and the other 6 GSCs-related topics, as those emerge from the citizens’ visions.**

Table 1. Cross-cuttings between GSC5- and other GSC’s-related topics, emergent from the citizens’ visions

GSC5 cross-linked with	Issues – new research areas/areas of concern
<p style="text-align: center;">GSC1</p> <p>Health, demographic change and well-being</p>	<ul style="list-style-type: none"> • Air pollution and wider changes in eco-systems and their impacts of human health • Healthy and sustainable lifestyles that mitigate the environmental footprint • Physically active population, which contributes to mitigating environmental challenges (e.g. through developing and utilising technology for transforming kinetic to potential energy) • Production of nutritious food (GSC2) and promotion of healthy diet
<p style="text-align: center;">GSC2</p> <p>Food security, sustainable agriculture</p>	<ul style="list-style-type: none"> • Sustainable agricultural practices • New sustainable agribusiness models (e.g. urban farming) • Sustainable and nutritious food production

GSC5 cross-linked with	Issues – new research areas/areas of concern
and forestry, marine and maritime and inland water research, and the bioeconomy	<ul style="list-style-type: none"> • Water ecosystems and impacts of human health (GSC1) • Small-scale agribusiness models
<p>GSC3</p> <p>Secure, clean and efficient energy</p>	<ul style="list-style-type: none"> • Growing scarcity of resources • Growing energy demand • Employing new business models (e.g. based on ‘shared resources’) • Improved energy and material efficiency in major sectors • Low-cost, low-carbon renewable energy supply • Green energy solutions • Small-scale energy projects and resulting health benefits (GSC1) • Access to clean and reliable energy and energy services
<p>GSC4</p> <p>Smart, green and integrated transport</p>	<ul style="list-style-type: none"> • Reducing car fleet • Integrated transport environment • Introducing ICT technologies • Sustainable business models in transport (e.g. shared transport) • Green transport • Using low-carbon fuels
<p>GSC6</p> <p>Europe in a changing world - inclusive, innovative and reflective societies</p>	<ul style="list-style-type: none"> • Change of individual values and patterns of consumer behaviour in view of optimising the use of resources and achieving long-term sustainable development • Distributive justice for essential resources • Socially responsible, eco-friendly, innovative and efficient business models • Reconciling human behaviour with the technological potential of new socially and environmentally friendly products • Developing sustainability indicators which reward compliance to social and environmental imperatives • New ways of organising society that promote solidarity and a shift to sustainable lifestyles • Holistic forms of education and curricula that integrate the principles of inclusiveness, citizens’ participation, respect for the environment and social/cultural differences • Spatial planning that fosters social cohesion and limits environmental pollution • New ways of organising society that promote solidarity and a shift to sustainable lifestyles
<p>GSC7</p> <p>Secure societies - protecting freedom and security of Europe and its citizens</p>	<ul style="list-style-type: none"> • International cooperation in the management of natural resources founded on the principles of solidarity and fair distribution of and access to essential resources

A number of **conclusions** can be derived from the research findings. Above all, **the majority of topics of primary concern to the citizens are multi-layered and appear to interplay with one another**. The citizens do not envision the future in linear terms but rather seek to describe it in complex, all-encompassing ways that invoke a number of cross-references between issues. Indeed, one of the salient characteristics of sustainability, as perceived by the citizens, is that it is **a multidimensional concept that simultaneously addresses the environment, individual and societal well-being, equity, human development, and the economy**, among other things. This is not fully reflected by the current work programmes of Horizon 2020, whose impact may be further enhanced by considering certain overlapping aspects that exhibit strong potential for integrative research, and yet seem to be narrowly associated only with individual GSCs. **Assuming a truly multidisciplinary and cross-sectoral approach could indeed address existing discrepancies and help fill any research gaps that ensue.**

Importantly, a great number of the citizens’ perspectives **assumed implicitly or explicitly that a systemic societal transformation is necessary in order to achieve sustainability**. Conceptualised mainly as a long-

term societal goal or objective, sustainability emerges from citizens' visions as entailing important socio-economic aspects and requirements for wider social change as complementary, if not integral, to technological development and environmental targets. All in all, the citizens acknowledge the importance of socio-economic aspects for sustainability which they see, though not always in plain terms, incorporated in the eco-efficiency improvement targets for the future. Generally, we may conclude, **citizen visions highlight the categorical imperatives of both technological development and social change**, paving the way for the pursuit of sustainable solutions that address those two critical issues in a joint and balanced manner.

The analysis of the citizens' visions demonstrates further that **sustainability requires actions in order to reconcile technological innovation, new business models and alternative economic principles with models for inclusive societal development which envisage the active participation of citizens as drivers for change**. As people make multiple references to a number of socially and culturally relevant themes, such as improving social cohesion, reducing pressures on natural resources, stimulating cooperation and peaceful coexistence, improving quality of life, introducing holistic education, and so on, a trend emerges that could be of great importance to sustainability as it implies a **rethink (re-organisation) of the way concrete solutions are being developed and tailored to specific social contexts**.

In this regard, the **theme of experimenting in social life was identified as central to sustainability**. The desired change is brought about not only at the theoretical (through abstract economic or other research), but also at the more practical level via the development of grassroots initiatives based on sharing or community economy, for instance.

In the visions they developed **the citizens made multiple references to their boosted participatory role in building a sustainable future**. In regard to urban spaces in particular, in order to improve sustainability-oriented discussions and research scenarios about viable urban spaces, the public participation process needs to be aligned to local contexts in which specific objectives are derived through robust stakeholder engagement.

All in all, **technology is contextualised as a peripheral factor that shapes the wider socio-ecological system** by means of opening new possibilities for alternative economic practices that can ultimately be of greater benefit to both people and the environment. Under these conditions, it seems highly improbable, even for the short term, that society will develop according to a business-as-usual scenario, be it highly technologically-driven.

Citizens' Visions vis-à-vis Expert-Identified Research Priorities

Taking into account the results of the expert workshop, which took place in June 2015 as part of CASI's methodology for research topics formulation and prioritisation, conclusions were drawn, which reveal important insights as to the input citizens could have in the process of developing R&I programmes.

At the workshop, the invited experts clustered the citizens' visions from all 12 countries into thematic areas. It is noteworthy that the cluster of visions named "*Social development and people*" formed the largest thematic cluster, containing 10 visions altogether (out of the 50 in total). These visions were humanistically and/or socially oriented and differed thematically from the other, more technologically and economically oriented clusters of visions. An outline of the number of the citizens' visions according to clustered topics is presented below.

Table 2 Number of visions according to clustered topic and cluster size

Clustered Topic	Number Of
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	Citizens' Visions
Social development and people	10
Change for the future	8
System resources	8
Values and politics	7
Energy and production	6
Living and spaces	5
Urban life	4
Local needs and support	2

The experts at the workshop selected visions to be further elaborated into draft and final research priorities (see Table 3). Only two of the ten (20%) citizens' visions on the topic of social development and people were selected by the experts to be used in the development of research priorities. In contrast, more technologically oriented clusters of visions were selected for further development to a much higher degree (energy and production 83%, urban life 75% and system resources 63%).

Table 3 Selection of cluster-specific research priorities for elaboration, according to original cluster size

Clustered Topic	Draft Research Priorities	Elaborated Research Priorities	Share of Elaborated Priorities, %
<i>Social development and people</i>	<i>10</i>	<i>2</i>	<i>20</i>
<i>Change for the future</i>	<i>7</i>	<i>4</i>	<i>57</i>
<i>System Resources</i>	<i>8</i>	<i>5</i>	<i>63</i>
<i>Values and politics</i>	<i>7</i>	<i>3</i>	<i>43</i>
<i>Energy and production</i>	<i>6</i>	<i>5</i>	<i>83</i>
<i>Living and spaces</i>	<i>5</i>	<i>3</i>	<i>60</i>
<i>Urban life</i>	<i>4</i>	<i>3</i>	<i>75</i>
<i>Local needs and support</i>	<i>2</i>	<i>2</i>	<i>100</i>

In the cases in which the experts gave socially relevant concerns and visions a high priority (such as in the cases of the vision "Food for all", which contributed to the formulation of the research priorities "New European food culture", and the vision "Recognition, rethinking and responsible governance/action", which contributed to the research priority "Sustainable economics"), **the experts mostly picked formulations belonging more closely to the realms of production and economics rather than the humanistic and social character of the original visions (see Table 4)**. This is in striking contrast to the citizen-drawn perspectives which, in their large part, are underpinned by social issues and overarching societal concerns that bridge different areas of future sustainability engagement.

Table 4 Expert-elaborated priorities derived from the citizens' visions, according to overall rank⁵

⁵The list of research priorities elaborated by the experts includes a total of 27 research themes. In this document we present the top-10 priorities as being ranked by the experts as well as the top-10 research priorities as being ranked by the 12 citizens' panels.

Overall Expert Rank	Elaborated Research Priority	Originating Citizens' Visions (by Country Panels ⁶)
1	Improvement of European electricity transmission to increase renewable energy production	'Sharengy – Sharing renewable energy sources' (Slovenia)
2	Research on business models and changing institutions related to sustainable energy economy	'New sustainable energy economy' (Germany)
3	Sustainable living environment	'Sustainable living environment, sustainable values' (Finland)
=4	Holistic education for a sustainable future	'Education - a path to spiritual and sustainable future' (Bulgaria) & 'Education=aware citizen=aware society=sustainability' (Poland)
=4	A new European food culture	'Food for all' (UK)
6	Access to natural resources as a human right	'Distributive justice of essential resources' (Austria)
7	Co-developing green technology	'Development of new technologies and improvements of the existing harmony with nature and society' (Slovenia)
=8	Sustainable economics	'Recognition, rethinking and responsible governance/action' (Germany)
=8	Unified ecological grading system	'Eco credits' (UK)
10	Sustainable transformation of existing traffic infrastructure in cities	'Reducing traffic congestion through the creation of green transport corridors and the protection and development of open and recreational space' (UK)

Considering the last phase of the citizen panel methodology, namely the ranking of the expert-formulated research priorities by the citizens, our analysis revealed that often researchers and citizens put different emphasis on the same issue. Many priorities, which were ranked highly by the experts, seem to have attracted less attention by the citizens and vice versa (see Tables 4 and 5). This again demonstrates that citizens and experts may assess priorities (mostly on socially oriented issues) quite differently. Again, while the citizens tend to give higher priority to research themes in search of socially oriented solutions and changes, the experts are more supportive of technically oriented solutions. This divergence in perspectives illustrates that **there are multiple valuable ways of evaluating the same issues which need to be reconciled in order for a meaningful consensus-based approach to be put in motion.**

Table 5 Top-10 European research priorities (as voted by citizens in 12 countries) against experts' corresponding overall evaluation

European Citizens' Rank	Name of research priority	Overall Expert Priority Evaluation
1	Supporting local/regional agricultural production, distribution and consumption system	=19
2	Holistic education for a sustainable future	=4
3	Supporting people to become producers of renewable energy	11
4	Sustainable construction of buildings	=14

⁶CASI's detailed catalogue on the '50 Citizen Visions On Sustainable Futures' is available online at: <http://www.casi2020.eu/library/citizen-panels/>

European Citizens' Rank	Name of research priority	Overall Expert Priority Evaluation
5	Sustainable transformation of existing traffic infrastructure in cities	10
6	New working models – new economic models	13
7	Innovating agriculture: the sustainability option	=16
8	More green in cities	26
9	Understanding and implementing sustainable electronics	=16
10	Fair and participatory access to limited resources	=14

Analysing the content of the research priorities and of the citizens' visions further demonstrates that **ideas originating in dovetailing visions can correspond to alternative research priorities and in the process be applied to new contexts**. Mostly, research priorities developed by experts tend to cut across several research areas and weave together technical and social elements. In other words, cross linkages between the visions and the research priorities can still be traced, which provides new opportunities for further formulation of research priorities in the given area.

The divergence in the ways citizens and experts assess priorities lends support to the claim that all participants must be engaged in the creation and exploration of a future sustainability agenda as it is being developed and elaborated, rather than simply provided post factum with the externally designed research ideas. The various social processes and values involved in the production of knowledge, moreover, point to the need for **a continuous process of negotiation between researchers and the wider public at all stages of the participant-driven approach**. Indeed, **citizen participation at all stages of the research policy consultation process** may expand the potential for meaningful engagement, the recognition of co-benefits of proposed topics and ideas, and ultimately a deeper understanding of the complex interrelationships of sustainable systems. **Involving citizens in the making of research priorities is further apt to raise novel topics to the research agenda and can successfully disrupt established forms of expert-based development of research priorities**. Topics relating to social development and citizen participation could be particularly successful disruptors of research policy design.

It is particularly noteworthy that **the three top priorities across Europe, voted by the citizens, focus on different ways to enable citizens to live and act more sustainably** (producing food closer to their home; education on how to live a more sustainable life; assisting citizens with producing renewable energy themselves). **This focus on empowerment is rarely highlighted in research programmes, be they national or European**. Participatory research features are seen as being critical in building capacity as they organise and encourage information exchange, as well as mutual and joint learning.

Citizens' Visions vis-à-vis Horizon2020 GSC5 Priorities

The analysis reveals that the citizens tend to focus more on climate change issues than on resource efficiency, raw materials or environment-related issues. Although less predominant than climate action, resource efficiency is also a matter of the citizens' concern while raw materials priorities have received around half the interest expressed towards climate action. It is reasonable to assume that the citizens' visions are, to a large extent, a manifestation of individual worries and fears influenced by the knowledge

on environmental affairs of each citizen. This may, to some extent, explain why climate change, whose negative consequences and threats are pervasively present in our daily life (e.g. floods), is more predominant in citizens' visions than other problems like sourcing raw materials, with which citizens are probably less familiar. The following paragraphs focus on how the citizens-based research priorities relate to each of the EC sustainability priorities in the domain of GSC5 ('Climate action, environment, resource efficiency and raw materials').

- Citizens-based research priorities vis-à-vis H2020 Climate Action priorities

A focus on mitigation solutions is clearly seen in most climate-oriented research priorities inspired by the citizens' visions. Citizens' visions have also shown the importance of a conscious promotion of a sustainable lifestyle as a way to tackle climate change problems. Developing adaptation solutions to climate change and formulating eco-innovation policies are also among the main key aspects discussed in CASI citizen panels. In their visions the citizens highlight the importance of prevention, supervision and assessment of those human actions that may have harmful impact on climate and environment.

The research priority that more specifically refers to climate change aspects is *Unified ecological grading system*, which reflects to a great degree the importance that the citizens ascribe to the prevention, supervision and assessment of those human actions that may have harmful impact on climate and the environment. **Yet, while this research topic aligns well with the experts' evaluations, it is ranked rather low by the citizens – pointing perhaps to the need to go beyond narrow GSC5-specific considerations and taking careful note of the multifarious ways in which citizens discuss climate action.**

- Citizens-based research priorities vis-à-vis H2020 Environment priorities

In most visions related to the environment we can observe a growing reference to and interest in citizens' participation. In fact, they propose a more active public engagement in SI, e.g. including civil society in the formulation and implementation of action plans on sustainable innovation and sustainable future in general, or involving citizens in the process of designing sustainable and responsible education policies. **Given the cross-sectoral nature of such topics, which exceed the paradigm of narrow environmental conservation, it is perhaps not surprising that as research themes some of those issues were appreciated by both the citizens and experts.**

- Citizens-based research priorities vis-à-vis H2020 Resource efficiency priorities

Based on the citizens' visions, 'eco-innovation and green economy transition' and 'resource efficient sustainable lifestyle' are the most critical resource efficiency-related priorities. Similarly to climate action, lifestyle is also found to be a key factor for fostering sustainability. The fact that a representation of European citizens recognises the necessity of behaving in a sustainable manner makes this priority even more relevant.

Some visions combine environmental, responsible and distributive justice-related rationales. Other resource efficiency-oriented visions claim for a more effective research on individual urban farming and support to the local/regional agricultural production, distribution and consumption system.

- Citizens-based research priorities vis-à-vis H2020 Raw materials priorities

The citizens stressed the need for effective raw materials policies, underpinned by a conscious sustainable lifestyle. To achieve this, it is necessary to increase people's awareness on raw materials shortage. Similarly to resource efficiency priorities, the citizens underlined the

importance of a research priority focused on a fair and participatory access to limited resources. Another interesting insight, which relates to quite a high number of EC priorities, is the one advocating for a wider participation of users and stakeholders in technological and social innovation, and in general for the development of effective open innovation approaches. We can thus recognise the relevance that a sense of community has on the implementation of SI policies and strategies.

Taking into account all expert-elaborated research priorities vis-à-vis H2020 priorities shows that 10 out of these have a very high alignment with the EC sustainability agenda. From these, only four priorities (namely “More green in cities”, “Fair and participatory access to limited resources”, “Holistic education for a sustainable future” and “Supporting people to become producers of renewable energy”) are among the ones that were ranked in the Top 10 of the transnational list of research priorities, which came as a result of the second citizen panel in the 12 participating countries.

The misalignment between the citizens’ priorities and the EC research programme stresses the **need for participatory practices in eliciting the key topics that could potentially reinforce the H2020 sustainability agenda, so that it reflects people’s general alarms, concerns and hopes for the future more closely.** Indeed, this focus on a proactive, interdisciplinary and transparent research policy that works in tandem with the needs of society can be purposefully pursued at the level of harmonising research priorities with multiple societal challenges (as specified in H2020).

CASI Online Survey Confirms the Importance of Sustainable Innovation

The results of the online survey⁷ revealed important insights for the relevance of Sustainable Innovation (SI) in addressing the challenges related to GSC5 and the importance of stimulating it further through research programmes and projects. The data gathered within CASI through the online survey show that the great majority of respondents recognise SI as a factor in addressing the environmental challenges of today and prioritise the environmental dimension of sustainability as the most essential one in terms of SI. Hence, sustainable innovation is considered as being particularly well suited to contribute to protecting the environment, sustainably managing natural resources, water, biodiversity and ecosystems, as well as enabling the transition towards a green economy and society. Sustainable innovation is believed to have the most significant impacts in sectors with particularly visible environmental impacts, such as in agriculture, forestry and fishing, in the utilities sector – electricity, gas, steam and air conditioning supply, as well as water supply, sewerage, waste management and remediation activities and in manufacturing.

Another substantial element of SI is that it integrates social and economic considerations as well, which demonstrates its relevance to addressing environmental challenges in a socially-sensitive manner. **Mobilising relevant actors through variety of engagement methods** is what is needed to make sure informed decisions are taken in terms of achieving sustainability in all its dimensions. The participants in the survey underlined the importance of bringing business actors, CSOs, policy makers and research and education actors together in designing and developing innovative products, services and processes. Involving a wide range of stakeholders in these processes brings in interdisciplinary expertise, which is essential as it allows for considering the various possible impacts of the particular research project or

⁷ The online survey was launched by CASI partners in mid-2015 and kept online until August 28th, 2015. A total of 1793 responses were received. The survey reached to sustainability and innovation experts (from civil society organisations, research and academia, business, individual entrepreneurs, policy advisors, local, national and regional government representatives and officers in EU institutions) across the entire EU.

innovation, thus, improving the sustainability of its results. These collaborations also improve the potential for generating innovative ideas and developing working solutions.

Further conclusions from the survey included: i) there is a need for **funding programmes for exchange of experience in sustainable innovation** in order to contribute to spreading excellence in sustainable innovation research and practice across Europe; ii) reinforcing gender principles in the field and **strengthening women's capacities in sustainable innovation**, as well as more directly involving women in the process can foster the sustainability of innovations by bringing in a more gender-balanced perspective to the process.

The assessment of sustainable innovation is an integral part of the process of sustainable innovation management and needs to be implemented throughout the innovation cycle – from the conceptualisation and design of the particular innovation to its delivery and commercialisation. Assessment needs to be strongly anchored to the SI management processes within organisations and oriented towards pre-defined sustainability-oriented goals.

Despite the great importance experts lay on these processes, the online survey's results demonstrate that the majority of organisations represented by the participants in the survey currently have no access to a tool for assessment and management of sustainable innovation. In this respect, CASI's outcomes, and in particular the development of a framework for assessment and management of sustainable innovation can play a vital role in strengthening organisational capacities in managing innovation processes while taking multi-disciplinary and multi-actor perspectives into account.

Conclusions

Based on the analysis of the results of the above mentioned engagement approaches, the CASI project has identified the following policy-relevant insights and input for the new work programmes of H2020 in order to demonstrate the added value of public participation when looking for solutions to societal challenges and concerns:

- **Systemic societal transformation is needed.** The majority of presented visions assumed implicitly or explicitly that a systemic societal transformation is necessary in order to achieve desirable futures and sustainability. Indeed, broader socio-economic issues must be reconciled/considered jointly with technological ones in order to address people's sustainability expectations more fully. Among other things, a strong emphasis should be placed on how best to bring more environmental considerations into the social economy and use the social economy to advance equity concerns within sustainability. Exploring the potential for community transformation is critical for achieving values-based commitment to structural change.
- **Multidisciplinary and cross-sectoral research should play a bigger role.** Discussing sustainability necessarily implies taking into account its behavioural, social, cultural and economic aspects, along with its physical and systemic elements, and requires combining different disciplinary domains, methodologies and levels of analysis.
- **There is a need for assuming a multi-actor perspective**, whereby dialogues between different groups are encouraged: between experts from various scientific domains (especially natural and social scientists); between experts and the public; and between both of these groups and policy decision makers. Importantly, in light of the holistic cross-sectoral nature of the research priorities developed on the basis of citizens' visions, the engagement of citizens as a method for defining research objectives should be bolstered as a means for 'remedying' linear/silo approaches to sustainability research.

- **Human and social sciences should underpin any sustainability research policy.** Research for sustainable development needs to be wide-ranging and reflect the dynamics and complexity of the intricate interrelationships of sustainability systems. The participatory aspect of sustainability research may be seen to involve humanities and social sciences as well as the meaningful engagement of societal actors, and as such is best positioned to analyse the deliberative processes that inform sustainability decisions. The qualitative and interpretative approaches of the social sciences and the humanities are therefore needed to get to an understanding of the different views, purposes and practices held in society with regard to an issue and develop the knowledge or solutions needed in response to such concerns.
- **More research priorities should focus on social change and empowerment of citizens.** Citizens favour research priorities with stronger emphasis on social change and solutions as well as those with the aim of empowering citizens to bring about themselves a more sustainable future. Research agendas should therefore focus more directly on issues of broader social change and provide the means for empowering citizens as drivers for sustainable futures.

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