State-of-art of Sustainable Innovation:
Climate action, environment, resource efficiency and raw materials

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State-of-the-art of Sustainable Innovation: Climate Action, Resource Efficiency, Environment and Raw Materials

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Executive summary

The main objectives of the ‘State-of-art of sustainable innovation’ work package (WP2) in the CASI project are (1) to position sustainable innovation (SI) within the framework of the 5th European Union Societal Challenge on Climate Action, Environment, Resource Efficiency and Raw Materials (SC5) of the European Commission’s Horizon 2020 Framework Programme for Research and Innovation (H2020); and (2) to set the theoretical foundations for the assessment and management of sustainable innovation. This report summarises the work undertaken by the CASI partners to achieve these objectives. In so doing, it describes the key findings of a major stocktaking exercise that required the mapping of SI initiatives, and presents some implications that these findings may have for future research and innovation (R&I) policies for sustainability.

The study draws on the exploration and identification of more than 500 sustainable innovation initiatives. The identification required a combined focus on social, economic and environmental dimensions, as well as relevance to one or more of the priorities areas of SC5. Over 200 cases were further analysed and mapped, based on five selection criteria: public participation and mobilisation; sustainability and cross-sectoral linkages; multi-dimensional transformations; deployment and diffusion; and novelty.

To position sustainable innovation, the authors have conducted, first, a comprehensive review of H2020’s key areas in SC5, including the description of SI practical examples; and, second, an assessment of the selected cases in relation to the type of innovation, their impacts, systemic sustainability, roles and common features. These tasks led to the working definition of sustainable innovation as ‘any incremental or radical change in the social, service, product, governance, organisational, system and marketing landscape that leads to positive environmental, economic and social transformations without compromising the needs, welfare and wellbeing of current and future generations’. (See also CASI’s Sustainable Innovation Conceptual Framework report by Popper et al. (2016).)

To lay the foundations for the assessment and management of sustainable innovation, the CASI project’s State-of-art of sustainable innovation activities involved conducting an inductive analysis of 500+ cases, which led to the identification of four SI management dimensions, 10 SI management key aspects and 50 critical factors; then, based on these factors, a set of common considerations or recommendations for sustainable innovation managers were suggested using technological, economic, political, social, environmental and ethical perspectives. Both the critical factors and common considerations provide a practical frame that guides the conception, design and future development of the methodological framework for the assessment and management of sustainable innovation (CASI-F).

The large volume of data generated and analysed by CASI’s State-of-art of sustainable innovation activities (WP2) is captured in the CASIPEDIA database, which provides strength for the conclusions presented in the final part of the report. These conclusions suggest:

- a further exploration, by the EC, of 76 research and innovation potential priorities (classified in the report by type of innovation), as they represent those areas explicitly addressed by innovators as relevant for the future of European SI.

- the recognition of 10 research and innovation policy agendas for SI, by incorporating them into the discussions of a Grand R&I Policy Agenda for sustainable innovation in Europe. A cross-cutting analysis is provided in Annexe 3 of the alignment between these potential grand agendas and the current H2020 funding priorities.

In sum, the report illustrates how bottom-up approaches can be utilised to build both theoretical and practical structures for sustainable innovation. In general terms, its findings will hopefully be seen as a valuable contribution to improving sustainable innovation governance, at a time when evidence-based methodologies are increasingly sought as a way of legitimising European policy action.
**About the CASI Project**

The CASI project (‘Public participation in Developing a Common Framework for Assessment and Management of Sustainable Innovation’) aims to respond to one of the Grand Challenges set out in the EU’s Horizon 2020 programme, namely ‘Climate Action, Environment Resource Efficiency and Raw Materials’. It represents an EU-wide cross-sectoral partnership on innovation-related challenges and considers not only the impacts of social and technological innovation, but also the types of actor involved and their inherent interests. It thus effectively integrates the perspectives of civil society, SMEs, industry, policy stakeholders and leading academics.

CASI is based on the understanding of innovation as a key driver of societal progress in the age of technology, and of imminent uncertainties about the future. Sustainable innovation, on the other hand, further enhances this understanding by introducing sustainability as a focal core of the innovation process and as an objective of innovation diffusion through social and market opportunities. At the same time, this is not an attempt to introduce yet another distinctive type of innovation. Rather, CASI fosters a debate on conceptual dimensions, policy boundaries and good practices, combining innovative pursuits with sustainability objectives.

Collaboration among partners investigates the scope of sustainable innovation as a societal phenomenon and enables the elaboration of an assessment and management framework of sustainable innovation practices, based on a sound conceptual framework and a shared understanding of sustainability in innovation processes among stakeholders. CASI further explores the impacts of innovative practices, as well as of specific technological and social innovations, vis-à-vis the persisting challenges of climate change and resource depletion, and the societal effects thereof. Thus, it makes a thorough inquiry into the balance between the social, economic and environmental impacts of innovations, and helps determine the scope and priorities for national and EU policy making.

CASI 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’. It is coordinated by the Applied Research and Communications Fund (ARC Fund), a Bulgarian non-governmental policy and innovation research institute. The project’s consortium includes 19 partner organisations from 12 EU countries and relies on an extended network of national experts in the remaining 16 countries not represented in the consortium, in order to ensure coverage and inquiry in every EU member state.

CASI includes a rich and intensive set of activities carried out across the EU. The methodology of the project is structured into the following work packages (see Annexe 1):

- WP1 Management;
- WP2 State-of-art;
- WP3 Dialogue and Participation;
- WP4 Common Framework for Assessment and Management of Sustainable Innovations (CASI-F);
- WP5 Pilot Projects on Testing and Validating CASI-F;
- WP6 Management of Sustainable Innovation;
- WP7 Policy Watch;
- WP8 Policy Recommendations;
- WP9 Heritage;
- WP10 Communication and Dissemination;
- WP11 Evaluation.
1. Introduction

1.1. About this report
This state of the art report on research and innovation related to the EU Horizon 2020 5th Societal Challenge on Climate Action, Environment, Resource Efficiency and Raw Materials (SC5) presents the results of a comprehensive review, analysis and mapping of 500+ sustainable innovation (SI) initiatives from across Europe and beyond. The report is structured around six chapters. After this brief introduction, Chapter 2 provides an overview of the sustainability R&I priorities in SC5, complemented by selected examples and a featured study from CASIPEDIA. Chapter 3 presents the results of the analysis of 548 SI initiatives by type of innovation. In Chapter 4 we introduce the results of an inductive approach we undertook to analyse the CASIPEDIA database in order to identify some key SI management dimensions. Some critical considerations and lessons from major technological, economic, environmental, political, social, ethical and special (TEEPSES) issues are discussed in Chapter 5, and mapped against some 10 key aspects of SI management. In Chapter 6 we provide some final remarks.

1.2. The CASI research foci
Our research foci required the analysis of 500+ sustainable innovations of seven types:

- 195 product innovations
- 121 service innovations
- 75 social innovations
- 62 organisational innovations
- 46 governance innovations
- 31 system innovations
- 19 marketing innovations

All innovations required a combined focus on social, economic and environmental dimensions, as well as relevance to the H2020 priorities for SC5.

2 CASIPEDIA is the database of sustainable innovation initiatives. It constitutes a key element of the CASI project. http://www.casi2020.eu/casipedia/cases/.
1.3. The CASI mapping methodology

Most CASI project key outcomes are supported by a comprehensive and inductive analysis of sustainable innovation initiatives. The high number of real SI cases makes CASI a very useful instrument of strategic intelligence. In particular, CASI intelligence can contribute to:

- Developing more consistent and effective formulation and implementation of European evidence-based SI policies. CASI can actually increase the legitimacy of SI-related funding decisions, e.g. informing on new Horizon 2020 prioritised areas.
- Strengthening SI innovators’ assessment and management capabilities. CASI will serve as a platform of distributed intelligence for SI stakeholders, e.g. innovators, research and innovation centres, academic actors, civil society, etc., through which these actors will learn about innovation best practice, and innovation drivers and barriers.

The relevance of mapping for understanding European innovation-related initiatives has already been suggested in the field of foresight (Popper et al., 2011). Practices, players and outcomes were the dimensions explored in the frame of the European Foresight Platform (EFP). The trajectory of mapping exercises started in 2002 with the EUROFORE project and has gradually evolved through different European mapping initiatives to produce the present CASI project. In this sense, CASI evidence of sustainable innovation has also been gathered and clustered around these three EFP dimensions.

The work was undertaken by a network of 12 CASI partners and 16 CASI correspondents or country representatives, thus covering all EU Member States. The process involved research and innovation centres, universities and consultancy businesses within the SI sector.

The case selection aimed to identify different types of SI innovations: product/process innovation, service/process innovation, social/behavioural innovation, organisational/business model innovation, governance innovation, system/paradigm innovation, marketing/positioning innovation. The cases had to have been initiated after 2000, and had to be supported by a consistent and reliable source of information, e.g. reports, books, interviews, websites, academic papers, grey literature.

The following key criteria were used to select SI cases:

a) Public participation and mobilisation, to assess the engagement in the issues of the sustainable innovation by the public, civil society and democratic governance, with the goal of fostering independent thinking and debate, i.e. not corporate market research.

b) Sustainability and cross-sectoral linkages, to assess the way further innovation or positive effects are enabled among a wide range of sectors, levels, and users.

c) Multi-dimensional transformations: to assess the degree to which the sustainable innovation can produce positive change or transformation for one or more dimensions (social, economic or environmental).

d) Deployment and diffusion, to assess the degree of advancement in the process of deployment or implementation.

e) Novelty and originality, to assess the creativity associated with the process, i.e. the degree to which a sustainable innovation represents an original or novel idea.

The assessment against these criteria was used to select and fully map six SI initiatives per EU28 country (i.e. 168 initiatives), complemented with some additional 34 SI initiatives covering selected non-EU countries, as well as the seven types of innovations. All cases, both initially nominated (500+) and those mapped (200+) are included in the CASIPEDIA database.

The CASIPEDIA analysis has contributed to building a framework for SI management and assessment, to defining new research and innovation priorities, and to informing policy-makers on different conceptions of SI.

Every conclusion in the CASIPEDIA analysis is based on SI stakeholders’ suggestions and is complemented by relevant SI literature. The CASIPEDIA analysis may also serve to initiate or shed some light on ongoing SI debates.
1.4. CASIPEDIA as a knowledge platform on sustainable innovation

CASIPEDIA is a mobilisation and mutual learning (MML) knowledge platform on SI. Access to SI intelligence through CASIPEDIA may thus increase the quality of SI policies and the level of European governance.

CASIPEDIA can provide knowledge on sustainable innovation to the main actors of the European R&I system. Below are some brief descriptions of the way CASIPEDIA can help businesses, universities, governments and civil society in their SI-related processes.

- The business sector may find it useful to use CASIPEDIA to explore others’ SI experiences, thus reinforcing or amending their ongoing innovation-oriented activities. Using filtering tools, companies can find similar SI cases in different countries or sectors. CASIPEDIA may also become a source of inspiration for further innovation developments.
- Academic actors (universities, research and technology organisations, etc) can use CASIPEDIA to support their activities. For example, CASIPEDIA can provide SI case studies to illustrate and support SI learning and lecturing processes in business schools. As for research, CASIPEDIA may be used to conceive new models of SI management, explore SI innovators’ behaviors (identifying drivers, rationales, etc), compare SI practices in different countries or by different actors, or identify emerging areas of research.
- Governments can use CASIPEDIA to support the formulation and implementation of SI policies. The analysis of SI cases can help to identify those areas that need a higher volume of funding or other resources. Policy-makers may also use CASIPEDIA to find evidences of the benefits of applied policies, i.e. ex-post policy evaluation approaches.
- CASIPEDIA is also an important source of knowledge for civil society. Consumers and innovation users, for example, may find the database useful for identifying new trends in different sustainability-related sectors, e.g. new developments in agriculture and the food industry, novel modalities of energy production and consumption, emerging citizens’ platforms, etc. Foundations and NGOs can find in CASIPEDIA some SI practices that may be used to justify or support their social action, e.g. endorsing NGOs’ ongoing activities through the comparison and benchmarking of other countries’ initiatives.

The utility of CASIPEDIA as a platform of distributed intelligence is enhanced by its comprehensive filtering and clustering tools. This filtering enables a more focused and narrowed extraction of data, thus facilitating research analysis.

Through CASIPEDIA filtering, SI cases may be classified according to types of innovation, key areas, success factors, SI drivers, geographical scope, SI priority areas, or sectoral relevance, among others.

Other important CASIPEDIA data are related to controversial aspects of SI. These aspects may eventually feed ongoing social discussions and political debates. These aspects include, for example, different innovators’ tensions and dilemmas on the consequences of SI initiatives. The potential transformation that SI projects may generate, in social or economic terms, is also a matter of reflection. Aspects related to SI transferability between communities, sectors, or countries also constitute material for academic research and NGO studies.

CASIPEDIA also facilitates information that permits a better understanding of the innovators’ mutual learning processes. Mutual learning is an important rationale underlying the whole CASI project. As a matter of fact, the CASI activities, facilitated by CASIPEDIA, can be considered part of a mutual learning process on their own, as they promote knowledge transference across all SI actors.
2. Key areas in ‘Climate action, environment, resource efficiency and raw materials’

The following priority areas have been extracted from the Council decision of 3 December 2013 establishing the specific programme implementing Horizon 2020. They correspond to Chapter 5 subsections (Annexe 2, part III) describing SC5.

All the symbols and figures appearing in the following sections are identified in Annexe 2.

2.1. H2020 Priority Area 1: Climate action

2.1.1. Climate change projections and scenarios

2.1.1.1. Description

Getting more consistent knowledge of the factors and drivers associated with climate change is essential for devising more effective mitigation and adaptation solutions. A better understanding of these factors and drivers can be achieved through the development of more accurate measurement systems, scenarios and models. Improved climate projections (time-based and/or geographical) can actually serve as a base for scientific explanations on the functioning of Earth ecosystems.

2.1.1.2. SI examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Smart Climate Map</td>
<td>The smart climate map is an initiative of Leuven Klimaatneutraal (Leuven climate neutral) in cooperation with the province of Vlaams-Brabant. The map demonstrates all the initiatives (of companies) that are contributing to the ambition of becoming climate neutral in 2030. It enhances transparency about how businesses in the region contribute to reducing GHG emissions and encourages businesses in the region to showcase concrete action. For each initiative, the map provides you with contact details, production capacity, CO₂ reduction, etc.</td>
</tr>
<tr>
<td>Wiklimat</td>
<td>WIKLIMAT is a platform for sharing knowledge between public and private actors of adaptation to climate change. WIKLIMAT aims to facilitate the sharing of knowledge and know-how from multiple actors: operators of public bodies acting in the field of climate change, civil servants in local state departments, French national climate change adaptation plan actors, local authorities, consultants, contractors, associations and NGOs.</td>
</tr>
<tr>
<td>Green Finance: Methodology for evaluation of projects with positive environmental impact</td>
<td>Green Finance is part of a comprehensive environmental approach which the ProCredit Group has adopted with a view to substantially improving its internal and external environmental impact. The process of creation and implementation of the methodology is supported by the specialised German consultancy firm IPC GmbH. Green loans are designed to complement the existing loans offered to business clients by financing measures in the area of energy efficiency, renewable energy and other environment-related fields. The approach is suitable for the investment needs of small and medium business, taking into consideration national and sectoral characteristics. Projects are divided into standard investments that are evaluated against a baseline and non-standard investments assessed by specially trained in-house experts.</td>
</tr>
</tbody>
</table>

http://www.casi2020.eu/casipedia/cases/1123

http://www.casi2020.eu/casipedia/cases/799

http://www.casi2020.eu/casipedia/cases/1156
2.1.1.3. **Featured study**

<table>
<thead>
<tr>
<th>Center for IT-Intelligent Energy Systems in Cities (CITIES)</th>
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<tbody>
<tr>
<td><strong>CASIPEDIA URL</strong></td>
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<tr>
<td><a href="http://www.casi2020.eu/casipedia/cases/1027">http://www.casi2020.eu/casipedia/cases/1027</a></td>
</tr>
</tbody>
</table>

**SI Description**

A wide range of research activities has arisen in Denmark to support the achievement of a 100% renewable energy system by 2050. CITIES will contribute to this target by establishing an integrated research centre covering all aspects of the energy system, including gas, power, district heating/cooling and biomass. It will also investigate methods to forecast, control and optimise their interactions through the use of advanced data analysis, decision process analysis, graphical information systems, and modelling, using combined mathematical and statistical approaches.

**SI Lead organisation**

Technical University of Denmark

**SI Objectives**

- Establish a realistic and concrete pathway to ultimately achieve independence from fossil fuels, by harnessing the latent flexibility of the energy system through intelligence, integration and planning. This will focus on city environments and will work towards achieving both 2020 and 2050 European and Danish goals
- Use a holistic research approach in developing methodologies and ICT solutions for the analysis, operation and development of fully integrated urban energy systems
- Educate a generation of academics, engineers and entrepreneurs on the values and necessity of considering the energy system as a whole in a collaborative, integrated context, rather than focusing on a single facet or component
- Identify and establish solutions which can form the background for commercial opportunities within the smart cities environment, and support the development of these and other smart cities demonstration projects, including through a range of decision support tools to be developed as a result of the research efforts

**Critical issues**

**Big data**: In Denmark, and Europe in general, it is difficult to get data from and about citizens, because it is perceived as private data and there is a reluctance to share it. It is a barrier for the SI to create the smart integrated energy system desired.

**Demand for a smart energy system**: There is global demand for reducing the reliance on fossil energy sources and to create a more efficient energy system. Where different energy sources like wind, solar and biomass work together with electric vehicles, heat pumps and district heating, a more sustainable and efficient energy system can be ensured.

**Energy efficient cities**: This technology will make it possible for cities to have smart and efficient energy systems. This is an important step towards more environmentally sustainable cities.
2.1.2. Climate change adaptation solutions

2.1.2.1. Description

Understanding the impact of climate change on the environment, economy and society is a complex challenge. It is urgent and important for scientists to identify what direct and indirect consequences climate variability and unexpected climate events may have on natural and built environments. This implies to the evaluation of the capacity of adaptation and prevention solutions (technological and non-technological) to tackle climate change. The effects, dilemmas, potential tensions and synergies of adaptation policy decisions must also be analysed in relation to other policy initiatives, e.g. those related to employment and demographic aspects.

2.1.2.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CORKSORB Cork based absorbents</td>
<td>Cork based absorbents absorb oil and organic solvents without absorbing water. They float even when they are saturated and can be used to deal with every kind of spillage and leak. CorkSorb products are suitable for use in ATEX (Explosive Atmospheres) environments. CorkSorb products are absorbents designed to deal with spillage of any kind of oil, solvent or organic compound.</td>
</tr>
<tr>
<td><a href="http://www.casi2020.eu/casipedia/cases/814">http://www.casi2020.eu/casipedia/cases/814</a></td>
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</tr>
<tr>
<td>POSSA™ - multipurpose super-absorbent for safe removal of hydrophobic substances</td>
<td>This is multipurpose super-absorbent for safe removal of hydrophobic substances from water surfaces and the ground. This includes mineral and synthetic motor oils, lubricants, fuels, cooling liquids, non-polar organic solvents and fats. With appropriate application it can be used for removal of floating coal dust from water surfaces. It is produced from natural fibres, does not contain any substances liable to provoke respiratory tract irritation and is completely safe for handling. Biodegradable cellulosic fibres in the shape of hollow micro tubes coated with natural waxes prevent the spread of oil slicks on bigger surfaces or penetration of the spilled substance into the ground. It is an environment–friendly, natural and multipurpose absorbent which can be landfill–incinerated after use, depending upon the substance absorbed. Its advantages are: immediate action, non-dusting absorbent, environment–friendly product, biodegradable, safe to handle cost-effective absorber.</td>
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<tr>
<td><a href="http://www.casi2020.eu/casipedia/cases/1271">http://www.casi2020.eu/casipedia/cases/1271</a></td>
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<tr>
<td>Grassblock</td>
<td>The AB Grass Block is a precast concrete paving flag that allows space for soil to be inserted into inbuilt cavities inside it. Turf seeds can then be planted into the soil and, once it grows, it will improve its surroundings by increasing their green aspect. Grassblock creates useable, hard-standing spaces while retaining the benefits of a natural grassed area, creating oxygen-producing driveways. Its cavities are designed to facilitate the growth of grass within a supporting concrete matrix, allowing grass to be cut in a conventional manner. The main benefit is that Grassblock has a permeable surface, thus allowing water to seep through cavities. This helps reduce the problem of flooding.</td>
</tr>
<tr>
<td><a href="http://www.casi2020.eu/casipedia/cases/991">http://www.casi2020.eu/casipedia/cases/991</a></td>
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</table>
2.1.2.3. **Featured study**

**Clean Air Make More initiative**


**Innovation Type** Service

**SI Description**

The USA’s Maricopa County’s Rapid Response Notification System - Clean Air Make More - aims to decrease the level of air pollution by providing real-time air monitoring information and an immediate notification of a pollution problem within the county. When the Maricopa County Air Quality Department detects dust pollution levels beginning to rise, it sends messages (email and text alerts) notifying where the pollution hot spot is and what measures citizens can take to help prevent violation of health standards. The initiative is funded through fines collected from air quality violations in the respective county. Pollution effects are:

- **Ozone Effects**: ground-level ozone is the most widespread air quality problem in the United States. Approximately one out of every three people in the country is susceptible to ozone-related health problems, including shortness of breath, coughing, wheezing, headaches, nausea, and throat and lung irritation. Ozone also aggravates asthma and other respiratory diseases and reduces the immune system’s ability to fight off respiratory infections.

- **Particulate Matter Effects**: elevated levels of particulate matter in the air affect citizens living in cities. Both PM-10 and PM-2.5 are so small they can pass through your throat and nose, enter the lungs, and even get into the bloodstream. PM-2.5 is believed to pose the greatest health risk because these tiny particles can get stuck deep in the lungs. It is noteworthy that everyone can suffer from temporary symptoms as a result of high amounts of particulate matter in the air. Children, the elderly, people exercising outdoors and those with heart or lung disease or asthma are at an especially high risk to its ill-effects.

**SI Lead organisation**

Maricopa Country Air Quality Department

**SI Objectives**

- Prevent exceeding the federal health limits for dust pollution
- Maintain clean air for the residents and visitors of Maricopa County
- Raise awareness and educate the residents of Maricopa County on the causes and effects of air pollution, and on measures that can be taken to address the problem

**Critical issues**

**Access to new technologies:** Considering that the notification system is based on using new technologies, such as online social media tools and text messaging, the groups which do not have access to these tools or do not have capacity to use them will be excluded from the system. Traditional media channels can be used to alleviate this challenge and allow such groups, e.g. the elderly, to be informed on dust pollution and measures to reduce pollution.

**Regulatory framework:** The federal Clean Air Act, which was first adopted by the US Congress in 1970, sets standards on air quality that states need to achieve and maintain via the implementation of regional enforceable plans.

**Better air quality:** As a result of the Rapid Response Notification System, the air quality in the region has been significantly improved.
2.1.3. Climate change mitigation solutions

2.1.3.1. Description

To construct an environmentally sustainable Europe requires the development of effective climate change mitigation strategies. The impact of innovative policy options, low-carbon technology strategies, and related new economy models must be explored in relation to the main economic and societal sectors at EU and global level. These mitigation initiatives should reinforce the connections between the key actors in the innovation system.

2.1.3.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>North West Bicester - UK’s first eco-town</td>
<td>This is a project to build up to 6000 new zero carbon houses (complying with the UK Government’s Code Five sustainability criteria) and associated facilities and infrastructure to sustain a vibrant, sustainable new community over the next 25 to 30 years. Each house will be designed to maximise sustainability through resource efficiency; moreover, the development will promote green travel. Leading housing provider A2Dominion is leading the Masterplan for NW Bicester and is the developer of the first Exemplar phase. The Exemplar is the first stage of the wider Masterplan and is developing the site with 393 zero carbon homes, a primary school, a local shop, an eco-pub and a community centre. A2Dominion works in partnership with Cherwell District Council and has appointed a number of experts to deliver this ground-breaking scheme. <a href="http://www.casi2020.eu/casipedia/cases/1007">http://www.casi2020.eu/casipedia/cases/1007</a></td>
</tr>
<tr>
<td>Local green deals</td>
<td>in 2009, business, government and civil society in the city of Tilburg organised themselves into the network organisation Klimaatschap. The aim was that, if all stakeholders work together, innovations will take place much faster. Where the Klimaatschap originally was aimed at forming alliances and stimulating new sustainability projects, it now focuses more on the closing of so-called local Green Deals. The Green Deal approach focuses more on the joint responsibility of initiators for the success of projects by closing deals. The municipality supports initiatives only where necessary. Tilburg wants to consume less energy, generate more sustainable energy and adapt to climate change. To achieve these goals for the municipality it is important that it is organised as a social process. <a href="http://www.casi2020.eu/casipedia/cases/904">http://www.casi2020.eu/casipedia/cases/904</a></td>
</tr>
<tr>
<td>Krk Island: Towards Energy Independence and Zero CO2 Emissions</td>
<td>The island of Krk is one of two largest islands in Croatia and is located in the northern part of the Adriatic Sea. This innovation comprises multiple initiatives undertaken jointly by local municipalities, the utility company which serves the island, NGOs and other local stakeholders. The initiatives are based on a strategy developed in 2012 and are being undertaken in order to make the island a prime example of energy independence, reliance on renewable sources, environmental protection, environmentally friendly waste management and zero CO2 emissions in Croatia. <a href="http://www.casi2020.eu/casipedia/cases/996">http://www.casi2020.eu/casipedia/cases/996</a></td>
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2.1.3.3. **Featured study**

### Bath & West Community Energy

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<th>CASIPEDIA URL</th>
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<tbody>
<tr>
<td><strong>Innovation Type</strong></td>
<td>Organisational</td>
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</tbody>
</table>

**SI Description**

Bath and West Community Energy (BWCE) was established in 2010 to initiate projects to address climate change and peak oil and retain economic value at a local level. BWCE is constituted as an 'Industrial and Provident Society for the Benefit of the Community' (part of the UK legislative framework for Cooperatives), which locks assets and surpluses into community benefit programmes, and provides members with a direct vote on how local energy is generated and used. In 2011 BWCE raised £722,000 from local community members as equity finance to fund projects installing 600kW of solar PV installations in local schools.

**SI Lead organisation**

The Community Shares Unit

**SI Objectives**

- Initiate projects that respond to the threat of climate change and peak oil
- Retain economic value at a local level
- Offer people a direct say in how their energy is generated and used
- Raise community investment (in the form of a Community Shares Offer) as a form of risk capital for community energy projects

**Critical issues**

**Political support for social investment:** The UK government's social investment strategy seeks to make the UK social investment market the global leader (HM Treasury, Social Investment Strategy Update, 2014). Accordingly instruments such as Social Investment Tax Relief are being introduced, which enterprises using Community Share Offers are using to encourage investment.

**Increasing political resistance to renewables:** BWCE have noted ‘increased political resistance to onshore wind and [that] large scale solar PV has introduced some uncertainty’ into their operating environment. UK policy-setting relating to community energy is in flux since the relative failure of the Green Deal and the end of the Community Energy Saving Plan, and the policy changes affecting local government are feeding into a present hiatus. This offers an opportunity for community-led initiatives in the short term but presents a potential long-term threat.

**Growth in on-line direct investment:** The growing use of on-line portals to raise crowd-funding and direct investment (of which there are many types, including invoice loans and time-banks alongside equity investment) is filtering through to the social and community sector.
2.1.4. ICT to assess and predict climate actions

2.1.4.1. Description
Addressing climate change challenges implies gathering and analysing high volumes of long-term data. Comprehensive and reliable information and communication systems are necessary to monitor, evaluate and estimate trends in the climate, and the effectiveness of mitigation and adaptation policies. These systems will draw on space technologies, networks, remotely operated sensors, mobile solutions and web services, among other tools. The access to information should be free, and information unrestricted. Related research results should be also subject to adequate and secure storage and management.

2.1.4.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Interactive energy city map</td>
<td>The new Amsterdam Energy Atlas brings together in one place all the data in the field of energy saving and consumption and opportunities for possible energy sources in the city, per neighbourhood, area and even block. All data are available as open data via an interactive map on <a href="http://maps.amsterdam.nl/">http://maps.amsterdam.nl/</a>. In this atlas, the city’s energy use is not only detailed geographically; the atlas also contains many potential maps for distributed generation of energy (solar, wind) or energy savings. In this way the atlas becomes a real source of inspiration. One innovation is that the map is based on actual data on consumption of electricity and gas at these addresses. This differentiates the Amsterdam atlas from counterparts which have served as its inspiration, such as the websites of Hamburg and New York, but which are in the end based on estimates.</td>
</tr>
<tr>
<td>Integrated Computerised Information System for Environmental Management (ICISEM)</td>
<td>ICISEM is a dedicated tool for state and municipality institutions, international environmental organisations and society to provide reliable information and data on the state of environmental quality, and the crucial anthropology impact on the state of environmental changes. ICISEM electronic services are allocated for private and legal persons to submit data on environmental quality, for municipalities - to gather information on air and bathing water quality, for environmental specialists and society - to get data and information on the quality of the local environment. Using ICISEM it is possible to gather environmental monitoring data analysis and information in one’s own territory, to present information for competent institutions, and to analyse gathered data and picture data on maps. The ICISEM portal submits information on air, water, landscape, waste management, chemical substances, etc.</td>
</tr>
<tr>
<td>SIPAID – Comprehensive Flood Alarm and Prevention Management System</td>
<td>The aim of SIPAID is to provide a comprehensive solution to flooding risk. The solution is based on real-time monitoring and data integration of different sensor networks (water levels in sewerage, pluviometer networks, actuators, etc), and weather forecasts in order to define the potential risk and impact of floods in the Mediterranean region. It includes an alerts and alarm system combined with actuation protocol in case of flood occurrence.</td>
</tr>
</tbody>
</table>
Global Forest Watch


**Innovation Type** System

**SI Description**

Global Forest Watch (GFW) is a dynamic online forest monitoring and alert system that empowers people everywhere to better manage forests. For the first time, Global Forest Watch unites satellite technology, open data and crowd-sourcing to guarantee access to timely and reliable information about forests. GFW is free and follows an open data approach in putting decision-relevant information in the hands of governments, companies, NGOs and the public. The system provides 'near real time' data on changes in forest cover and carbon storage in the EU and globally. GFW is supported by a diverse partnership of organisations that contribute data, technical capabilities, funding and expertise. The partnership is convened by the World Resources Institute based in Washington DC.

**SI Lead organisation**

World Resources Institute

**SI Objectives**

- Empower people everywhere to better manage forests
- Bring together the most current, reliable and robust data to monitor forest change around the world
- Unite satellite technology, open data and crowd-sourcing
- Guarantee access to timely and reliable information about forests for policy-makers and businesses, NGOs and inter-governmental organisations, and all forest stakeholders

**Critical issues**

- **Policy evidence and transparency:** there was a strong driver for more transparent reporting and analysis, as a basis for policy-making, negotiation, trade-offs, etc, in the international development and conservation community; this was given more impetus by the REDD programme of the COP for climate change

- **High quality satellite imaging and processing:** GFW seeks to bring together the most current, reliable and robust data to monitor forest change around the world. GFW incorporates and integrates a wide range of data sets that can be overlain and compared, including forest change data, such as global tree cover loss and gain data from the University of Maryland/Google, near real-time FORMA alerts for the humid tropics, SAD alerts for the Brazilian Amazon from Imazon, quarterly vegetation change data from NASA; forest cover data, including global tree cover extent data; intact forest landscapes and pan-tropical carbon density; forest fire data, from NASA’s Modis satellite (see GFW Fires); forest use data, which includes contextual information, such as concession areas for natural resource extraction or agricultural production; and conservation data, such as global boundaries for protected areas and biodiversity hotspots.

- **Concerns from indigenous people:** there is concern from indigenous people resident in or near forest areas that the new functionalities will enhance conservation and adversely affect their livelihoods.
2.1.5. Climate action by sustainable lifestyle

2.1.5.1. Description

The construction of green societies requires structural changes. It is necessary for research and innovation to explore the barriers and implications of these changes, while fostering a culture of sustainability between consumers, industry and policy-makers. In particular, the Social Sciences and Humanities will contribute with instruments to understand and promote key socioeconomic, cultural and institutional change.

2.1.5.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Awareness-raising blog Eco-recommendations</td>
<td>Eco-recommendations started in 2009, in order to increase the number of consumers exhibiting responsible behaviour. To reduce the environmental impact of consumption, Eco recommendations provide knowledge about environmental issues and help to develop consumer willingness to contribute to solving environmental problems through their everyday behaviour. Thematic advice (in such areas as home, work, food, driving) are prepared every week, because everyone's behaviour can contribute to significant positive changes in an environmentally safe way. The guidelines specify personal benefits that accrue to changing the habits of consumerist behaviour. Eco recommendations promote the following slogans: Prove that you have the strength to not only change, but also contribute to significant changes; Small things create great ones; Everyone has the power to make significant changes.</td>
</tr>
<tr>
<td>Publication on Environmental Education OZONAS (OZONE)</td>
<td>In order to unite people who share ideas of sustainable development and ecological awareness, in 2006 Ozonas (Ozone) was born - the journal on Environmental Education, dedicated to the promotion of sustainable lifestyles. The mission of Ozonas is to inform and develop values that promote wise use, preservation and recycling, while increasing environmental awareness in social, public and private sectors. Ozonas is open to everyone, creating opportunities to participate in the preparation of publications that bring together scientific, business, non-governmental organisations and activists. It is published both in electronic and paper formats: as an electronic library and a free magazine distributed in public places, especially those declaring sustainable lifestyles (restaurants, events, etc).</td>
</tr>
<tr>
<td>The Green Idea: Facilitating Organic Food Production through Marketing</td>
<td>The Green Idea: Facilitating Organic Food Production through Marketing is a project led by the Croatian Association of Communications Agencies (HURA) and its partners, initiated with the goal of helping local organic food producers with their methods of reaching a wider market, as well as of promotion of organic products. It includes marketing experts in creating awareness of the importance of organic food among the general public.</td>
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http://www.casi2020.eu/casipedia/cases/942

http://www.casi2020.eu/casipedia/cases/1046

http://www.casi2020.eu/casipedia/cases/1093
2.1.5.3. **Featured study**

<table>
<thead>
<tr>
<th>Transition now</th>
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<tbody>
<tr>
<td><strong>CASIPEDIA URL</strong> <a href="http://www.casi2020.eu/casipedia/cases/1114">http://www.casi2020.eu/casipedia/cases/1114</a></td>
</tr>
<tr>
<td><strong>SI Description</strong></td>
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<tr>
<td>On 23 February 2013 the Danish green think tank CONCITO and the newspaper <em>Dagbladet Information</em> hosted a seminar for 50 young people interested in the numerous challenges that surround our society today: climate change, resource depletion, environmental degradation, financial crisis, economic crisis, unemployment and social unrest. During the seminar, participants had the chance to analyse the situation in depth and to come up with creative, innovative, pragmatic and radical ideas. They continued their cooperation after the seminar and established Transition Now, which today is an independent entity. Transition Now (Omdstilling Nu) is a network and a project platform that works to create a transition to a sustainable future society. This requires action, innovation and not least a common effort from both politicians and citizens. The network aims to provide the opportunity for open interdisciplinary dialogue related to new sustainable solutions. It includes activities such as large-scale seminars, monthly debate cafes and guidelines for citizens, all focused on how to move towards a sustainable society.</td>
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<tr>
<td><strong>SI Lead organisation</strong></td>
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<tr>
<td>Omstilling Nu/Transition Now</td>
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<tr>
<td><strong>SI Objectives</strong></td>
</tr>
<tr>
<td>• Create a transition to a sustainable future society</td>
</tr>
<tr>
<td>• Provide a platform for dialogue between citizens, professionals, academia and politicians</td>
</tr>
<tr>
<td><strong>Critical issues</strong></td>
</tr>
<tr>
<td><strong>Financial resources:</strong> As Transition Now is an NGO, it does not receive any financial support from the government, and does not have any financial sponsors. It gets support for office facilities, but it also needs money for flyers, campaigns, etc. Growth will be difficult! It can involve new volunteers, but if it cannot find financial support it will be hard to run new campaigns or host events.</td>
</tr>
<tr>
<td><strong>Important actors:</strong> The Danish government is aiming to make the transition to a society without fossil fuels in 2050. It is beneficial for Transition Now to work together with the government and not against it.</td>
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<tr>
<td><strong>Pass on the know-how:</strong> There are 20-30 core members who have been in Transition Now since the beginning. Early on working for many hours was not an issue as the network members were studying and didn’t have other jobs. However, currently many of them have work and children, and therefore they find it difficult to find the time and energy for voluntary work. If the network is to thrive in the future, it is important to transfer all the know-how to its new members.</td>
</tr>
</tbody>
</table>
2.1.6. **Climate action eco-innovation policies**

2.1.6.1. **Description**

A resource-efficient and climate change-resilient economy must be underpinned by a consistent set of eco-innovation indicators. These indicators are useful for assessing the relevance and effectiveness of sustainability-related policies while taking into account geographical, spatial and economic specificities. In parallel, other supporting and measuring instruments need be explored so as to facilitate a more fluent and comprehensible transition to a European green economy.

2.1.6.2. **Examples**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th><a href="http://www.casi2020.eu/casipedia/cases/1102">Link</a></th>
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<tbody>
<tr>
<td>Brownfieldconvenanten</td>
<td>Brownfieldconvenanten is a policy programme launched by the Flemish Government in 2007, in which private and government actors sign a contract to redevelop contaminated and/or deserted land previously used for industrial purpose. Private and public actors cooperate to ease the pressure on green fields, and to provide new space for economic activity, recreation, housing, etc.</td>
<td><img src="http://www.casi2020.eu/casipedia/cases/1102" alt="Brownfieldconvenanten" /></td>
</tr>
<tr>
<td>Compte Epargne CO2</td>
<td>The firm 450 wants to encourage citizens to reduce their CO2 emissions. The firm created the Compte Epargne CO2, a CO2 savings account. Members can upload their housing and vehicle energy consumption factures online, and the platform calculates their CO2 savings compared to reference emissions. The CO2 savings are accounted as kilograms of CO2 on members’ savings accounts and allow them to buy products or services from partner companies. The reference kilograms of CO2 are those defined in the Kyoto protocol. The Compte Epargne CO2 is a project approved by the UNFCCC’s Clean Development mechanism and by the French authorities.</td>
<td><img src="http://www.casi2020.eu/casipedia/cases/783" alt="Compte Epargne CO2" /></td>
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<tr>
<td>Prediwaste</td>
<td>PREDIWASTE is a software system enabling the collection and management of local authorities’ waste data. PREDIWASTE models waste deposits using statistical tools and specific data. PREDIWASTE is able to model the impacts of awareness campaigns to reduce waste and to analyse households’ behaviour. The software system also calculates in real time the volume and type of waste generated. Moreover, PREDIWASTE follows up the updating of environmental waste indicators and permits the management activities of waste treatment plants and waste collecting.</td>
<td><img src="http://www.casi2020.eu/casipedia/cases/784" alt="Prediwaste" /></td>
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</table>
### 2.1.6.3. **Featured study**

#### Environmental Policy Support Tool for Recycling on Islands (REPT)

<table>
<thead>
<tr>
<th>CASIPEDIA URL</th>
<th><a href="http://www.casi2020.eu/casipedia/cases/871">http://www.casi2020.eu/casipedia/cases/871</a></th>
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<tbody>
<tr>
<td><strong>SI Description</strong></td>
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<tr>
<td>The project’s aim is the development of a decision support tool that will allow island-based national authorities and other involved stakeholders to calculate the environmental benefit and financial cost of alternative means of waste management, especially focusing on packaging waste (paper, glass, plastic and metals) and waste from electrical or electronic equipment (cooling equipment, CRT screens and fluorescent lamps). The projects’ beneficiaries are the Ministry of the Interior (coordinating beneficiary), Nicolaides and Associates Ltd, the University of Cyprus, Green Dot Cyprus, Hellenic Recovery-Recycling Corporation SA, Green-Pak and Eco-emballages.</td>
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<tr>
<td><strong>SI Lead organisation</strong></td>
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<tr>
<td>Ministry of Interior of Cyprus</td>
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<tr>
<td><strong>SI Objectives</strong></td>
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<tr>
<td>• Develop a decision support tool that will allow national authorities and other involved stakeholders to calculate the environmental benefit and financial cost of alternative means of waste management, especially focusing on packaging waste (paper, glass, plastic and metals) and waste from electrical or electronic equipment (cooling equipment, CRT screens and fluorescent lamps)</td>
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<tr>
<td>• Cooperate with other countries which have the same problems</td>
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<tr>
<td>• Improve recycling legislation</td>
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<tr>
<td><strong>Critical issues</strong></td>
<td></td>
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<tr>
<td><strong>Avoidance of fines and penalties</strong>: Operation of processes in an environmentally friendly way and improvement of their environmental performance/harmonisation with the relevant EC Directives’ targets and priorities in the field of PPW and WEEE management and recycling in islands. Avoidance of imputing of fines and penalties by the competent authorities for inappropriate waste management and for non-compliance with the targets of the directives</td>
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</tr>
<tr>
<td><strong>Data analysis</strong>: The analysis and processing of data in order to produce comparable data in each participating country proved to be a slow process because of the many different methods used by four countries for acquiring and presenting the data. A great deal of conversions between parameters such as distance, weight, cost, etc. were carried out in order to produce data and parameters comparable among countries.</td>
<td></td>
</tr>
<tr>
<td><strong>Energy savings</strong>: Significant emissions reductions, energy savings and additional environmental benefits will be achieved through the long-term implementation of Best Available Techniques and identification of the most environmentally friendly scenarios. These include transport and export/transhipment expenses and emissions, the expense of establishing sorting facilities on the islands in combination with their total consumed energy and emissions produced, the associated emissions and expenses relating to collection of materials and the examination of options relating to the direct re-use of the recovered materials, their sale and their recycling.</td>
<td></td>
</tr>
</tbody>
</table>
2.2. **H2020 Priority Area 2: Environment**

2.2.1. **Biodiversity examination and understanding**

2.2.1.1. **Description**

Analysing, evaluating, monitoring and predicting the consequences that human activities have on water, air, biomass, soils, biodiversity and ecosystems are key tasks in terms of environmental sustainability. This requires studying how biodiversity and ecosystems perform and react to these activities, how they can be protected and recovered, and what implications they have for the economy and human welfare.

2.2.1.2. **Examples**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving the conservation status of fauna species in Cyprus: from micro-habitat restoration to landscape connectivity</td>
<td>ICOSTACY takes place in 14 Natura 2000 sites in Cyprus and the project aims to improve the conservation status of 20 selected fauna species and their habitats. This will be achieved through the implementation of concrete conservation actions, which include the protection, restoration and creation of new micro-habitats for the targeted species. Furthermore, the project will examine the consequences which may result from climate change in the next 100 year in those sites. The Department of Environment (Ministry of Agriculture, Environment and Natural Resources of Cyprus) is the Coordinating Beneficiary of the project. Associated beneficiaries are the Forestry Department and the Department of Fisheries and Marine Research, both under the previously mentioned Ministry, the National History Museum of the University of Crete, and the OIKOS Ltd and ATEPE-Ecosystem Management Ltd companies. <a href="http://www.casi2020.eu/casipedia/cases/864">http://www.casi2020.eu/casipedia/cases/864</a></td>
</tr>
<tr>
<td>Sustainable Forestry Inventory System (SMSIS)</td>
<td>Estonia has over 2 million hectares of forestland. The national forest inventories data collection and processing systems, while the collection of information on several indicators of sustainable forest management is based on the State Register of Forest Resources, which has been elaborated by the new information system of the management of state forests based on its accounting system and a GIS-based database of forest resources. SMSIS covers all land-use classes, including all forests and other wooded lands in all ownership groups, including protected forests. SMSIS enables the systematic monitoring and evaluation of the sustainability and legality of actions by forest owners and monitors the forests’ conditions. It supports the use of forestry info by different administrations, ensuring the necessary real-time information for decision making. <a href="http://www.casi2020.eu/casipedia/cases/889">http://www.casi2020.eu/casipedia/cases/889</a></td>
</tr>
<tr>
<td>BIOforLIFE: Cyprus Biodiversity</td>
<td>The scope of the BIOforLIFE project is the development of a communications campaign with the aim of raising public awareness on the subject of biodiversity. The Department of Environment (Ministry of Agriculture, Environment and Natural Resources of Cyprus) is the Coordinating Beneficiary of the project. Associated beneficiaries are the Dias Media Group, Terra Cypria, Sigma TV and GrantXpert. Moreover PREDIWASTE (see example 2.1.6.2) provides follow-up by updating environmental waste indicators and permitting the management activities of waste treatment plants and waste collecting. <a href="http://www.casi2020.eu/casipedia/cases/870">http://www.casi2020.eu/casipedia/cases/870</a></td>
</tr>
</tbody>
</table>
### 2.2.1.3. Featured study

**Arche Noah - diversity of cultural plants**

<table>
<thead>
<tr>
<th>CASIPEDIA URL</th>
<th><a href="http://www.casi2020.eu/casipedia/cases/768">http://www.casi2020.eu/casipedia/cases/768</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>Innovation Type</td>
<td>Service</td>
</tr>
<tr>
<td><strong>SI Description</strong></td>
<td></td>
</tr>
<tr>
<td>ARCHE NOAH was established in 1990 on the initiative of heirloom gardeners, farmers and journalists concerned about the future of seeds and heirloom plant varieties. For over 100 years the diversity of our cultural plants has dramatically decreased all over the globe, as a result of the industrialisation of agriculture – more than 75% are already lost. Today, genetic engineering and various seed monopolies, climate change and war are threatening this precious heritage. ARCHE NOAH responds to the loss of agro-biodiversity with a positive vision and numerous activities. We can all contribute to more diversity through cultivation of threatened varieties in our gardens, through shopping awareness and political action.</td>
<td></td>
</tr>
<tr>
<td><strong>SI Lead organisation</strong></td>
<td></td>
</tr>
<tr>
<td>Arche Noah</td>
<td></td>
</tr>
<tr>
<td><strong>SI Objectives</strong></td>
<td></td>
</tr>
<tr>
<td>• Improve societal framework to protect the variety of cultivated plants and their sustainable use</td>
<td></td>
</tr>
<tr>
<td>• Build awareness of producers, consumers and decision-makers in politics and economy</td>
<td></td>
</tr>
<tr>
<td>• Collect and share knowledge regarding cultivation, use and reproduction of endangered cultivated plants</td>
<td></td>
</tr>
<tr>
<td>• Protect endangered cultivated plants and make them available</td>
<td></td>
</tr>
<tr>
<td>• Conservation through utilisation, based on the principle that humans and cultivated plants are indivisible</td>
<td></td>
</tr>
<tr>
<td><strong>Critical issues</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Preservation of knowledge regarding biodiversity</strong>: There was already serious time pressure to invest efforts into the preservation of crop diversity before knowledge is lost. The benefit is a systematic documentation of crop diversity for future generations.</td>
<td></td>
</tr>
<tr>
<td><strong>Trends towards healthy/ethical food and a gardening renaissance</strong>: The trend for healthy and ethically produced food and the trend towards a renaissance in gardening are widespread phenomena which will continue in the future. In a time where work-life balance is high on the agenda, gardening makes a valuable contribution to recreation.</td>
<td></td>
</tr>
<tr>
<td><strong>Legal framework</strong>: The legal framework on plant propagation material (current legislation and ongoing revision) has a negative impact on stakeholders with regard to activities aiming at new products and markets based on crop diversity.</td>
<td></td>
</tr>
</tbody>
</table>
2.2.2. ICT mapping natural resources and trends

2.2.2.1. Description

Addressing natural resources challenges involves the study of high volumes of data in the long term. Comprehensive and reliable information and communication systems are necessary to monitor, evaluate and estimate trends in natural resources availability and the effectiveness of natural resources-oriented policies. These systems will draw on space technologies, networks, remotely operated sensors, mobile solutions, and web services, among other tools. The access to information should be free, and information unrestricted. Related research results should also subject to adequate and secure storage and management.

2.2.2.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cybercartography</td>
<td>Cybercartography is the organisation, presentation, analysis and communication of spatially referenced information on a wide variety of topics of interest and use to society in an interactive, dynamic, multimedia, multisensory and multidisciplinary format. Cybercartography offers a new method of design, production, dissemination and use of online maps. It is used to preserve and share indigenous knowledge by providing location-specific cultural information and interactive tools. One example is the Inuit Sea Ice Use and Occupancy Project (ISIUOP), which investigates the importance, uses and knowledge of sea ice from the perspective of northern communities.</td>
</tr>
<tr>
<td><a href="http://www.casi2020.eu/casipedia/cases/1249">http://www.casi2020.eu/casipedia/cases/1249</a></td>
<td></td>
</tr>
<tr>
<td>Vital Fields farm management app</td>
<td>Vital Fields offers web and mobile apps for farm management, and accurate weather and plant disease forecasting. It is essentially a cloud-based agricultural early-warning system that helps farmers to carry out plant disease and growth phase modelling, tracking climatic patterns and other farm management-related activities (farm planning, stock management and P&amp;L reports). It allows farmers to plan fieldwork effectively based on a specialised weather forecast that enables greater operational efficiency, to fill in an e-fieldbook that stores data and is also accessible on phones, to get info about crop production while forecasting plant diseases, tracking crop phases and the cost of inputs, and to access personal weather forecasts, harvest readiness forecasts and plant disease forecasts, etc.</td>
</tr>
<tr>
<td><a href="http://www.casi2020.eu/casipedia/cases/1023">http://www.casi2020.eu/casipedia/cases/1023</a></td>
<td></td>
</tr>
<tr>
<td>Let’s Do It!</td>
<td>Let’s Do It! is a civic-led movement for cleaning the environment of illegally dumped waste in just one day by mobilising volunteers, engaging stakeholders from all sectors and using modern ICT tools to map waste and spread awareness. It was born in 2008 in Estonia when 50,000 people came together to get rid of 10,000 tons of illegal garbage from roadsides, forests and towns, cleaning the entire country in five hours. The success of this model inspired other countries to follow suit and, in 2012, the movement initiated the World Cleanup campaign to spread the social innovation worldwide. Let’s Do It! can now be considered one of the biggest and fastest-growing civic movements in the world, engaging 112 countries and more than 11 million volunteers.</td>
</tr>
<tr>
<td><a href="http://www.casi2020.eu/casipedia/cases/1011">http://www.casi2020.eu/casipedia/cases/1011</a></td>
<td></td>
</tr>
</tbody>
</table>
2.2.2.3. **Featured study**

**Co-creation practices in ENMAK 2030+ Estonian Energy Sector Development Plan**

<table>
<thead>
<tr>
<th>CASIPEDIA URL</th>
<th>Innovation Type</th>
<th>Governance</th>
</tr>
</thead>
</table>

**SI Description**

ENMAK 2030+ (the Estonian National Development Plan of the Energy Sector until 2030) is a development plan for long-term energy management with the objective of providing consumers with a stable, accessible and reasonably priced energy supply that has a minimal environmental impact and is in line with the EU’s long-term energy and climate strategies. To choose the optimal energy supply scenario, a Wiki environment was set up in order to describe the ENMAK 2030+ work process and involve as many interested stakeholders as possible. It is essentially a cooperative platform for compiling and renewing energy sector strategies.

**SI Lead organisation**

Ministry of Economic Affairs and Communications of Estonia

**SI Objectives**

- Build cooperation platform for creating, renewing and implementing energy management strategic plans
- Choose the optimal energy supply scenario which is reasonably priced, easily available, has a reduced environmental impact and is in line with the EU’s long-term energy and climate policy objectives
- Produce electricity without subsidies
- Reduce the number of strategic plans in Estonia in order to increase the significance of the development plans compiled in energiatalgud.ee
- Promote causes that improve the environment and competitiveness of through resource management
- Provide a tool for government bodies to communicate with experts in the energy field
- Provide an opportunity for stakeholders to participate in the formulation of energy policies
- Provide information on long-term energy-related objectives and the means for citizens and businesses

**Critical issues**

- **Underlying challenges in the energy sector:** The Government Office has acknowledged the need for a holistic and comprehensive energy development plan in order to tackle today’s complex energy challenges and provide consumers with an energy supply that is reasonably priced, available, accessible and environmentally sound. Besides reducing the administrative load, bringing all the energy-related sectors under one umbrella strategy also means greater compliance with the long-term energy and climate objectives of the EU.

- **Diversity of interest groups:** In the process of assessing the environmental impacts of various energy scenarios, many interest groups offered their input to making the ENMAK draft as comprehensive as possible. Proposals were taken into account in a balanced and reasoned manner. To ensure objectivity, all the respective indicators were quantified when assessing impacts, while qualitative assessments that reflected subjective interests were excluded.

- **Long-term visions:** ENMAK includes a long-term vision – up to 2050. This ensures that actions taken to achieve 2030 goals are part of a long-term national strategy. The 2050 vision includes development directions for making the economy more resource-efficient and competitive, joining the European frequency band, supporting the market entry of innovative solutions, ensuring the most affordable technical solutions to meet heating demand, producing heat mainly from local renewable sources, and achieving greater added value in fuel management.
2.2.3. Solutions for cultural heritage assets

2.2.3.1. Description

Sustainable innovation also implies the development of adaptation/mitigation solutions, strategies and technologies for the protection, conservation and management of cultural heritage under threat from the impacts of climate change.

2.2.3.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burren &amp; Cliffs of Moher Geopark</td>
<td>The Burren &amp; Cliffs of Moher Geopark project concerns an area of geological heritage and international importance. Geoparks are special regions with outstanding geology and local culture – regions that support sustainable development, research, education and cultural heritage by working closely with local communities and agencies. GeoparkLIFE within the Burren and Cliffs of Moher aim to strengthen the working partnership between local, national and international champions of conservation, tourism and the community to ensure increased benefits locally. The initiative works with community groups on a range of projects that are centred around education, heritage, conservation and access.</td>
</tr>
<tr>
<td>Electric city shuttles (CargoHopper)</td>
<td>CargoHopper is an innovative city distributions system that replaces large transport vehicles by small electric city transportation. It started in the city of Utrecht and is now spreading to other cities. These city shuttles are silent, electric-powered trains that include a zero emission electric vehicle followed by three mini trailers with loose interchangeable trailers that can carry containers the size of three euro pallets. Because of the standardised size of containers used in normal road transport, it is easy to transfer goods from a city distribution centre along the motorway outside the city to a transhipment point within the city centre. There the containers are put on mini trailers which glide into the city centre. No longer do half-empty trucks for one shopping chain have to drive from city to city; rather, more efficient streams of delivery goods can be combined. It saves time for the shops and distributors, and saves CO2 emissions. Congestion on the canal roads is also avoided.</td>
</tr>
<tr>
<td>ECOH2O- Ecological lagoon for water purge system</td>
<td>ECOH2O was the pilot project for a water purge in a small rural community. The pilot was developed in 2011 in Viscri village, Brasov county Romania. Following the good results of this service innovation, a regional project was promoted in several villages in Transylvania, in order to set up 10 lagoon based water purge systems, serving 8500 residents. The ecological system has low maintenance costs, compared with a more complex chemical system of water treatment and it uses bacteria in order to purify the waste water. The water is not recycled, but pollution is cast out and the sludge can be used in agriculture processes.</td>
</tr>
</tbody>
</table>

http://www.casi2020.eu/casipedia/cases/1147

http://www.casi2020.eu/casipedia/cases/805

http://www.casi2020.eu/casipedia/cases/998
2.2.3.3. **Featured study**

<table>
<thead>
<tr>
<th>Bussaco Digital</th>
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</thead>
<tbody>
<tr>
<td>CASIPEDIA URL</td>
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</tbody>
</table>

**SI Description**

The Bussaco National Forest (BNF) in Italy brings together an unpaired natural and cultural heritage. Its outstanding collection of notable ancient trees, as well as patches of old growth forest were severely damaged by a windstorm in 2013. The Bussaco Digital initiative, an environmental awareness project created by the Bussaco Forest Foundation and developed in partnership with the University of Aveiro, SAPO labs and supported by the PT Foundation, consists of a digital platform which seeks to foster social interaction, encouraging the community to participate in the reforestation of BNF. Any user, anywhere in the world, through a simple online registration, can plant new trees or dedicate a notable one to someone special, while contributing with a donation. The planted trees are located using GPS coordinates, making it possible for the user to follow their growth. The contributions made also allow for additional conservation actions and to raise awareness about sustainable forest management.

**SI Lead organisation**

Bussaco Forest Foundation, University of Aveiro, SAPO labs, PT Foundation

**SI Objectives**

- Contribute to the recovery of Bussaco National Forest, after the Gong windstorm (19-01-2013) destroyed a substantial number of trees
- Develop innovative digital-based ways to reach audiences as part of environmental education and education for sustainability
- Engage general local and distant publics with Bussaco’s unique natural and cultural heritage
- Promote public awareness of the importance of forests
- Stimulate the public feeling of belonging, connecting people, environment and local heritage
- Create a novel green business model
- Market and promote Bussaco National Forest as a tourist hotspot
- Promote the unique natural vales of Bussaco Natural Forest and include public participation in its management

**Critical issues**

- **Immediate recovery of Bussaco Forest with long-lasting engagement effect**: Benefits include the contribution to the recovery of Bussaco National Forest, after the destruction caused by Gong windstorm (2013), and the development of an innovative digital channel to reach audiences as part of environmental education and education for sustainability, thus promoting long-lasting engagement by the local public with Bussaco’s unique natural and cultural heritage.

- **Cultural issues**: Transmuting immaterial technological web-based components into the physical embodiment of the reforestation without being able to physically plant the tree, combined with a lagged response motivated by insufficient resources, may lead to a mistrust of the process.

- **Insufficient resources**: The material component of the project relies intensely on human resources to actually plant the trees. The attribution of tree to user depends on the quantity of trees the Foundation’s human resources are able to plant, map and register.
2.2.4. Strategic intelligence and citizens’ participation

2.2.4.1. Description

In order to anticipate future impacts and environmental vulnerabilities, sustainability policies require early warning, monitoring and forecasting systems. These systems are valuable instruments for informing and supporting policy makers, thus enhancing the effectiveness of evidence-based governance. Other benefits of participatory anticipation are policy consistency, an easier resolution of trade-offs, better management of conflicting interests, and the raising of public awareness about research results and citizens’ participation in policy formulation.

2.2.4.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participatory Budgeting</td>
<td>Participatory Budgeting (PB) is a mechanism of participatory democracy that allows citizens to decide on a portion of the municipal budget. In PB Cascais, the executive part of the budget highlights and invites all citizens to identify, discuss and prioritise projects for the region. Citizens can participate in the discussion stage, in the presentations of proposals and also in the voting phase of the finalists. Proposals may be submitted at the sessions of public participation organised throughout the county. Participation is done in sole proprietorship and aims to improve the quality of the community’s life. The proposals with the most votes will be evaluated by a technical team from the municipality and, after the validation, they open for voting. The chosen projects will be implemented by the municipality within two years. <a href="http://www.casi2020.eu/casipedia/cases/813">http://www.casi2020.eu/casipedia/cases/813</a></td>
</tr>
<tr>
<td>BINSE – Berchumer Initiative für solare Energien e.V.</td>
<td>BINSE is a local citizens’ initiative in the village of Berchum, near Hagen in North Rhine Westphalia, taking a stand for the expansion of renewable energies in the village. It provides an example of civil society being involved in the energy transition process. The stated aim of the association is the fostering of environmentally friendly energy production, the use of renewable fuels, and energy saving in general. Another goal is an information and consulting service for the villages’ citizens regarding an energy-sustainable lifestyle. Some current projects are: a solar education path and geo-caching; photovoltaics in one grammar school, two churches and one youth training centre; - thermic energy from wood pellets; vision 2050; solar premier league; and a wood pellet buying syndicate. <a href="http://www.casi2020.eu/casipedia/cases/1055">http://www.casi2020.eu/casipedia/cases/1055</a></td>
</tr>
<tr>
<td>Dorf ist Energie (klug) (Village is Energy(clever))</td>
<td>Dorf ist Energie( klug) is a project within the framework of the Regionale Südwestfalen, a structural development programme for the region of South Westphalia funded by the federal state of North Rhine Westphalia. Through the project, villages in the region of South Westphalia are supported in their efforts to improve the field of energy efficiency. Villages can apply with a concept, and the five best ideas are chosen by a jury, with the villages concerned receiving assistance for the realisation of their concepts. The other applicants receive consulting advice on maturing their ideas. The process is guided by the concrete question of how civic participation, rural development and energy transition can complement each other. As a result of the process a tool box with best practice examples for other villages will be created. <a href="http://www.casi2020.eu/casipedia/cases/1138">http://www.casi2020.eu/casipedia/cases/1138</a></td>
</tr>
</tbody>
</table>
### 2.2.4.3. Featured study

<table>
<thead>
<tr>
<th>Sustainable Energy Landscape</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CASIPEDIA URL</strong> <a href="http://www.casi2020.eu/casipedia/cases/905">http://www.casi2020.eu/casipedia/cases/905</a></td>
</tr>
</tbody>
</table>

**SI Description**

The rationale of the Armhoede sustainable energy landscape (ADEL) project is that the inhabitants own the project and the way it is shaped. It tries to assess the actual possibilities for the generation of renewable energy in a rural area such that sustainability, landscape development, a thriving agriculture and a good quality of life go hand in hand. In the Armhoede area around the former waste site Armhoede, there are 15 farms and 60 households. The ADEL interest group is investigating how, with today's knowledge, the area can (as far as possible) become climate neutral in 2030. The project is subsidised by the Innovation Programme for Climate Neutral Towns (IKS) and it had its official start on 11 November 2010, Sustainability Day. Using a baseline measurement, several themes have been defined (design of the landscape, energy, water and agricultural business enterprises). These themes have been formulated by groups of residents and businesses with the help of experts.

**SI Lead organisation**

Armhoede sustainable energy landscape (ADEL)

**SI Objectives**

- Generation of renewable energy such that sustainability, landscape development, a thriving agriculture and a good quality of life go hand in hand
- Make the area climate neutral in 2030 (no emissions of CO2 or other climate gases)
- Realise sustainable dairy farming that is financially profitable

**Critical issues**

- **Continuation of the process:** A process that depends strongly on the commitment of inhabitants of an area and their intensive efforts to come up with solutions and contribute to its implementation runs the risk of running late because of the time investment and energy required of the actors involved.

- **New role for the municipality:** Although the municipality itself has created the energetic society as a participatory policy concept, the municipal organisation itself is still struggling with its new role. Evaluation of the project, for example, shows that municipal procurement procedures work against initiatives because projects costing more than €15,000 should be applying competitive procurement procedures, even if the municipality only wants to use or thinks relevant one party.

- **Solving conflicts between different uses in an area:** Living, farming and nature are different interests in the area. This bottom-up process with broad consultation and the involvement of all the interests together with a broad research agenda contributes to solving conflicts between opposing interests.
2.3. **H2020 Priority Area 3: Resource efficiency**

2.3.1. **Solutions for water imbalances**

2.3.1.1. Description

Innovation for water sustainability encompasses appropriate strategies, tools and technologies that may improve water quality, cope with water needs and availability imbalances, close the water cycle and foster sustainable consumption. These solutions should also guarantee the integrity, consistency and functioning of aquatic ecosystems.

2.3.1.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>WMS1000</td>
<td>The WMS1000 wind turbine allows people living in remote areas to benefit from access to safe water for a period of 20 years. The device is capable of producing up to 1200 litres of water a day. The turbine is designed to produce water without any external power source. Wind is the only energy used. With an installed capacity of 30kW and using air as a source of water, the WMS1000 Wind Turbine is perfectly adapted to supplying remote areas completely devoid of any existing infrastructure.</td>
</tr>
<tr>
<td>INNERS - Innovative Energy Recovery Strategies in the Urban Water Cycle</td>
<td>INNERS is a project with the aim of rethinking the urban water cycle to optimise the energy balance of urban water systems. Specific focuses are assessing the energy balance of the urban water cycle, optimising thermal energy recovery technologies, developing new approaches to operational and chemical energy, and enabling implementation of innovative approaches. Within the project, CRP Henri Tudors team from the Resource Centre for Environmental Technologies (CRTE) will work together with the German water management association Wupperverband, the North Luxembourg wastewater syndicate SIDEN and the University of Luxembourg to develop a multi-criteria system for the real-time energy optimisation of wastewater treatment plants. Called the Energy Online Service Tool (EOS), it will provide continuous energy consumption data for WWTPs.</td>
</tr>
<tr>
<td>Box4Water</td>
<td>Box4Water is a complete water treatment system in one single 20-foot container, resulting in important space reductions when compared with conventional treatment systems. It can treat very dirty wastewater all the way up to drinking water quality. Box4Water uses the ExSep technology, a pre-treatment module developed by Epuramat, a Luxembourg-based company. The technology features high efficiency for solid and liquid separation processes, and relieves the cleaning processes of subsequent treatment stages. Box4Water requires low maintenance and is easy to operate. Other benefits include mobile installation via simple and secure transportation, and minimal running-in time. It can be used for many applications where fresh water is required quickly and easily, for residential and industrial wastewater (i.e. after natural or human-made disasters, at fairs and sport venues and on construction sites).</td>
</tr>
</tbody>
</table>

http://www.casi2020.eu/casipedia/cases/792

http://www.casi2020.eu/casipedia/cases/851

http://www.casi2020.eu/casipedia/cases/846
### Hydro Efficiency for Buildings and Public Spaces Project


<table>
<thead>
<tr>
<th>Innovation Type</th>
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</thead>
<tbody>
<tr>
<td>Service</td>
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</tbody>
</table>

#### SI Description

The Hydro Efficiency for Buildings and Public Spaces Project - The Way to Sustainable Water Management, approved by the Municipalities of the Baixo Vouga Region and the University of Aveiro, aims to develop and implement a simple model for Water Efficiency Rating (EH) which may be adopted in buildings and public spaces (EEP). It constitutes a new level of demand in water resources management in order to promote water efficiency in the commons and lay the groundwork for a more ambitious level of management between municipalities, starting a path that leads to the construction of a Model of Water Efficiency adjusted to the characteristics and specifics of each municipality, whether for buildings and their devices or for public spaces, using a model Hydropower Certification.

#### SI Lead organisation

Inter-municipal Community of the Aveiro Region in partnership with Aveiro University

#### SI Objectives

- Create a platform for sharing information between researchers and technicians, tailoring responses to the specificities of each municipality, also equipping users with the necessary tools to be able to contribute to a framework for supporting other municipal agents
- Demonstrate the benefits associated with small changes reflected in the sustainable use of water and in economic, social and environmental gains
- Promote a reduction of the flow of water circulation to allow a reduction of network maintenance and domestic wastewater costs, which will result in a reduction of monthly bills
- Promote the reduction of energy consumption and costs of water treatment
- Disseminate the results of this initiative by publishing indicators for output and efficiency of consumption, allowing these to serve as a justification for the adoption of the model by other municipalities
- Replicate the project in other cities of the country, especially in cities that suffer from water stress
- Raise awareness of industrial units producing devices to adapt their products to these solutions
- Raise awareness among local communities to the problem of climate change and sustainable use of water

#### Critical issues

**Better management of water resources:** This project achieves a new level of demand on water resources management, promoting water efficiency in public spaces and laying the groundwork for a more ambitious level of management at Inter, beginning a path leading to the construction of a Model of Efficient Use of Water

**Efficient use of a basic resource:** Need for the efficient use of water is a key driver of the conception and development of innovative solutions

**Public awareness:** There is a need to increase public awareness about water stress risks and the implications of proper water efficiency measurements that need to be implemented.
2.3.2. ICT systems improving resource efficiency

2.3.2.1. Description

Innovations in information and communication technologies are important to gain efficiency in productivity, notably through automated processes, real time monitoring and decision support systems, in order to foster resource efficiency.

2.3.2.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological innovation for urban waste management</td>
<td>This application of ICT to urban waste management and collection tries to reduce waste generation and promote waste recycling. It is based on the principle that those who contaminate must cooperate by making a stronger economic contribution.</td>
</tr>
<tr>
<td>Sustainability Observatory of South Metropolitan Area of Porto</td>
<td>The Sustainability Observatory is hosted in a web-based platform that covers the municipal services of the six municipalities associated with ENERGAIA (Espinho, Oliveira de Azeméis, Santa Maria da Feira, So Joao da Madeira, Vale de Cambra and Vila Nova de Gaia). It allows the monitoring and management of energy, equipment, public lighting networks and municipal fleets, among others, in real time, thereby facilitating their optimal use. The observatory was designed to receive information relating to any energy-using equipment (school, sports, cultural), lighting, water heaters, computers and electronic equipment and transport, vehicles, etc. It also enables the gathering of information on the various suppliers, on billing and consumption of electricity, natural gas, fuel, renewable energy and others.</td>
</tr>
<tr>
<td>Collection and Management of Energy from Renewable Energy Sources</td>
<td>The Intelligent Power Manager (IPM) is an inverter that provides the user with the capability to harvest energy from the sun and the wind, and, in turn, to utilise this energy in a way that is best suited to the user’s needs and environment. IPM is a programmable device that can be employed as a UPS or a simple APU. In this case, it can be programmed to consume energy from renewable sources, from the grid, or from a genset. It can also be programmed to feed energy into the grid with or without limit.</td>
</tr>
</tbody>
</table>

http://www.casi2020.eu/casipedia/cases/1323

http://www.casi2020.eu/casipedia/cases/1274

http://www.casi2020.eu/casipedia/cases/892
### 2.3.2.3. Featured study

**ELSYS - electronic system for international transfer of waste**

<table>
<thead>
<tr>
<th>CASIPEDIA URL</th>
<th>Innovation Type</th>
<th>System</th>
</tr>
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</table>

**SI Description**

This innovative electronic system was designed in order to support the exchange of data and information and to monitor the international transfer of waste. The system has similar objectives to the existing systems EUDIN (BENELUX and Austria) and TFS (Scandinavian countries). Waste operators and companies can apply and receive permission from the authorities for international transfer of waste using the electronic platform. The GIS system allows authorities to visualise the proposed route chosen by the economic agent, and to change it if there are sound reasons for doing so. The Environmental Minister has proposed extending ELSYS as a regional integrated system to its neighbours Bulgaria and Hungary.

**SI Lead organisation**

The Ministry of Environment, Waters and Forests of Romania

**SI Objectives**

- Create a database and a functional platform for waste operators and economic agents
- Establish monitoring procedures for waste
- Implement an innovative electronic system that monitors the international transit of waste
- Offer technical support for authorities
- Simplify procedures of the international transport of waste
- Inter-connect with other EU waste monitoring systems

**Critical issues**

- **Monetising waste:** The existing system is not efficient in identifying total amounts of transferred wastes. Many amounts are either not registered or lost in the paper flow. The new system could determine an impulse for developing new businesses, waste flows and resource efficiency.

- **Connectivity:** The system is based on GIS but there are many places in Romania where geography and satellite coverage limits cause connectivity breakdowns.

- **Political changes:** The frequent changes in the ministerial structure and political views are a risk for the implementation of the system, since there are still many steps required in order to get the system functional. The complexity of this kind of system could induce errors.
2.3.3. **Resource-efficient sustainable lifestyles**

### 2.3.3.1. Description

The purpose of this priority is to identify and overcome the main obstacles to a societal and market change that would empower SI stakeholders to adopt sustainable behaviour. Social sciences and humanities research is crucial to achieve this objective. Models and schemes need to be developed so as to analyse those necessary economic, societal, cultural and institutional changes to create/reinforce a new paradigm oriented to a green economy. Some initiatives are the promotion of sustainable lifestyles and consumption patterns, enhancement of socioeconomic research, development of behavioural science, encouragement of user engagement and public acceptance of innovation, and improvement of communication and public awareness.

### 2.3.3.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>De Wakkere Akker</td>
<td>De Wakkere Akker is a Community-supported agriculture (CSA) farm, located in Herent (near the city of Leuven). CSA is based on the following pillars: social, honest, ecological, healthy, educational and economic. Citizens from the neighbourhood can become a member by paying €250/year. This amount equates to a ‘harvest share’. Members are invited to help with farming during specific work days throughout the year, but it is not obligatory for members to farm. Members can come to the farm on Saturdays to receive their share of the harvest.</td>
</tr>
<tr>
<td></td>
<td><img src="http://www.casi2020.eu/casipedia/cases/1126" alt="De Wakkere Akker" /></td>
</tr>
<tr>
<td>Gent in Transitie</td>
<td>‘Gent in Transitie’ is one of the outputs of the research programme on Transitions towards Sustainable Development, funded by the Flemish government. The output is a website that demonstrates sustainable types of urban development. In total, the website demonstrates and explains 88 projects situated in Ghent. All the projects aim to contribute to a society that is just and climate-friendly, in other words, to projects that contribute to a place where citizens like to live.</td>
</tr>
<tr>
<td></td>
<td><img src="http://www.casi2020.eu/casipedia/cases/1109" alt="Gent in Transitie" /></td>
</tr>
<tr>
<td>Sustainable Citizenship</td>
<td>The Sustainable Citizenship project aims to encourage, test and support people’s ideas for making Peterborough a more sustainable place to live – particularly those that would make green behaviour easier in the city. By convening a series of competitive processes, including workshops to help people develop their ideas, and pitching events to allow groups to apply for small grants, it has funded over 10 green initiatives. It is also working with Peterborough Environment City Trust (PECT) to further strengthen the network of environmentally-minded individuals and community groups in Peterborough through events and online platforms. The project is one strand of the Royal Society for the Arts’ (RSA) Citizen Power programme in the city, a strategic partnership between Peterborough City Council, the Arts Council and the RSA to explore and revive notions of place and identity at a local level and investigate ways of strengthening civic society in Peterborough.</td>
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<td></td>
<td><img src="http://www.casi2020.eu/casipedia/cases/1367" alt="Sustainable Citizenship" /></td>
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</table>
### Actyva


**Innovation Type** Service

<table>
<thead>
<tr>
<th>SI Description</th>
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<tbody>
<tr>
<td>Actyva is an innovative multi-stakeholder agricultural cooperative (this legal model in Spain is termed an integral cooperative) that aims to achieve a model of local sustainable agriculture that follows agro-ecological and food sovereignty principles, based on mutual aid and networking, and aims for social, economic and environmental sustainability. As opposed to conventional agricultural cooperatives that only have one type of members - farmers - Actyva is an integral cooperative that not only involves different types of member (producers, consumers and workers) but also different co-operativised activities. One of Actyva’s first initiatives, still ongoing, is Big Brother Bio-Farming (BBBF). BBBF, the big brother of organic farms, is an online platform that facilitates and encourages small organic producers to live-stream activities happening on their farms as well as providing online courses and spaces for consumers and producers to create and develop regular contact.</td>
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<tr>
<th>SI Lead organisation</th>
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<tr>
<td>ACTYVA S. Coop.</td>
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<tr>
<th>SI Objectives</th>
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</thead>
<tbody>
<tr>
<td>• Keep agro-ecological production local, only exporting surpluses to Europe of products whose markets are saturated in Spain. This is a key objective, given that most organic production in Spain is exported</td>
</tr>
<tr>
<td>• Create links among long-standing food producers and neo-rurals, thus fostering new entries into farming, much needed in the EU as the farming population is both ageing and decreasing</td>
</tr>
<tr>
<td>• Follow a two-fold approach to sustainability: first to minimise and then to internalise the normally non-accounted externalities of food production through their growing methods, governance and close connections with their buyers and locality</td>
</tr>
<tr>
<td>• Foster small-scale production and create links between growers and local communities (rural and urban)</td>
</tr>
<tr>
<td>• Promote agro-ecological production approaches and training, responsible consumption, protection of rural livelihoods, food sovereignty and social transformation</td>
</tr>
<tr>
<td>• Encourage actively unemployed workers to become entrepreneurial</td>
</tr>
<tr>
<td>• Promote and facilitate a do-it-yourself culture that enhances self-sufficiency</td>
</tr>
<tr>
<td>• Restore a model of social economy in the community to increase resilience</td>
</tr>
</tbody>
</table>

**Critical issues**

- **Food re-localisation**: There is a market trend for food re-localisation that aims to revive local food traditions and food consumption in an attempt to both reduce food miles and protect rural livelihoods and culinary cultures.

- **ICT tool development**: No adapted tools for this kind of multi-stakeholder organisation exist, which places a burden on this type of initiative as it increases the level of resources needed for legal and management processes.

- **Unable to meet demand**: A potential risk could arise through an inability to meet the needs of members, which could happen in two ways: unmet needs of farmer members (unable to find a market for all their produce) or unmet needs of member consumers if this latter type of membership was to grow too fast and request local organic food from farmer members unable to meet demand.
2.3.4. **Eco-innovation and green economy transition**

2.3.4.1. **Description**

The path towards a green economy demands the use of new indicators and methods. Its utilisation can actually reinforce the effectiveness of the policies implemented, and support more efficient socio-economic research. This will also facilitate a better understanding of producers and consumers’ behaviour. Methods can include integrated modelling and technology assessment.

2.3.4.2. **Examples**

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Mill</td>
<td>Urban Mill is an emerging, global thematic focal point for Urban Innovations. It is a physical and social Knowledge Triangle test-bed focused on bringing together research and innovation actors in built environment development, ubiquitous and responsive City ICT, urban services and urban life transformation. <a href="http://www.casi2020.eu/casipedia/cases/1131">http://www.casi2020.eu/casipedia/cases/1131</a></td>
</tr>
<tr>
<td>LundaMaTs - A strategy for sustainable transportation system in Lund municipality</td>
<td>LundaMaTs is a strategy for a sustainable transportation system in Lund municipality up to 2030, which has been in place since 1999 and been constantly updated and improved to address the main challenges of the transportation system. The latest version, LundaMaTs III, recognises the reduction of greenhouse gases, urban expansion and a more sustainable transportation system as key challenges for the transportation system in the city. LundaMaTs structures its work in six focus areas, including village development, living city centre, commercial transport, regional commuting, growing Lund and innovative Lund. Each area includes examples of specific measures. Key results of LundaMaTs include a reduction in car traffic by 2% in Lund between 2001 and 2010, an increase in bicycle and pedestrian traffic and public transport, and a significant reduction in GHG emissions, other transport related emissions, noise, and injuries and deaths in traffic accidents. Within Lund City 43% of all trips are made by bike. <a href="http://www.casi2020.eu/casipedia/cases/754">http://www.casi2020.eu/casipedia/cases/754</a></td>
</tr>
<tr>
<td>ČEZ Group Smart Region Project</td>
<td>In 2010, the Czech company ČEZ a.s. cooperated with the town of Vrchlabi in order to launch a unique Smart Region project. Until 2015, 4.5 thousand households and enterprises were equipped with smart energy meters, infrastructure for electro-mobility and some elements of the automation and monitoring distribution network. Through the installation of smart meters ČEZ a.s. is testing a new concept of management of consumption and production of electricity. Additionally, through the installation of elements of automation and monitoring of a distribution network at the level of networks of low and high voltage and distributing stations, energy flow can be redirected during blackouts. Several charging stations and electric vehicles were provided as part of the electro-mobile infrastructure development. <a href="http://www.casi2020.eu/casipedia/cases/1234">http://www.casi2020.eu/casipedia/cases/1234</a></td>
</tr>
</tbody>
</table>
2.3.4.3. **Featured study**

**BIOVALUE SPIR**


**Innovation Type**

Product/process

**SI Description**

BIOVALUE SPIR has a vision to create a bio-based society, where biomass is substituted for fossil fuel products. In this field, the project wants to play a leading role at the global level. To achieve this, a strategic platform between universities, big companies and existing GTS and innovation networks has been established. Together they want to develop new sustainable technologies so as to upgrade plant material into internationally competitive products, which can replace existing fossil fuel-based products. BIOVALUE SPIR consists of six projects where working groups are trying to develop new solutions with biomass, protein, sugar, lysine, catalysis and lignin. Furthermore, it has a Socioeconomic and Sustainable Platform and an SME platform. The two platforms work across the six projects and are intended to assess results and decide whether they are sustainable. The SME Platform aims to increase small companies’ involvement.

**SI Lead organisation**

University of Copenhagen, SCIENCE, Department of Plant and Environmental Sciences

**SI Objectives**

- Create a decentralised/robust/optimised pre-treatment process for green biomass for the production of animal protein feed and a storable fibre as substrate in centralised bio-refineries
- Develop new catalytic processes for the chemical conversion of carbohydrate streams into value-added products including methyl lactate. Develop new catalytic materials for catalytic conversion of sugars.
- Upgrade sugar streams from biomass, partly by testing different pre-treatments and investigating how these can be optimised to support the physical separation of sugars from lignin - to improve the purity of the sugar streams and obtain lignin with improved properties for bio-refining
- Develop and comparatively evaluate new methods for conversion of lignin into value-added products such as phenols and functional binders
- Link the results from the research and innovation activities of BIO-VALUE into a production/value chain context in order to assess the system-wide sustainability of biomass production and bio-based products in terms of their economic impacts, environmental effects and ethical aspects.

**Critical issues**

- **A long start-up phase:** The start-up and coordination of this project has taken a long time, because of the many different interests involved. It was important that the project be carried out in cooperation with private companies.
- **A potential new market thanks to huge imports of protein:** Most of the corn produced in Denmark is used to feed animals, but there is not enough protein in corn, so protein from soybeans is imported from South America. There is a huge potential in this green biomass to produce protein. It is more effective than corn production and its production is better for the environment because there is not the same demand for nitrate.
- **Different Standards:** There are many different standards that a product has to meet to be sold in Denmark. Companies may have problems when developing brand new biomaterials.
2.4. H2020 Priority Area 4: Raw materials

2.4.1. Long-term availability of raw materials

2.4.1.1. Description

To formulate raw materials-related policies, Europe needs to estimate and evaluate the availability of global and EU resources in the long term. This assessment would include, for example, studies on the evolution of landfill sites, on mining, and on coastal-sea and deep-sea resources (sea-bed mining of rare minerals).

2.4.1.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>National Industrial Symbiosis Programme (NISP) UK</td>
<td>NISP has been operating in the UK since 2003, and is the world’s first National Industrial Symbiosis Programme. Recent changes in government spending have meant we have had to change the way NISP works. NISP today provides a platform to INSPIRE businesses to implement resource optimisation and efficiency practices, keeping materials and other resources in productive use for longer through industrial symbiosis. The European Commission’s Roadmap to a Resource Efficient Europe states: ‘A number of schemes show the benefits of increased information flows, and the payback from providing advice or bringing firms together in National Industrial Symbiosis Platforms’. Based on the performance of the UK NISP, improving the re-use of raw materials through greater industrial symbiosis across the EU could save €1.4bn a year and generate €1.6bn in sales.</td>
</tr>
<tr>
<td>Carbon Calculations over the Life Cycle of Industrial Activities (CCaLC)</td>
<td>CCaLC is an environmental sustainability project launched by researchers at the University of Manchester. The main aim of the project was to develop a life-cycle methodology and decision-support instrument for calculating and reducing the carbon footprint of different industrial sectors along complete supply chains. The CCaLC team have developed a number of tools, which are available to download for free. The CCaLC team also offer training courses aimed at understanding the practice of carbon footprinting.</td>
</tr>
<tr>
<td>LiDAR</td>
<td>LiDAR is a technology that uses laser radars to detail the amount of carbon stored in Ireland’s hedgerows. This technology has been used to scan a hedge, picking out its detailed structure and providing a precise image of the plants that make up the hedge. This detail is then processed to estimate the amount of carbon contained in the hedgerows. The aim is to determine the contribution that hedgerows and smaller wooded areas of Ireland make in storing carbon.</td>
</tr>
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http://www.casi2020.eu/casipedia/cases/1231
http://www.casi2020.eu/casipedia/cases/1193
http://www.casi2020.eu/casipedia/cases/1125
2.4.1.3. **Featured study**

### Promotional Forest Complex

<table>
<thead>
<tr>
<th>CASIPEDIA URL</th>
<th><a href="http://www.casi2020.eu/casipedia/cases/1330">http://www.casi2020.eu/casipedia/cases/1330</a></th>
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<tbody>
<tr>
<td><strong>Innovation Type</strong></td>
<td>System</td>
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</table>

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<thead>
<tr>
<th><strong>SI Description</strong></th>
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<tbody>
<tr>
<td>The Promotional Forest Complex (PFC; Lesne Kompleksy Promocyjne in Polish) is a pro-ecological pilot project managed by the State Forests National Forest Holding. They are forestry zones scattered all over Poland which are open to tourists. These zones combine several functions: sustainable management of raw materials, research and development activities, education and recreation. The Promotional Forest Complex shows that production of raw materials, research and entertainment can be balanced. It should be stated that Poland is one of the most important exporters of wood and at the same time forested areas in Poland are systematically increasing. PFCs are accompanied by other initiatives focused on an active and sustainable life style. Currently (October 2014) there are 25 zones defined as Promotional Forest Complexes, occupying an area of 1 222 537 ha.</td>
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<tr>
<th><strong>SI Lead organisation</strong></th>
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<tbody>
<tr>
<td>The State Forests National Forest Holding</td>
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<table>
<thead>
<tr>
<th><strong>SI Objectives</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Support wood industry policies</td>
</tr>
<tr>
<td>• Preservation of forest and biodiversity</td>
</tr>
<tr>
<td>• Raise citizens’ ecological awareness</td>
</tr>
<tr>
<td>• Combine strategies of research and development, health policy and strategy for wood industry in a sustainable manner</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Critical issues</strong></th>
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<tbody>
<tr>
<td><strong>Preservation of Forests</strong>: PFCs were created as a result of international agreements related to the Declaration of European Forestry Ministers with regard to the protection of European forests (Strasbourg 1990, Helsinki 1993, Lisbon 1998, Vienna 2003, Warsaw 2007, Oslo 2011); and to the Kyoto Protocol of 1997 concerning the role of forests in carbon sequestration.</td>
</tr>
<tr>
<td><strong>Sustainable use of forest areas and forest resources</strong>: The scheme enables forest users to gain benefits from using the same area of forest. In the FPCs researchers conduct their experiments and observations, sawmills are logging and ordinary families are using their free time to rest and spend time in a healthy environment. Unlike national parks access to FPCs is open and the traffic of tourists is not so strictly controlled.</td>
</tr>
<tr>
<td><strong>High demand for wood</strong>: The wood industry in Poland is very effective and provides a high margin for companies. National forests are the main supplier of wood in Poland (near monopoly). The steady supply of wood is confronting increasing demand. For specific interest groups keeping the quantity of supply at the same level impedes economic growth.</td>
</tr>
</tbody>
</table>
2.4.2. Solutions for exploring, extracting, processing and recycling

2.4.2.1. Description

The objective of sustainable actions in this section is the development and deployment of economically viable, socially acceptable and environmentally friendly exploration, extraction and processing solutions that help to achieve a more efficient use of resources. Some targeted resources are, for example, land and sea minerals and urban mines. Actions should also try to develop financially viable recycling and recovery innovations, including business models, processes and systems.

2.4.2.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>ZenRobotics Recycler</td>
<td>ZenRobotics Recycler (ZRR) is the first robotic waste sorting system in the world. It reclaimed raw materials from waste with the help of machine-learning technology. The ZRR is able to sort metal, wood and stone fractions from waste. It uses multiple sensors (visible spectrum cameras, NIR, 3D laser scanners, optical sensors, etc) to create an accurate real-time analysis of the waste stream. Based on the analysis, the system makes autonomous decisions on what objects to pick out and how.</td>
</tr>
<tr>
<td>[Image of ZenRobotics Recycler]</td>
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<tr>
<td>Plasma technology in electronic waste processing</td>
<td>One of the latest technologies for processing electronic waste is a plasma melting technology. In the Czech Republic, this technology is possessed by SAFINA, a.s., which has developed a unique process called PlasmaEnvi®. The process was designed specifically for processing industrial catalytic converters with the main emphasis on those containing precious metals. Low-purity materials from scrapped electrical equipment are processed through plasma melting. These metals are mainly nonferrous metals containing copper and precious metals. Outputs of the technology are copper bars containing precious metals (gold, silver, palladium, platinum). Therefore, valuable raw materials are obtained from waste while environmental burdens caused by emissions are minimised. The overall use of the materials or waste processed is, therefore, well over 90%.</td>
</tr>
<tr>
<td>[Image of Plasma technology]</td>
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<tr>
<td>Green Bottle</td>
<td>GreenBottle is environmentally superior packaging for liquid consumable products. GreenBottles are made from a (recycled) paper outer shell, with a thin, detachable plastic liner inside. The paper outer is compostable or recyclable, and the product has a much lower carbon footprint than equivalent plastic bottles.</td>
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<tr>
<td>[Image of Green Bottle]</td>
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</table>
### 2.4.2.3. Featured study

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<th>WAI</th>
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<tr>
<td><strong>CASIPEDIA URL</strong> <a href="http://www.casi2020.eu/casipedia/cases/1089">http://www.casi2020.eu/casipedia/cases/1089</a></td>
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<tr>
<td><strong>SI Description</strong></td>
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</tbody>
</table>

This project aims to introduce to the international market a new technology for transforming agricultural, urban, industrial and forestry waste into a new eco-material with outstanding mechanical and calorific characteristics. Its mechanical properties make the material very attractive as a substitute for wood and other natural resources, and its calorific features give the material great potential to be used as an eco-fuel.

<table>
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<tr>
<th><strong>SI Lead organisation</strong></th>
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<tr>
<td>WASTE´S ALCHEMY IBÉRICA S.L.</td>
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<table>
<thead>
<tr>
<th><strong>SI Objectives</strong></th>
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<tbody>
<tr>
<td>• Develop a technology for transforming waste into an eco-material with remarkable calorific, mechanical and ecological characteristics</td>
</tr>
<tr>
<td>• Commercialise this technology to the waste treatment sector, both nationally and internationally</td>
</tr>
<tr>
<td>• Establish strategic alliances to commercialise the eco-material, through waste treatment entities, to electric power plants and energy high-consumption industries (use of the material as an eco-fuel)</td>
</tr>
<tr>
<td>• Establish strategic alliances to commercialise the eco-material in the construction and derived sectors, and to consumer-goods manufacturers (material used as a substitute for natural sources, e.g. wood)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Critical issues</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commercial agreements</strong>: The potential markets (consumers) of the eco-material (i.e. the markets to be directly addressed by the waste treatment entities, and eventually by WAI through strategic agreements) are: a) electric power plants aiming to introduce renewable and low-carbon alternatives in their systems and to increase their energy-production efficiency (apart from the high calorific properties, the homogeneity and malleability of the WAI eco-fuel adds another important advantage in terms of electric production efficiency); b) industries requiring large amounts of energy in their production processes, such as paper mills and the cement industry; and c) consumer-goods manufacturers, construction firms and derived sectors aiming to substitute natural and non-renewable materials.</td>
</tr>
<tr>
<td><strong>Environmental concerns and EU awareness</strong>: WAI’s technology contributes to solving four European problems: 1) recovering urban and industrial wastes relieves the environmental pressure and ecosystem instabilities caused by the residues accumulated in landfill; 2) the use of the eco-material preserves natural resources (e.g. wood, coal) and reduces the use of plastics and non-recyclable materials; 3) the use of the material as a fuel constitutes a climate change mitigation action through the replacement of contaminant fossil fuels and reduction of CO2 emissions; 4) the renewable material will contribute to making the transition to a reliable, affordable, publicly accepted, competitive and sustainable European energy system, with less dependence on international imports.</td>
</tr>
<tr>
<td><strong>Still limited capacity for international expansion</strong>: the company should reinforce the international network and the necessary skills for internationalisation</td>
</tr>
</tbody>
</table>
2.4.3. Alternative raw materials

2.4.3.1. Description

This priority aims to encourage researchers and innovators to identify and develop sustainable substitutes and alternatives for critical raw materials. This will not only ensure the subsistence of some EU sectors and industries but also make these sectors more globally competitive.

2.4.3.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Czech Nanospider</strong> – a global technology for the production of nano-fibres for environmental applications</td>
<td>The Nanospider technology is unique in the world. It is the only technology that enables the industrial production of fibres a thousand times thinner than human hair (nano-fibres) and which is able to produce millions of square metres of nanofibrous materials every year. The Nanospider technology was developed in cooperation with the Technical Universities of Liberec and Elmarco. It was awarded the Nano 50TM Prize granted by the prestigious magazine Nanotech Briefs (an official periodical of NASA) and was a nominee for two Index Awards at the INDEX 08 fair in Geneva. The technology is based on electrospinning and protected by a patent and a trademark. It is used by several of the most significant international companies, especially in the USA and Asia.</td>
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http://www.casi2020.eu/casipedia/cases/1211

| **Brick House** | What if a house could last at least five generations instead of two? LETH & GORI’s Brick House is a project that creates innovation by reinventing history. By revisiting materials and solutions from historic houses which have proven to be robust and have a long life span a new type of contemporary sustainable house is created. Brick House is part of a development project titled Mini-CO2 houses initiated by the philanthropic foundation Realdania. The goal of the Realdanias project is to develop affordable sustainable houses with a low CO2 footprint. A total of six houses has been built on a site in Nyborg, Denmark. Each house has a different approach to how CO2 reduction can be achieved, for example by focusing on materials and building techniques or by focusing on aiding the inhabitants to reduce CO2. Brick House has two main objectives, to create a house which is maintenance free for 50 years, and to create a house with a life span of a minimum of 150 years. |

http://www.casi2020.eu/casipedia/cases/1104

| **Adventure - production of environmental catalysts** | Production of environmental catalysts: for the reforming of gasoline, diesel, alcohols, natural gas, for the purification of hydrogen fuel from carbon monoxide and for three-way catalytic converters for abatement of exhaust emissions from internal combustion engines. The products are more effective than the catalysts presently offered on the market with the advantage of higher conversion capabilities at lower temperature and lower cost. The company’s catalysts are novel nanoparticles composition of noble and base metals oxides combined with rare earth oxides. The catalysts for abatement of toxic exhaust emissions from ICE have a low light-off temperature and incorporate NOx trap. The process of manufacturing utilises a proprietary nanotechnology. |

http://www.casi2020.eu/casipedia/cases/1162
### 2.4.3.3. Featured study

<table>
<thead>
<tr>
<th>AirCarbon</th>
</tr>
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<tbody>
<tr>
<td>Innovation Type</td>
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<tr>
<td><strong>SI Description</strong></td>
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</table>

AirCarbon is a material made by sequestering carbon emissions that would otherwise become part of the atmosphere. While almost all plastics today are made exclusively from oil or other fossil fuels, AirCarbon is different. By replacing oil with AirCarbon, the products we use every day are transformed into materials that sequester more carbon than they emit and actually improve the world - reducing the amount of carbon in the air, displacing oil and ending climate change one step at a time. After 10 years of continuous pilot and demonstration-scale operations, in August 2013 the AirCarbon production process was scaled to commercial scale, with the successful commissioning of a four-story, multi-acre AirCarbon production operation in California, using air and concentrated methane-based carbon emissions generated at an agricultural digester as inputs to produce AirCarbon. By weight, in its most basic form, AirCarbon is approximately 40% oxygen from air and 60% carbon and hydrogen from captured carbon emissions.

| **SI Lead organisation** |
| Newlight Technologies |

| **SI Objectives** |

- Reduce the levels of CO2 in the atmosphere
- Develop plastics and other sustainable materials with useful new characteristics
- Replace petroleum consumption

| **Critical issues** |

- **Competence, current plastic manufacturers and oil plants:** There are entry barriers based on the potential risk of product substitution. There may therefore be major reactions from competitors, principally from traditional plastic manufacturers. AirCarbon™ is able to meet the performance requirements of a wide range of applications, including applications currently using fossil fuel-based polypropylene, polyethylene, ABS, polystyrene and TPU. AirCarbon™ can be also used in extrusion, blown film, cast film, thermoforming, fibre spinning, and injection-moulding applications.

- **Policy support:** This technology may be consolidated if government establishes production rates. The intervention of government may help to reduce competitors’ tensions related to product substitution, thus contributing to technology development

- **Reduction of fossil fuels for producing plastics:** AirCarbon™ has been independently verified on a cradle-to-grave basis as a carbon-negative material, including all energy, materials, transportation, product use, and end-of-life/disposal associated with the material.
2.4.4. Awareness of raw materials shortages

2.4.4.1. Description

To tackle the skills shortage in the raw materials sector it is necessary to create cultural, behavioural, socioeconomic, systemic and institutional initiatives. Actions may consider SI stakeholder partnerships, including academic and industry actors, as well as structural changes to facilitate a more intense cooperation between citizens, policy-makers, practitioners and institutions. These sorts of action should increase awareness of the rational use of domestic raw materials.

2.4.4.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Humana Nova: A Social Enterprise that Facilitates Sustainability</td>
<td>Social Cooperative Humana Nova encourages the employment of the disabled and other socially excluded persons through the production and selling of quality and innovative textile and apparel products made from ecological and recycled fabrics. Humana Nova collects used clothing in northwest Croatia. After sorting, clothing in best condition is refined (when necessary) and resold in a store, some clothes are used to manufacture new products (patchwork blankets, purses, clothing and industrial napkins), whereas unusable textiles and waste are sent to recycling companies.</td>
</tr>
<tr>
<td>Repair Café</td>
<td>Repair Café is a movement that organises gatherings (in cities or villages) where citizens can come with broken stuff or objects: clothing, bicycles, furniture and electrical equipment. During the gatherings skilled people (volunteers from the neighbourhood) will fix the stuff and objects for free. Citizens realise that objects and stuff can be fixed instead of throwing it away. In addition, during the organisation of a Repair Café people from the neighbourhood get to know each other better or come into contact with neighbours they have never met before.</td>
</tr>
<tr>
<td>AV Symbiosis</td>
<td>This project targets two important social objectives: to increase the awareness of sustainability in society, and to develop children’s creativity skills for innovation. A process of upcycling is proposed to transform rejected household goods (which otherwise would have been sent to landfill) into recovered objects with new functions, thus offering them a second life. Different workshops, carried out in collaboration with NGOs and charities, are organised to guide children through a process whereby they will be able to transform things into delicate pieces of art.</td>
</tr>
</tbody>
</table>

http://www.casi2020.eu/casipedia/cases/1097

http://www.casi2020.eu/casipedia/cases/1120

http://www.casi2020.eu/casipedia/cases/1094
### 2.4.4.3. Featured study

**3D Ecobus – Mobile Education Center**


**Innovation Type** Social

<table>
<thead>
<tr>
<th>SI Description</th>
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</thead>
<tbody>
<tr>
<td>3D Ecobus is a mobile information-educational centre – and unique globally – an innovative tool for highly effective training. Ecobus is equipped with a state-of-the-art technique for 3D projection, Dolby Surround system and audio connection with the audience. The project is aimed at primary school students, as well as employees of companies and government institutions. The results of the project are impressive: since March 2011 more than 80 000 kids in 500 schools in 70 municipalities have been trained. Website registrations have reached 8000, while 4000 employees of international companies and governmental and municipal agencies have been through the training programme (the number is growing). Its purpose is to enrich their knowledge about the separate collection of waste and the benefits for the environment and society, to build a positive, sustainable attitude towards the process of selective collection and to encourage the creation of sustainable habits for participation in it.</td>
</tr>
</tbody>
</table>

**SI Lead organisation**  
Ecopack

**SI Objectives**

- Educate people, especially children, on sustainability challenges, and increase people’s awareness of sustainable actions
- Disseminate sustainable and environmentally responsible behaviour by touring the country going from town to town, village to village, school to school

**Critical issues**

- **Securing partners for the next stages:** The project has attracted as a strategic partner the leading NGO in the field of education – Paideia Foundation - which is responsible for the didactic quality of the educational products – lectures, films, quizzes and tests. Furthermore, the technical support has enabled the creation of a 3D movie theatre within a bus. Job descriptions for some team members have been produced and partners trained to acquire technical and communication skills and specific knowledge to operate the 3D mobile education centre.

- **Transforming partnership:** There are three key elements in the process of creating and implementing an innovative product. First, building a broad coalition of partners from the public, NGOs and private sector, which enables the aggregation of the individual expertise of each participant, as well as the diversification of risk and increased investor interest. Second, it is important to make a good market analysis and a smart choice of market approach. Finally, it should be recognised that goals should be not only economic, but also oriented to social problems.

- **Main spread strategies moving forward:** The next stages of the 3D movie project are: a) developing technological, workplace and social innovation; b) implementing a collaborative model for effective change, involving private companies, NGOs, central and local government institutions, international organisations and the media; c) addressing social exclusion issues by providing high-quality education to minorities anywhere; d) high efficiency – effective educational content delivered to a large number of trainees through centralised school and company structures; and e) measurability.
2.4.5. ICT systems to map raw materials trends

2.4.5.1. Description

Addressing raw materials availability problems implies the collection and evaluation of long-term data. Comprehensive and reliable ICTs are necessary to monitor these data, and to evaluate and estimate the future needs of raw materials, and the effectiveness of related policies. This will draw on space technologies, networks, remotely operated sensors, mobile solutions and web services, among other tools. The access to information should be free and information unrestricted. Related research results should also be subject to adequate and secure storage and management.

2.4.5.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Freecycle Network</td>
<td>Freecycle is a grassroots movement of people who are giving (and getting) stuff for free locally: it matches waste objects with new users and users. There are 572 local groups in the UK with 3.3 million members. The Freecycle concept has spread to over 85 countries, where there are thousands of local groups representing millions of members -- people helping people and changing the world one gift at a time. The Freecycle Network (often abbreviated to TFN or just known as Freecycle) is a non-profit organisation registered in the state of Arizona, USA, and separately registered as a UK charity, which organises a worldwide network of gifting groups, aiming to divert reusable goods from landfill. It provides a worldwide online registry, and coordinates the creation of local groups and forums for individuals and non-profits to offer and receive free items for re-use or recycling, promoting gift economics as a motivating cultural outlook - changing the world one gift at a time.</td>
</tr>
<tr>
<td>Vertelis</td>
<td>Vertelis is a type of software that enables energy consumption management. The software collects all sensor data in real time, reports consumption and permits the detection of non-efficient behaviours. Vertelis also helps users to simulate factures and the impacts of the progress plan. The software manages sensors, metres, analysers and measurement units which are installed in the monitored building. All data can be uploaded into a cloud, permitting comparison of energy consumption in different buildings.</td>
</tr>
<tr>
<td>TrashOut</td>
<td>TrashOut is an environmental project aiming to locate illegal dumps around the world. The project is developing a solution to take proper steps to prevent illegal dumps. It helps ordinary people to have an impact on their environment and to be easily involved. This project will also help local institutions and governments to improve the situation worldwide.</td>
</tr>
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</table>

http://www.casi2020.eu/casipedia/cases/1221

http://www.casi2020.eu/casipedia/cases/798

http://www.casi2020.eu/casipedia/cases/837
2.4.5.3. **Featured study**

**myEcoCost**


**Innovation Type**

System

**SI Description**

The myEcoCost (consuMer oriented prototYpe – forming the nucleus of a novel ECOlogical acCOunting sySTem) Project is set up to design and develop the core of an information system that can measure the ecological cost of any product by analysing the resources it requires and then collecting the environmental data from manufacturing, assembling and transport, right to its disposal. Designed to be readable through smart phones or other modern electronic devices, the ecological cost will be available as either a single value or score, appropriate to an individual consumer, or as an entire breakdown of its components, appropriate to business users. While interim product weight over its lifecycle decreases, its ecological and financial costs increase.

**SI Lead organisation**

TriaGnoSys GmbH

**SI Objectives**

- Develop key ICT and software elements to demonstrate a resource accounting framework and infrastructure in a proof-of-concept prototype, involving users, environmental data processors and policy-makers
- Develop a working nucleus of core functions of the myEcoCost concept
- Work on a methodology that defines a global collaborative network of resource-accounting nodes
- Provide a means of accounting for and expressing usage of natural resources for products and services, to provide economic actors with environmentally relevant information with dynamically calculated, near real time figures
- Give businesses, owners and consumers the choice to be more environmentally conscientious

**Critical issues**

**Lack of one clear resource accounting methodology:** The myEcoCost approach combines the ecological concept of dematerialisation and Life Cycle Assessment (LCA) methodology into one framework, bridging the gap between mass-based indicators and impact-based indicators. The framework provides environmental information directly to companies and consumers but can also build up a giant database for LCA inventories and statistics. MyEcoCost gives consumers the chance to compare products based on their ecological impact and to track their own consumption in myEcoCost over the year.

**Embracing myEcoCost – Suppliers:** While some piloting has taken place, the product has not yet been tested in the market place against normal market forces. It is likely that extensive education of suppliers will be required. There is vastly more work involved in extending the nucleus of the system with the core functions outwards so it can be more widely used.

**Measuring Impact of myEcoCost:** Currently there are different ways of measuring impacts, different limits and assumptions when gathering data, and different assessment methods, all of which result in analyses that are difficult to compare and can mystify users. Making the process transparent and applied via such tools as a smart phone, as envisaged, will reduce barriers. Consumers, who have historically been overlooked in eco-accountability research, are included in the myEcoCost architecture as a primary stakeholder.
2.4.6. **Eco-solutions to reduce raw materials use**

2.4.6.1. **Description**

Reducing the consumption of raw materials requires different forms of incremental and radical eco-innovation. This may imply comprehensive solutions that combine technological, organisational, societal, behavioural, business and policy answers to SI problems, as well as the reinforcement of civil society participation. In particular, it will be useful to incorporate user-driven strategies, business models, industrial symbiosis, product service systems, product design, full life cycle and cradle-to-cradle approaches.

2.4.6.2. **Examples**

<table>
<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td><strong>ECO-SANDWICH:</strong> Sustainable Prefabricated Wall Panel Systems made of Recycled Aggregates</td>
</tr>
<tr>
<td><strong>Carlsberg circular community - 'upcycling' system</strong></td>
</tr>
<tr>
<td><strong>Modcell - carbon-negative building</strong></td>
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<table>
<thead>
<tr>
<th>Description</th>
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<tbody>
<tr>
<td>ECO-SANDWICH is a ventilated prefabricated wall panel system which utilises construction and demolition waste (CDW) and mineral wool. It is produced using innovative and sustainable Ecose® technology in order to reduce primary energy consumption (for heating and cooling) in building stock. The technology has been developed through cooperation between Croatian research institutions and industry. The project received support through the CIP Eco-innovation programme.</td>
</tr>
<tr>
<td>Carlsberg joins with global suppliers to develop ‘upcycling packaging that reduces reliance on natural resources, while still appealing to consumers, using the Cradle-to-Cradle platform’.</td>
</tr>
<tr>
<td>ModCell® is one of the first products to make large-scale, carbon-negative building a commercial reality. The ModCell® system utilises the excellent thermal insulation qualities of straw bale construction to form prefabricated panels, made in a local Flying Factory™. ModCell® allows super-insulated, high-performance, low energy ‘passive’ buildings to be built using renewable, locally sourced, carbon sequestering materials that include straw bale and hemp to create a less than zero carbon construction system.</td>
</tr>
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http://www.casi2020.eu/casipedia/cases/1308

http://www.casi2020.eu/casipedia/cases/1229

http://www.casi2020.eu/casipedia/cases/1232
### Rediscovery Centre

**Innovation Type** Social

<table>
<thead>
<tr>
<th>SI Description</th>
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<tbody>
<tr>
<td>The Rediscovery Centre Initiative is an eco-innovation project based in Ballymun, Co Dublin. The programme involves four re-use enterprises (Rediscover Furniture, Rediscover Fashion, Rediscover Paint and Rediscover Cycling) which use waste and unwanted materials as a resource and raw material for new product design; in-house training for CE, TUS and JobBridge candidates as well as public training courses in sewing skills and furniture restoration; educational facilities including workshops for schools, youth groups, community groups, libraries and festivals; and research investigating aspects of resource efficiency, sustainable development, behavioural change and impact measurement.</td>
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<th><strong>SI Lead organisation</strong></th>
<th>Obeo</th>
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<table>
<thead>
<tr>
<th><strong>SI Objectives</strong></th>
</tr>
</thead>
</table>
| • Prevent waste going to landfill  
| • Provide employment and training  
| • Inspire sustainable living and sustainable product consumption  
| • Provide education to the local community and support visiting communities |

<table>
<thead>
<tr>
<th><strong>Critical issues</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Development of training schemes:</strong> A key driver in the development of the SI was the need to build skills and training capacity in the area - to train local residents and provide them with valuable 'back to work' skill-sets that would help the individuals, the wider community and the local economy.</td>
</tr>
<tr>
<td><strong>Understanding the concept:</strong> A key barrier in starting up this SI was the 'fear of the unknown' element and ensuring that the stakeholders and local citizens were able to understand what was being proposed. The Rediscovery Centre concept was developed initially on paper with much discussion and varied consultation. However, it was the 'showing by doing' actions at the start of the project that led to the successful development of the Rediscovery Centre for the future.</td>
</tr>
<tr>
<td><strong>Navigating through the waste legislation landscape:</strong> A key barrier initially for the project team was initially to understand the environmental and waste policy and the legal requirements to be met. For example, much time and resources were initially spent looking at whether a waste licence or permit was required. The costs and conditions that would accompany such would initially have been considered a barrier. However, in consultation with the local authority, it was determined that a letter of exemption was applicable in this case and this barrier or perceived challenge was overcome.</td>
</tr>
</tbody>
</table>
2.4.7. Raw materials-conscious sustainable lifestyle

2.4.7.1. Description

The objective is to identify and analyse those barriers that hinder positive societal and market changes in relation to raw materials utilisation. The social sciences and humanities have great relevance to achieving this objective. Innovations in this area should promote sustainable lifestyles, foster more rational consumption patterns and encourage users’ engagement in raw material sustainability.

2.4.7.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMILE Resource Exchange</td>
<td>SMILE Resource Exchange is an industrial symbiosis programme for businesses that encourages the exchanging of resources between members in order to save money, reduce waste going to landfill and to develop new business opportunities. Potential exchanges are identified through free networking events, a free online exchange facility and a support team to assist throughout. All resources offered are either free of charge or below market value. The service is available to businesses in the Republic of Ireland.</td>
</tr>
<tr>
<td>Sustainable innovation on outright purchases</td>
<td>Outright purchase is a voluntary movement. The movement participants create small societies in different parts of Latvia. Each small society searches for organic farmers in order to buy organic products from them. An important aspect is the geographical principle – each small society cooperates with the nearest organic farm to save transportation expenses and protect the environment. A representative of the local community collects the list of organic products required each week and sends it to cooperating farmers. Farmers collect all the products and send them to one identified place. Customers come to this base, get their orders and pay for them.</td>
</tr>
<tr>
<td>The Goldfinger factory</td>
<td>The Goldfinger Factory is an up-cycling production and learning hub for the training, support and inspiration of London’s most disadvantaged residents to create desirable furnishings and fit-outs for London trendsetters with a social conscience. This is a charitable enterprise without the charity shop feel, mixing quality reclaimed pieces lovingly refurbished with design classics and custom-made pieces to make golden spaces at our stores and in your home, business or pop-up event. These spaces are conceived by designers, artists and craftspeople, and are all restored by trainees from socially disadvantaged groups, providing skills, support and ultimately jobs, while creating value in London’s rapidly growing re-use sector, and at the same time saving materials from ending up in landfill.</td>
</tr>
</tbody>
</table>

http://www.casi2020.eu/casipedia/cases/1090
http://www.casi2020.eu/casipedia/cases/1091
http://www.casi2020.eu/casipedia/cases/1366
## 2.4.7.3. Featured study

<table>
<thead>
<tr>
<th>M&amp;S Sustainable building and learning</th>
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<tbody>
<tr>
<td><strong>Innovation Type</strong></td>
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</table>

### SI Description

Design and build of a new ‘sustainable learning’ M&S store which integrates all aspects of sustainability – climate change, waste, natural resources, fair partnership, health and wellbeing and involving customers in the journey. This store was an opportunity to try new things, invest in sustainable innovations – technologies, processes and systems and, if successful, embed them into the way that the company does business.

### SI Lead organisation

Marks & Spencer

### SI Objectives

- Achieve customers’ and users’ involvement in sustainable lifestyle
- Devise new sustainable solutions and services
- Exchange experience and knowledge with stakeholders on shared sustainability concerns
- Foster collaboration between local economic agents at the business level
- Promote collaborations that will have a positive impact on the environment

### Critical issues

**Environmental benefits:** Working towards the company’s sustainability targeting the following areas:  
- a) Transport: electric car charging points; LED screens in the store to provide real time local transport information; green–roofed trolley and cycle shelters;  
- b) Energy efficiency: all heating provided by expelled heat from refrigeration units; 25% less energy usage for powered lighting; sun pipes use for natural lighting; natural ventilation in the stock room and staff areas; predicted energy savings of 45% from mobile fridges;  
- c) Water efficiency: reduction of water usage by up to 40% (in excess of 0.5m litres of water per annum);  
- d) Use of FSC certified materials;  
- e) Waste reduction: 98.2% of soil recycled and the remainder treated off site and re-used;  
- f) Biodiversity: a sedum roof and green ‘living wall’ to create wildlife habitats, contribute to the insulation of the building and act as a pollution filter; bird boxes around the perimeter wall of the site; 62 types of plants species are on or around the store.

**Sensitivity to local business and residents:** M&S needed to make sure that the build process was sensitive to the local businesses and residents on Ecclesall Road.

**Impacts on the community:** The store has created over 50 jobs in the area. Furthermore, the local school ecology club visited the site regularly: this was an opportunity for them to learn through active participation.
2.4.8. Effective raw materials policies

2.4.8.1. Description

The transition towards a green economy must be underpinned by robust indicators and assessment/monitoring methods. These indicators can support the formulation of more effective sustainability-related policies.

2.4.8.2. Examples

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covenant capacity</td>
<td>Capacity building within local governments to advance Local Climate and Energy Action – from planning to action to monitoring - was a three-year project, co-funded by the Intelligent Energy Europe programme. It started in June 2011 and ran until May 2014. The main aim was to assist Sustainable Energy Action Plan (SEAP) development in Europe - from motivation, planning and implementation, to monitoring and evaluating. It did this by dealing with three main activities: 1) An easy learning programme was offered to local governments (local leaders and municipal staff); 2) A ‘train-the-trainer’ programme to extend the support offered, invited participation by representatives from local government associations and energy networks agencies working with municipalities; 3) It actively supported selected cities and towns in 15 countries – in a step-by-step roll-out their Local Climate and Energy Actions.</td>
</tr>
<tr>
<td>Environmental Product Declaration (EPD) - National Register System of Environmental Product Declarations for Habitat</td>
<td>DAP Habitat consists of a record/monitoring system of Environmental Product Declarations (EPD) for products and services of the Habitat programme. It is a programme of national registry that allows any interested company or entity to request the development of rules for the Product Category (RCP) or register DAPs, regardless of their country of origin. The EDP is an innovation in environmental protection, aiming for a more sustainable Habitat tool. Registration makes visible the environmental performance of products and services through documents checked by independent third parties. The primary mission of the DAP is to demonstrate the environmental performance of a product or service, based on studies of Life Cycle Assessment.</td>
</tr>
<tr>
<td>Sustainable Habitat Cluster</td>
<td>Sustainable Habitat Cluster brings together companies from the extractive sector for the transformation of building materials, passing through the area of construction and rehabilitation, among others related to the supply of goods and equipment for Habitat. Based on sustainability as a dynamic factor and transversal strategic development, it aims to contribute to the creation of Sustainable Habitat. Its primary mission is to develop a concerted drive that seeks, through innovation, quality and modernisation of enterprises, the reinforcement of its competitiveness, mobilising a range of actors focused on specific and critical areas for the development of the Cluster. It aims to create synergies for the development of new products, technologies and construction systems and a new practice of designing spaces and environments, inducing an attitude of innovation through the sustainability of the created environment.</td>
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</tbody>
</table>

http://www.casi2020.eu/casipedia/cases/1349

http://www.casi2020.eu/casipedia/cases/1341

http://www.casi2020.eu/casipedia/cases/1339
### 2.4.8.3. Featured study

**Greenhouse building subsidies**

<table>
<thead>
<tr>
<th>CASIPEDIA URL</th>
<th><a href="http://www.casi2020.eu/casipedia/cases/1025">http://www.casi2020.eu/casipedia/cases/1025</a></th>
<th>Innovation Type</th>
<th>Governance</th>
</tr>
</thead>
</table>

#### SI Description

The innovative Romanian Greenhouse programme is a public policy which intends to encourage individuals and households when building a new house or refurbishing the old one to introduce green technologies into their homes. The programme is based on an annual budget, allocated by central government from environmental funds. Owners of the houses are granted subsidies to install new technologies like photovoltaics, solar panels, heat pumps, biomass boilers or other eco-efficient and energy-efficient devices. Following the evaluation procedure, the beneficiary is reimbursed by up to 6000 or 8000 lei (€1500–€2000), depending on the type of device installed. The policy was encouraged at the time by the high rate of increase in real estate and residential development. As a result of the financial crisis, real estate and the Greenhouse policy were put on the back burner. In 2014, the programme was rejuvenated and received a push forward, with a huge number of new contracts waiting to be signed.

#### SI Lead organisation

Environmental Fund Administration - agency subordinate to the Ministry of Environment, Waters and Forests of Romania

#### SI Objectives

- Grant subsidies to individuals who invest in building a new house or refurbish their existing one
- Reduce GHG emissions, by increasing energy efficiency of buildings and/or by increasing the share of renewable energy in final consumption
- Stimulate real estate and residential development
- Support transition to green economy and encourage producers of green technologies

#### Critical issues

- **Administrative capacity:** A large number of applications was evaluated and selected very slowly, as a result of low administrative capacity
- **Clean energy and efficient energy:** Romania is one of the EU Member States with a high rate of energy intensity and the households sector has a significant role in the increase in energy intensity increase. Finding an incentive to reduce energy consumption would be a solution to reducing energy intensity
- **Stagnating real estate:** The intention to develop new houses and refurbish old ones has slowed with the economic crisis; people are reluctant to invest money. Low investments and slow pace of recovery could affect the engagement to introduce new and green technologies.
3. State-of-art of sustainable innovation

3.1. Sustainable innovation priorities by type of innovation

3.1.1. State-of-art of sustainable product innovations

*Product innovation* is the introduction of a good that is new or significantly improved with respect to its characteristics or intended uses (OECD, 2005). Product innovations include: scientific advances with innovation potential, industrial innovations with deployment potential, and new products on the market with sustainability potential.

Of the 500+ sustainable initiatives in CASIPEDIA, 194 (35%) are product innovations with a primary focus on the following top 10 H2020 priority areas:

- Climate change mitigation solutions (35%)
- Eco-solutions to reduce raw materials use (31%)
- Resource-efficient sustainable lifestyles (30%)
- Eco-innovation and green economy transition (25%)
- Alternative raw materials (19%)
- Climate action by sustainable lifestyle (19%)
- Solutions for exploring, extracting, processing and recycling (16%)
- ICT systems improving resource efficiency (15%)
- Raw materials-conscious sustainable lifestyle (13%)
- Climate change adaptation solutions (13%)

The top five socioeconomic sectors of relevance to sustainability-oriented product innovations are:

- Manufacturing (51%)
- Energy (26%)
- Water (21%)
- Construction (17%)
- Agriculture (11%)

The CASIPEDIA cases’ objectives were clustered into the following 15 key SI priorities of product innovations:

- Developing reliable equipment and saving solutions for renewable and non-renewable energy.
- Decreasing raw materials use through waste processing and recycling plants (e.g. biofuel, plastic).
- Improving society’s and people’s health by ensuring high levels of indoor and outdoor air quality.
- Reducing the use of clean and drinking water in industrial processes (e.g. fracking, gas/oil drilling).
- Developing sustainable public transport infrastructures that promote employment and safety.
- Lowering the carbon footprint through effective carbon dioxide sequestration and storage.
- Using sustainable materials and nanotechnology in the construction of residential/office buildings.
- Reducing pollution (e.g. NOx) in waste incineration and combustion processes (e.g. automobiles).
- Supporting sustainable regional development and environmentally friendly lifestyles.
- Limiting the negative impact of climate change and greenhouse gas (GHG) emissions.
- Increasing the market share of electric vehicles and building sustainable (e.g. solar) power stations.
- Generating biogas resources from sustainable food production (e.g. Aquaponics plants).
- Using green roofs to reduce heat island effects in urban areas and gain a competitive advantage.
- Promoting more sustainable heating and cooling devices (e.g. using wood biomass as a fuel).
- Developing technological solutions for the effective re-use and recycling of products.
Figure 1: CASI key terms wheel from 194 sustainable product innovations
### 3.1.1.1. Examples of product innovations in CASIPEDIA

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Road Energy Systems</strong></td>
<td>Road Energy Systems is a patented energy system in which the heat-absorbing energy from asphalt surfaces can be used. The system consists of an asphalt solar collector with which energy is buffered in the soil. This energy is then put through heat pumps in the built environment. This makes it possible to replace gas by thermal heat. It is also possible to use the cold from the asphalt for cooling buildings. The advantage of this solution is that the consumption of fossil fuels is avoided and that CO2 emissions drastically decrease. An additional major advantage of this system is the extension of the life of the asphalt construction. The asphalt solar collector is inextricably linked to it and thus constitutes a whole with the total asphalt construction. In addition, the application of system can be used for environmentally friendly snow and ice road control in the winter. Another advantage is the double use of space, for instance as a road or car park and also as a surface for the energy system.</td>
</tr>
<tr>
<td><strong>Aquaponic Food Production Utilising Waste Heat-Ponnod Prime</strong></td>
<td>The main problem that vegetable growers in Europe face is the cost of heating in the winter. On the other hand, there is a large supply of waste heat that the industry does not know how to use. Ponnod Prime is a system that will enable year-round local, fresh vegetable and fish production. For this it will use waste heat from industrial processes, e.g. bakeries, breweries, etc. to heat the water and the air in aquaponics systems.</td>
</tr>
<tr>
<td><strong>Waterwalk</strong></td>
<td>WATERWALK (Klimafisien) is a plug-and-play pavement capable of managing increased amounts of rainwater and at the same time creating new recreational adventures in the city. The aim is that WATERWALK would be fully developed by 2016, well proven and ready to enter the market, so large amounts of pavement areas will be activated to handle heavy rain and contribute to recreational elements in the urban space. More specifically, the concept consists of a modular plug-and-play system, which connects separate functions on the up-and underside of the city. WATERWALK contains an innovative underground water-management system (PLUG), linked directly to adventurous recreational elements in the urban spaces (PLAY).</td>
</tr>
</tbody>
</table>

http://www.casi2020.eu/casipedia/cases/884  
http://www.casi2020.eu/casipedia/cases/1260  
http://www.casi2020.eu/casipedia/cases/1021
### 3.1.1.2. Featured study

#### Fairphone

<table>
<thead>
<tr>
<th>CASIPEDIA URL</th>
<th><a href="http://www.casi2020.eu/casipedia/cases/1103">http://www.casi2020.eu/casipedia/cases/1103</a></th>
<th>Innovation Type</th>
<th>Product/ process</th>
</tr>
</thead>
</table>

#### SI Description

Fairphone is a social enterprise working to create a fairer economy and change how things are made by opening up supply chains, solving problems and using transparency to start a debate about what is truly fair. Besides debating, the social enterprise designs and produces smart phones that are continuously improving fair procedures throughout their lifecycle (sourcing, production, distribution, recycling). By using a smart phone as a storytelling device, Fairphone aims to reconnect consumers with their products and reveal how things are made. In 2013, with the support of crowd-funding, more than 10 000 Fairphones were sold before production had even started. And even before the crowd-funding campaign, Fairphone received funding from Waag, Stichting Doen and the NCDO (about €300,000 over the course of two-and-a-half years). It also received €10,000 as winner of the ASN Bank World Prize.

#### SI Lead organisation

Waag Society, Action Aid and Schrijf-Schrijf

#### SI Objectives

- use only conflict-free minerals for producing the Fairphone
- work together with manufacturing companies that invest in the wellbeing of their employees
- promote re-use and recycling of phones by incorporating features that add value for re-use and recycling in the Fairphone, in addition to providing consumers with the ability to purchase separate parts and repair their own phones
- push for safe conditions, fair wages and worker representation in manufacturing companies

#### Critical issues

- **Competition:** Fairphone has to compete with other big players like Apple and Android systems. According to an article in the *Guardian*, the Fairphone falls behind in terms of a number of functionalities like the processor (which is not very powerful), the software system (it runs an old Android system) and a less sharp pixel density than on other devices and smart phones.

- **Sustainability concerns:** More and more people are aware of the environmental and social impact of mining and extraction, creating a demand for fairer phones

- **Weak processor:** The MediaTek processor at the heart of the Fairphone is not very powerful compared to its competit. It is fine for running most simple apps, but it may struggle with more demanding apps and games.
3.1.2. State-of-the-art of sustainable service innovations

*Service innovation* is the introduction of a service that is new or significantly improved with respect to its characteristics or intended uses, for example, efficiency or speed improvements, new functions or characteristics of existing services, or the introduction of entirely new services (OECD, 2005).

Of the 500+ sustainable initiatives in CASIPEDIA, 121 (22%) are service innovations with a primary focus on the following **top 10 H2020 priority areas**:

- Resource-efficient sustainable lifestyles (46%)
- Climate action by sustainable lifestyle (33%)
- ICT systems improving resource efficiency (33%)
- Eco-innovation and green economy transition (26%)
- Climate change mitigation solutions (25%)
- Eco-solutions to reduce raw materials use (17%)
- Strategic intelligence and citizen participation (13%)
- Climate action eco-innovation policies (13%)
- Climate change adaptation solutions (10%)
- Solutions for exploring, extracting, processing and recycling (8%)

The **top five socioeconomic sectors** of relevance to sustainability-oriented service innovations are:

- Other services (23%)
- Transport (22%)
- ICT (22%)
- Energy (20%)
- Water (16%)

The CASIPEDIA cases’ objectives were clustered into the following **18 key SI priorities of service innovations**:

- Promoting alternative/renewable energy sources (e.g. biogas, kinetic energy) and monitoring their impact.
- Creating sustainable societies based on the circular economy and environmental protection principles.
- Preventing waste and managing the recycling/re-use of waste (including old electronic equipment).
- Contributing to the reduction of global CO2 and greenhouse gas emissions.
- Reducing private car ownership through effective car/bike rental and sharing services.
- Improving the efficiency, speed and eco-friendliness of public transport and freight services.
- Developing sustainable mobility networks and infrastructures supporting electric vehicles.
- Fostering self-sufficient rural areas through sustainable agriculture and energy production.
- Creating platforms/networks for information/knowledge sharing on sustainable tools and services.
- Analysing data on urban water use and modelling effective water management strategies.
- Providing timely communication of environmental hazards (e.g. floods) to citizens and authorities.
- Establishing and reinforcing organic food production and markets in local communities.
- Providing users of environmental data with real-time analysis/modelling of air/land/water quality.
- Preserving and consolidating cultural heritage, traditional values and sustainable lifestyles.
- Reducing traffic problems, fuel consumption and emissions linked to parking problems in cities.
- Reducing air and noise pollution from residential and cultural heritage areas.
- Providing citizens with advice on sustainability issues (e.g. environmental risks, floods, consumption, etc).
- Improving the efficiency of retail distribution centres and goods distribution to shops.
Figure 2: CASI key terms wheel from 121 sustainable service innovations
3.1.2.1. Examples of service innovations in CASIPEDIA

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<tr>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>BioTrans System</strong></td>
<td>BioTrans Nordic uses the existing technology of the BioTrans System. It offers customers a total solution to sustainable waste management based on the principles of a circular economy. The BioTrans System offers a recycling of food waste and peeling. The BioMaster feeding station converts waste products (incl. cooking fat, coffee grounds, etc) into a homogeneous biomass. This biomass is pumped through a closed system into a BioTank. From there, it is transported on a regular basis (4-6 weeks) to an aerobic digester (biogas plant) and recycled. BioTrans Nordic has developed the technology by taking responsibility for all stages of their clients’ organic waste handling. This includes the development of tailor-made installations, calculation of environmental impacts, and an overview of how the transformed waste contributes to heat and electricity production and/or the production of fertiliser.</td>
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</table>

http://www.casi2020.eu/casipedia/cases/957

| **Smarter Working West Midlands** | Smarter Working West Midlands is a programme funded by the European Regional Development Agency and managed by Coventry University Enterprises Ltd (CUE Ltd). The project provides free support to SMEs in the region. Typically this will consist of two days of specialist advice covering several topics, such as: travel planning, energy saving in the workplace and workplace wellbeing. The overarching aim of the smarter working project in the West Midlands is to raise the productivity of organisations, while reducing carbon emissions, through the collection of measures and initiatives which aim to change the way organisations operate. |

http://www.casi2020.eu/casipedia/cases/1195

| **Wimoov** | Wimoov is the association leader of French mobility. Its aim is to support all types of public initiatives towards sustainable, eco-friendly and solidarity mobility. The association focuses on three areas: road safety, sustainable mobility and insertion. In particular, it helps people to find a job through greater mobility. Wimoov offers bike training, car-sharing and vehicle rental. Wimoov also conducts workshops on smart and sustainable mobility. |

http://www.casi2020.eu/casipedia/cases/800
3.1.2.2. **Featured study**

**RUSZ Reparatur- und Service-Zentrum**

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<thead>
<tr>
<th>CASIPEDIA URL</th>
<th><a href="http://www.casi2020.eu/casipedia/cases/751">http://www.casi2020.eu/casipedia/cases/751</a></th>
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<tr>
<td><strong>SI Description</strong></td>
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<tr>
<td>RUSZ is a social enterprise that initiated changes in EU policies. Its primary objectives are resource efficiency and social inclusion. RUSZ provides repair services for household appliances, consumer electronics and IT. It sells certified, high-quality used equipment as well as new washing machines that have been diagnosed in the in-house R&amp;D department as particularly durable and easily repairable. From 1998 to 2007, RUSZ operated on a commission from the Viennese labour market authority, AMS. It was successfully transformed into a non-profit private enterprise in 2008 and now operates on a cost-recovery basis and employs more than 20 people (mostly former long-term unemployed people). RUSZ has been leading many initiatives to replicate its model and also to lift the barriers it faces and to change policies, both in Austria and Europe. RUSZ was among the initiators of the Austrian umbrella organisation RepaNet (<a href="http://www.repanet.at">www.repanet.at</a>) and its EU equivalent RREUSE.</td>
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<tr>
<td><strong>SI Lead organisation</strong></td>
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<tr>
<td>RUSZ Verein zur Förderung der Sozialwirtschaft</td>
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<tr>
<td><strong>SI Objectives</strong></td>
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<tr>
<td>• Achieve an economic edge of reliable repair services and the creation of green jobs</td>
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<tr>
<td>• Contribute to waste prevention: by repairing old machines RUSZ makes an essential contribution especially to electronic scrap prevention. Having repaired more than five million kilograms of electrical appliances in the past 18 years, RUSZ has contributed to resource conservation, climate protection and waste avoidance</td>
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<tr>
<td>• Fight the metastases of the economic system, such as planned obsolescence: Rusz deplores the fact that many electrical and electronic devices are designed to be replaced within five years. RUSZ works on the development of a white list of long-lasting and repair-friendly new drives</td>
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<tr>
<td>• Provide education for unemployed people: RUSZ not only offers jobs, it also provides the chance of technical training</td>
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<tr>
<td>• Offer a broad array of second life devices with warranty</td>
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<tr>
<td>• Offer qualitative high-standard yet low-priced repair services</td>
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<tr>
<td>• Provide customers with reliable Information about possible alternatives</td>
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<tr>
<td><strong>Critical issues</strong></td>
<td></td>
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<tr>
<td><strong>Profitability is difficult to calculate:</strong> For a non-profit social enterprise somewhere between social and ecological sustainability such as RUSZ calculating profitability is very challenging</td>
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<tr>
<td><strong>Re-integration of long-term unemployed into society:</strong> RUSZ has a high success rate of re-integrating long-term unemployed people back into society. It trains them to be service technicians and even helps them with financial and social issues, e. g. it supported quite a few in declaring private bankruptcy and even supported some in finding new housing.</td>
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<tr>
<td><strong>Austrian tax system:</strong> Repairing is labour-intensive work, thus repair costs are high. Repairing goods can be considered to be taxed twice: high employment taxes plus VAT. This is definitely a barrier to creating new jobs. Socio-environmental tax reform should be put in place.</td>
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</table>
3.1.3. State-of-art of sustainable social innovations

Social innovations are new solutions (products, services, models, markets, processes etc) that simultaneously meet a social need (more effectively than existing solutions) and lead to new or improved capabilities and relationships and better use of assets and resources. In other words, social innovations are both good for society and enhance society’s capacity to act (Caulier-Grice et al., 2012).

Of the 500+ sustainable initiatives in CASIPEDIA, some 75 (14%) are social innovations with a primary focus on the following top 10 H2020 priority areas:

- Resource-efficient sustainable lifestyles (61%)
- Climate action by sustainable lifestyle (49%)
- Strategic intelligence and citizen participation (31%)
- Raw materials-conscious sustainable lifestyle (29%)
- Eco-innovation and green economy transition (19%)
- Climate change mitigation solutions (17%)
- ICT systems improving resource efficiency (15%)
- Eco-solutions to reduce raw materials use (13%)
- Solutions for exploring, extracting, processing and recycling (11%)
- Awareness of raw materials shortages (9%)

The top five socioeconomic sectors of relevance to sustainability-oriented social innovations are:

- Education (29%)
- Other services (e.g. computer and household goods repairs, personal services) (23%)
- Agriculture (20%)
- Health/Social services (20%)
- Water (17%)

The CASIPEDIA cases’ objectives were clustered into the following 11 key SI priorities of social innovations:

- Improving organic food production, supply chains and distribution networks.
- Promoting sustainable lifestyles and consumption patterns through knowledge sharing.
- Supporting community life and development (e.g. solidarity networks).
- Reducing legal and illegal construction waste (e.g. recycling of building materials).
- Enhancing local quality of life by promoting regional industries, products and services.
- Raising public awareness and participation in environmental actions and education.
- Developing children’s interest and skills in the promotion of sustainable neighbourhoods.
- Understanding and improving the conscious use of resources and environmental responsibility.
- Promoting effective transport initiatives that reduce the impact of goods and human mobility.
- Promoting sustainable water access, distribution, management, use and treatment practices.
- Adopting social practices/actions for river and stream water quality improvement and monitoring.
Figure 3: CASI key terms wheel from 75 sustainable social innovations
### 3.1.3.1. Examples of social innovations in CASIPEDIA

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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<tbody>
<tr>
<td><strong>Bia Food Bank (BiaFi)</strong></td>
<td>Bia Food Initiative (BiaFi), an Irish charity formed in June 2012, aims to provide a socially responsible, environmentally sensitive, business-friendly alternative to wasting good food. Through BiaFi, a better understanding of the quantities and origins of surplus food is determined. This information assists in establishing a national food redistribution network to reduce the volumes of mismanaged food currently being disposed of and matching this surplus with the ever-growing incidence of food scarcity across Ireland. The initiative works on the basis that supermarkets with unwanted food products donate these materials to the BiaFood Bank. The excess food is stored in a specially developed distribution centre. Registered charities can then collect and redistribute the food where it is needed. The initiative saves money for the retailers who donate the food, as otherwise they would have to classify it as waste and send to an authorised landfill site.</td>
</tr>
<tr>
<td><strong>Earthship Brighton</strong></td>
<td>Earthship Brighton was the Low Carbon Trust’s first project and was the first Earthship to be built in England. The project was built as a community centre for use by Stanmer Organics on a Soil Association-accredited site in Brighton. This pioneering demonstration project has evolved over the past 10 years, providing jobs for local workers and enabling people to come and experience a cutting-edge eco-build and be inspired to respond to climate change in their own ways back at home and work.</td>
</tr>
<tr>
<td><strong>Blocket - an online second-hand market, the largest retail market in Sweden</strong></td>
<td>Blocket is a Swedish online second-hand market similar to Amazon or eBay. It is a private company, started in 1996. It employs 57 people. It is the largest national retail market with five million people visiting its webpage weekly. Eight out of 10 Swedes have bought or sold something on Blocket, 99% have heard about it. Individuals and businesses advertise used and new products via blocket.se, which creates revenue by charging a fee for each advertisement. The market is mainly peer-to-peer but aims to increase business-to-consumer sales of new products. In 2013 the sales of second-hand goods on Blocket contributed to the saving of 1.6 million tonnes of greenhouse gas (GHG) emissions.</td>
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### 3.1.3.2. **Featured study**

<table>
<thead>
<tr>
<th><strong>ANDES</strong></th>
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<tr>
<td><strong>Innovation Type</strong></td>
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#### SI Description

The Association Nationale de Développement des Epiceries Solidaires (ANDES) is a network of social and solidarity stores. These stores are local convenience stores where people on a low income can buy everyday goods for about 10% or 20% of their ‘regular retail price’. ANDES was created in 2000 and aims to creating social and solidarity stores, to stimulate the solidarity stores network in order to extend its practice and to supply these stores with quality products. The network has over 500 stores and more than 120 000 customers. To promote access to fresh fruit and vegetables in social and solidarity stores, and to develop its mission to help professional integration, ANDES has also, since 2008, opened professional integration workshops in different wholesale markets across France. These integration workshops are for the processing of fruit and vegetables that otherwise would have been destroyed as being un-saleable in supermarkets.

#### SI Lead organisation

ANDES, Association Nationale de Développement des Epiceries Solidaires

#### SI Objectives

- Help create social and solidarity stores wherever there is a need for them and ensure their long-lasting activity
- Stimulate the solidarity stores network in order to extend its practices, run national estimates and promote these structures to public and private partners, as well as the media
- Develop service for the solidarity stores, especially by proposing workshops on nutrition or team management, and training for volunteers
- Supply stores with quality products by developing national and local partnerships with food industries, hypermarket chains and local cultivators.
- Develop professional integration workshops that help to process gluts in the fruit and vegetable sector for solidarity stores and other food aid organisations.

#### Critical issues

**Economic incentive**: The discount on products is a driver of the initiative's success: solidarity stores are targeted at people with low incomes (the working poor, unemployed, retirees on low pensions, etc) who can't afford to buy food in ‘normal’ supermarkets but who, on the other hand, reluctant to seek charity.

**Social dimension**: The retail activity is an excuse for larger solidarity actions: people can be listened to and make exchanges, seek help and reinforce their self-esteem. In order to help each and every one rebuild links with society, and realise their own value and competences, many activities are organised, such as cooking lessons, cosmetic workshops, parent–children activities, employment reintegration, etc.

**Social inclusion**: One of the main benefits of this innovation is the social inclusion of individuals in need.
3.1.4. State-of-art of sustainable organisational innovations

Organisational innovation is the implementation of a new method in business practices, workplace organisation or external relations to increase performance by reducing administrative costs or transaction costs, improving workplace satisfaction (and thus labour productivity), gaining access to non-tradable assets (e.g. non-codified external knowledge) or reducing costs of supplies (OECD, 2005). This category includes business model innovations such as: financial innovations e.g. for renewable energy; and business / infrastructure models, e.g. car sharing.

Of the 500+sustainable initiatives in CASIPEDIA, some 62 (11%) are organisational innovations with a primary focus on the following top 10 H2020 priority areas:

- Climate change mitigation solutions (48%)
- Resource-efficient sustainable lifestyles (35%)
- Eco-innovation and green economy transition (32%)
- Eco-solutions to reduce raw materials use (27%)
- Climate action by sustainable lifestyle (26%)
- ICT systems improving resource efficiency (19%)
- Raw materials-conscious sustainable lifestyle (18%)
- Strategic intelligence and citizen participation (16%)
- Climate action eco-innovation policies (11%)
- Alternative raw materials (11%)

The top five socioeconomic sectors of relevance to sustainability-oriented organisational innovations are:

- Energy (29%)
- Manufacturing (19%)
- Transport (18%)
- Agriculture (16%)
- Retail (13%)

The CASIPEDIA cases’ objectives were clustered into the following 11 key SI priorities of organisational innovations:

- Implementing energy and water saving practices in schools and working environments.
- Developing future-oriented sustainable strategies for businesses and society.
- Engaging customers in the improvement of the quality and sustainability of business operations.
- Reducing CO2 emissions by promoting responsible procurement and consumption.
- Promoting easier and more efficient waste management practices and procedures.
- Fostering cooperative business models and collaboration in local communities.
- Exchanging information on and managing the surplus of resources in the public sector.
- Optimising the food supply chain for producers and consumers by decreasing intermediaries.
- Gaining access to smart grid projects and technologies stimulating renewable energy production.
- Implementing international e-waste recycling practices, especially in developing countries.
- Encouraging business practices (e.g. teleworking) that reduce traffic/congestion-related pollution.
Figure 4: CASI key terms wheel from 62 sustainable organisational innovations
### 3.1.4.1. Examples of organisational innovations in CASIPEDIA

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<tr>
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<th>Description</th>
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<tr>
<td><strong>Community Shops</strong></td>
<td>Community Shops open in the gaps left by the closure of commercial retail businesses, generally in small rural villages in the midst of social or economic change. They are owned and managed on a cooperative and community-ownership model, and are one of the success stories of the UK co-operative and community enterprise movement. In 1994 there were just 27 community shops trading in the UK; 20 years on there are 309, with a further 18 anticipated. Community ownership in village-scale shopping now represents a rational and achievable solution for communities that face losing all the retail and related services in their community.</td>
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<tr>
<td><strong>Lokalne potravinove komunity /Local food communities</strong></td>
<td>This initiative connects small farmers with local end-use customers. For local farmers, it offers the advantage of more guaranteed output (and stable income), without relying on retailers (thus keeping a higher portion of the added value). Customers get more information on the quality of their food (personal visits to their local farmers are encouraged and supported), and an opportunity to develop more conscious consumption patterns. The initiative supports environmentally friendly agriculture, promoting farming methods that place less stress on the local environment. At the same time, shorter delivery routes from producers to end-users bring additional added value (less energy spent on transport, food processing, cooling, etc.).</td>
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<tr>
<td><strong>Flexible work</strong></td>
<td>Employment statutes aimed at increasing the rights of individual employees to adjust their working hours are now common in high-income countries. The idea is to improve individual performance through an innovative approach to the job and the professional relationship: people come to work only when it is necessary. Moreover, they can better adjust and harmonise the working time with time for private life (family, time off, hobbies, etc.).</td>
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http://www.casi2020.eu/casipedia/cases/1225

http://www.casi2020.eu/casipedia/cases/927

http://www.casi2020.eu/casipedia/cases/950
### 3.1.4.2. Featured study

<table>
<thead>
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<th>Fifty- Fifty</th>
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<td><strong>Innovation Type</strong></td>
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</table>
| **SI Description** | Fifty/fifty is an initiative of over 3500 schools in Germany. Participating schools receive 50% of the energy costs saved through conscious usage, to be used at their discretion. The other 50% remains with the school district. This incentive contributes to environmental and climate protection as well as cost reductions. Climate and energy are the focus of lessons, project days, study groups and excursions.
Ten percent of general education schools are involved. With this project children learn about energy saving and spread the information into their families. As a consequence, the project can be seen as a grassroots approach to educate members of society at a very early stage and, in the long run, to raise awareness of the topic throughout society. |
| **SI Lead organisation** | Unabhängiges Institut für Umweltfragen |
| **SI Objectives** | • Educate children to act as multipliers to spread information about energy saving  
• Save money for the school and its provider  
• Save water and energy  
• Reduce CO2 emissions and invest in solar cells  
• Save energy and water in the children’s homes |
| **Critical issues** | **Coordination efforts:** The project’s main task is consultation with the schools taking part. The huge number of schools involved and the constant changes in the number of such schools, and the associated coordination efforts, make project management a very complex task.  

**Lack of responsibility:** Schools are empowered to save energy and the measures necessary are funded by public authorities. A problem that may arise is that there are no staff members responsible for the continuation of the measures, e.g. taking care of the maintenance of the new devices. This could annul the energy savings.  

**Education about energy topics:** Pupils can be involved in the implementation of energy measures; the topic can be implemented in the curriculum to raise awareness among pupils.
3.1.5. State-of-the-art of sustainable governance innovations

_Governance innovation_ implies new forms of citizen engagement, new democratic institutions, new public and user participation in service design and delivery, and the use of public boards to govern particular choices. They include new political arrangements in local and national governments as well as changes in the organisational form and arrangements for the planning and delivery of public services (Hartley, 2005). Governance innovations also include local policy innovation, i.e. policy transfer from other places; public service reform and efficiency; local/regional public knowledge systems, e.g. city energy/waste maps; and new configurations of public, business and civil sectors.

Of the 500+ sustainable initiatives in CASIPEDIA, some 46 (8%) are governance innovations with a primary focus on the following **top 10 H2020 priority areas**:

- Strategic intelligence and citizen participation (39%)
- Climate change mitigation solutions (39%)
- Resource-efficient sustainable lifestyles (28%)
- Eco-innovation and green economy transition (28%)
- Climate action by sustainable lifestyle (26%)
- Climate change adaptation solutions (20%)
- Climate action eco-innovation policies (20%)
- Eco-solutions to reduce raw materials use (13%)
- Effective raw materials policies (11%)
- ICT to assess and predict climate actions (9%)

The **top five socioeconomic sectors** of relevance to sustainability-oriented governance innovations are:

- Energy (28%)
- Public administration (24%)
- Water (20%)
- Agriculture (17%)
- Manufacturing (15%)

The CASIPEDIA cases’ objectives were clustered into the following nine **key SI priorities of governance innovations**:

- Enforcing **energy**-saving policies promoting the transition towards a post-carbon society.
- Promoting multi-stakeholder engagement in sustainable development actions for the **future**.
- Assessing and mapping businesses’ adaptation and innovative responses to **climate change**.
- Engaging **citizens** in the creation of sustainable municipal strategies and initiatives.
- Developing public **transport** networks and municipality plans promoting sustainable mobility.
- Formulating and implementing policies aimed at decreasing **CO2 emissions**.
- Supporting innovative ways of assessing and improving the quality of **air** and **life**.
- Securing resources to establish and support **renewable** energy and water networks.
- Mapping and monitoring reliable **data** and information on environmental problems and solutions.
Figure 5: CASI key terms wheel from 46 sustainable governance innovations
### 3.1.5.1. Examples of governance innovations in CASIPEDIA

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
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<tr>
<td><strong>Energiepass</strong></td>
<td>The Energiepass is a quality label based on a classification system like the one in place for appliances. Any buyer or tenant has a simple way to assess the energy performance of buildings. A building will be ranked from A to I, taking into account three criteria: 1) thermal insulation (thermal quality of walls, roofs, slabs, windows, etc); 2) energy performance (ventilation, passive solar systems, equipment for heating, hot water, etc); and 3) the emission of CO2. The certificate also contains proposals for improving the energy performance of buildings that may be useful in case of renovation. In such a case, various state financial aids may be requested. Energiepass is increasingly becoming a criterion for evaluating a building during a real estate transaction.</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.casi2020.eu/casipedia/cases/847">http://www.casi2020.eu/casipedia/cases/847</a></td>
</tr>
<tr>
<td><strong>Green Industry Innovation Programme</strong></td>
<td>While Estonia is in the European forefront when it comes to ICT, there is still a lot of potential to be realised in making use of ICT solutions so to achieve the greening of its economy. Building on its competitive ICT advantage, thus, Estonia decided to launch the Green Industry Innovation programme. This seeks to strengthen competence and capacity-building both in its public and private sectors by cooperating and exchanging experiences with its Norwegian counterparts. In this way, the green ICT agenda is divided into four focus areas and challenges which drive the development of green innovations with international potential: energy management systems, transport and logistics, manufacturing and trade, and e-health.</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.casi2020.eu/casipedia/cases/992">http://www.casi2020.eu/casipedia/cases/992</a></td>
</tr>
<tr>
<td><strong>Sustainability and self-sufficiency in Egerág</strong></td>
<td>The municipality manages many projects that support sustainable lifestyles and self-sufficiency. The Startprogramme, the public employment programme of the Hungarian government, was launched in 2012. Using the programme Egerág has integrated its plant-growing, stock-farming and public catering activities. The plant-growing includes forage plants for livestock and horticulture for municipality kitchens, for selling at market and for social usage. The stock-farming includes breeding and fattening of traditional Hungarian pigs. The programme has been very successful and was selected as one of Hungary’s four model projects. In 2013 many families that kept livestock or had gained the required knowledge in 2012 received pregnant sows.</td>
</tr>
<tr>
<td></td>
<td><a href="http://www.casi2020.eu/casipedia/cases/1381">http://www.casi2020.eu/casipedia/cases/1381</a></td>
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</tbody>
</table>
### 3.1.5.2. Featured study

<table>
<thead>
<tr>
<th>Energybook</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Innovation Type</strong></td>
</tr>
<tr>
<td><strong>SI Description</strong></td>
</tr>
<tr>
<td><strong>SI Lead organisation</strong></td>
</tr>
</tbody>
</table>
| **SI Objectives** | • Reduce school energy bills  
• Invest in making school buildings to enhance energy savings, smart sharing of energy and sustainable energy  
• Bring citizens together to think about how they can invest in making their neighbourhoods more sustainable  
• Develop an energy cooperative in which citizens take initiative themselves |
| **Critical issues** | **Citizen engagement**: Energybook is based upon a 'pull-model' in which citizens are invited to proactively initiate projects. Citizens may think that the government has to solve the problem, or think that because it has always been that way it should be that way.  
**Push model**: Dependent on a push model - Ilanga combines a push-model (a communication campaign to push citizens to engage themselves in thinking about how to make their actions and activities more sustainable) and a pull-model like Energybook in which citizens can proactively initiate projects.  
**Return on investment**: All projects are to be cost-effective (from 3% to 6% over a period of 10 to 15 years). Citizens’ savings are not cost-effective. Investing in sustainable projects can increase cost-effectiveness. |
3.1.6. State-of-art of sustainable system innovations

*System innovation* is a set of inter-connected innovations, where each is dependent on the other, with innovation both in the parts of the system and in the ways that they interact (Caulier-Grice et al., 2012). This is rarely achieved through a single organisation or sector, but involves a complex interaction of public policy and reforms to legislation, changes to business cultures and practices, as well as shifts in consumer attitudes and behaviour. System innovations also include combinations of two or more types of innovations but such cases are not always labelled ‘systems’.

Of the 500+ sustainable initiatives in CASIPEDIA, some 31 (6%) are system innovations with a primary focus on the following *top 10 H2020 priority areas*:

- Eco-innovation and green economy transition (35%)
- Resource-efficient sustainable lifestyles (32%)
- Climate change mitigation solutions (29%)
- ICT systems to improve resource efficiency (26%)
- Eco-solutions to reduce raw material use (26%)
- Monitoring and understanding of biodiversity (19%)
- Climate action by sustainable lifestyle (16%)
- Climate change adaptation solutions (13%)
- Solutions for exploring, extracting, processing and recycling (13%)
- Raw materials-conscious sustainable lifestyle (10%)

The *top five socioeconomic sectors* of relevance to sustainability-oriented system innovations are:

- Energy (32%)
- Construction (26%)
- ICT (26%)
- Agriculture (23%)
- Water (19%)

The CASIPEDIA cases’ objectives were clustered into the following seven *key SI priorities of system innovations*:

- Implementing more systemic and efficient solutions in the production of renewable *energy*.
- Developing sustainable platforms and policies to protect natural *resources* in urban and rural areas.
- Reinforcing services and practices that reduce the negative environmental impacts of food *waste*.
- Introducing standard criteria and practices to assess and improve the *quality* of life, water and air.
- Protecting endangered *species* populations and habitats from anthropogenic and other influences.
- Ending the negative impact of animal agriculture and the *food* industry (e.g. emissions, water use).
- Developing *integrated* applications, systems and content promoting resource efficiency.
Figure 6: CASI key terms wheel from sustainable system innovations
### 3.1.6.1. Examples of system innovations in CASIPEDIA

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hollerich Village</strong></td>
<td>Hollerich Village is a 3.6 ha ex-industrial site in the heart of the city of Luxembourg that aims to offer a high quality of life for residents while reducing their environmental impact. The Schuler Group, which wants to turn the village into a ground-breaking pilot to demonstrate how sustainable development can be delivered in practice, manages the eco-district. The overall aim is to create an urban hub that strengthens the local economy and boosts the competitiveness of companies in construction and sustainable development. An action plan explains how energy consumption will be reduced and how 100% of the heat and 20% of the electricity can be generated on-site. Nature and food production are a key part of the action plan, which includes the uncovering and re-naturalising of a river, and a large community garden.</td>
</tr>
<tr>
<td><strong>KWK-Modellkommune NRW 2012 – 2017</strong></td>
<td>KWK-Modellkommune NRW is a funding competition run by the climate protection government department of the German federal state of North Rhine Westphalia. It is part of a state-wide programme to increase the percentage of electricity generated by combined heat and power technology (CHP) by up to 25% by 2020. CHP is a technology that converts combustibles into heat as well as into electricity in a stationary installation. During the contest municipalities in North Rhine Westphalia may apply with a concept to foster the expansion of CHP in their region. The municipalities with the best concepts are granted funding for the implementation of their concepts.</td>
</tr>
<tr>
<td><strong>Energy Efficiency in Low-Income Housing in the Mediterranean - ELIH-Med</strong></td>
<td>ELIH-Med is a strategic project co-financed under the MED Programme. Its attention is focused on energy efficiency in low-income housing (LIH) in the Mediterranean area and on the involvement of residents in energy retrofit in LIH in order to help the MED area reach EU2020 objectives. Partners from seven countries covering the whole Northern Mediterranean coast are working together to improve energy efficiency and promote energy saving in low-income housing in Italy, Cyprus, France, Slovenia, Greece, Spain and Belgium.</td>
</tr>
</tbody>
</table>


### 3.1.6.2. Featured study

<table>
<thead>
<tr>
<th>Passive house kindergarten</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CASIPEDIA URL</strong></td>
</tr>
<tr>
<td><strong>Innovation Type</strong></td>
</tr>
</tbody>
</table>

#### SI Description

Gabrovo Municipality is a leader in Bulgaria regarding the implementation of energy-efficiency practices. Seven schools, ten kindergartens and a nursery feature in the projects of the municipality where energy efficiency measures have been introduced. The kindergarten ‘Sun’ was built to the passive house standard. The construction work was completed in seven months. The planning of the building was assigned to the architectural studio SolAir International Ltd., assisted by EcoEnergy and EnEffect. With the implementation of the project the team members were certified by the Passive House Institute. After testing the air-tightness, detailed inspection of all project documentation and all construction materials and technological equipment directly related to energy consumption for heating and ventilation, the building was certified as a ‘passive house’ by the Darmstadt Institute. This is the only building in Bulgaria currently holding this highly prestigious certificate.

#### SI Lead organisation

Gabrovo Municipality

#### SI Objectives

- increase energy efficiency in buildings and thus reduce their environmental impact
- support economic development that is in line with the principles of sustainability and efficient use of natural resources

#### Critical issues

- **Adoption of a new standard/model:** The benefit/opportunity from showcasing the advantages of passive house kindergartens lies in the possibility of adopting the model and approving it as a standard in the construction of such buildings.

- **Environmental awareness and healthcare, energy efficiency, economically sound construction projects:** Environmental awareness and healthcare, energy efficiency, economically sound construction projects.

- **Reduced costs, improved efficiency:** The SI showcases reduced costs of electricity (and/or heating).
3.1.7. State-of-art of sustainable marketing innovations

*Marketing innovation* is the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing (OECD, 2005). Sustainable marketing innovations are aimed at better positioning the social, economic and environmental benefits of new or improved products, services and processes.

Of the 500+ sustainable initiatives in CASIPEDIA, 19 (3.5%) are marketing innovations with a primary focus on the following **top 10 SI priority areas**:

- Climate action by sustainable lifestyle (63%)
- Resource-efficient sustainable lifestyles (42%)
- Eco-solutions to reduce raw materials use (37%)
- Eco-innovation and green economy transition (37%)
- Raw materials-conscious sustainable lifestyle (32%)
- Strategic intelligence and citizen participation (21%)
- Solutions for cultural heritage assets (16%)
- Climate change mitigation solutions (16%)
- Monitoring and understanding biodiversity (11%)
- Climate action eco-innovation policies (11%)

The **top five socioeconomic sectors** of relevance to sustainability-oriented marketing innovations are:

- Manufacturing (42%)
- Retail (32%)
- Agriculture (26%)
- Accommodation and Food (26%)
- Health/Social services (21%)

The CASIPEDIA cases’ objectives were clustered into the following five **key SI priorities of marketing innovations**:

- Promoting organic food products and healthy lifestyles.
- Increasing consumer awareness of sustainable shopping practices.
- Developing eco-labels and applications for sustainable businesses (e.g. mapping location, services).
- Sharing information on sustainable communities, lifestyles and initiatives (e.g. helping refugees).
- Reducing waste stream to landfills to a minimum by certifying sustainable packaging and recycling.
Figure 7: CASI key terms wheel from 19 sustainable marketing innovations
### 3.1.7.1. Examples of marketing innovations in CASIPEDIA

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Greenearn loyalty card</strong></td>
<td>Greenearn is the first environmental strategic alliance to offer a socially and environmentally responsible loyalty programme. It positions itself as the first company in Luxembourg to offer a sustainable loyalty card service. The programme rewards consumers’ eco-responsibility. Greenearn also develops related services: a) green marketing; b) sustainable communication; and c) sustainable development strategy. The sustainable loyalty card is also available on a mobile application. It can be used with several labels and companies. Private consumers and employees, known as members, are rewarded for their purchase of sustainable products. Purchase of sustainable products and services generate environmental credits. (1 green point = 0.01 EUR) These points are then exchanged for a bonus or other financial benefits at Greenearn partners.</td>
</tr>
<tr>
<td><strong>Sustainable alternatives to the current range of packaging</strong></td>
<td>Halen Mon were awarded a ReMake eco-innovation voucher to develop a more environmentally friendly packaging solution to those currently used for their products. The project used the eco-design compass (Fussler and James, 1996) that considers Service, Durability, Re-use, Mass, Energy, Safety and Resource-use. The output of this work was that overall the company could make both notable environmental improvements and cost savings through the alternatives identified. The managing director expressed sheer delight that the completed project looks like it will reduce unit cost, increase the profile on shelf, save Co2 and packaging and reduce stock holding costs in both square metres and in absolute cost, and improve lead time to deliver orders to customers.</td>
</tr>
<tr>
<td><strong>CUD MIÓD BOX</strong></td>
<td>CUD MIOD BOX is subscription box which contains only organic food from Polish producers. The box is delivered once in a month to subscribers’ houses. The content of the box is kept secret and every month the subscriber gets a surprise. CUD MIÓD Box is an innovative way of promoting organic food and a sustainable life style.</td>
</tr>
</tbody>
</table>
### 3.1.7.2. Featured study

**ECOverified**


<table>
<thead>
<tr>
<th>Innovation Type</th>
<th>Marketing</th>
</tr>
</thead>
</table>

**SI Description**

ECOverified was established with ambitions for a greener future. It is specialised in providing unique environmental and energy assessments. It summarises the results of these assessments in the form of an Ecolabel and also certifies products and services in order to provide a complete ecological package for the hospitality industry. Ecoverified is also creating and participating in social issues.

**SI Lead organisation**

ECOverified

**SI Objectives**

- Provide unique environmental and energy assessments
- Create an Ecolabel for the participating businesses
- Certify products and services as eco-friendly in cooperation with universities
- Advertise hotels that have gained its Ecolabel via online booking agents such as familygoesout, booking.com, etc.
- Create an NGO that will have a social impact by participating in causes such as ‘Adopt a tree in Greece’, food for refugees, 3D printed accessories, etc. Give holidaymakers the chance to adopt sea turtles, see them and learn about them
- Create an application that will map eco-friendly locations and businesses. Greece will be the starting point, hoping to expand to other countries as well
- Find alternative solutions for regions where recycling is not carried out, i.e. small islands
- Create a map with all the eco-related activities that are available

**Critical issues**

- **Because of the economic crisis many companies are interested in green solutions but cannot afford to invest money in sustainable solutions:** Also sometimes raw materials have a very low cost, which makes it unsustainable from an economical point of view to purchase environmentally-friendly products.

- **Geographical boundaries causing problems in applying solutions:** In several areas like the Greek islands it is nearly impossible to recycle and as a result Ecoverified is doing its best to find alternative solutions. For example, if plastic bottles made of PET cannot be recycled and water is not drinkable in the area, vast amounts of refuse are collected. Instead of created refuse they have discovered that the University of Rotterdam has used PET for 3D printers; ECOverified advises hotels to do so too. Their guests will be able to turn their used water bottles into customised 3D souvenirs, the sales of which provide extra income for the hotel.

- **Some areas have difficulty achieving an ecolabel, as a result of physical constraints:** These include areas that are heavily polluted, or areas that do not have the luxury of recycling, etc.
3.2. Assessment of impacts and systemic sustainability of innovations

The assessment of impacts or systemic sustainability might not be difficult in principle if there was high quality evidence, modelling, monitoring and analysis. However, in practice few of these exist, even for large technology R&I or corporate schemes. Furthermore ‘transformation’ is the most challenging criterion, as it raises questions about how to best measure impacts: from a marginal improvement within the existing system, to a more fundamental structural change in multiple dimensions (technological, economic, ecological, policy, social, etc.), with radical implications for the status quo. In the CASI project, such transformations are assessed on a ‘best available’ basis, in a frame which is suited to the sustainable innovation, so that a large corporate product improvement can be contrasted on the same basis as a village school’s social project. ‘Individual development’ transformations include civil liberties, gender equality, self-determination, education, health and behaviour change. Also we have to be careful regarding the difference between transformations which are expected, achieved, or in progress, or those which happen downstream as a result of other transformations. More detailed case-by-case analysis would look for patterns in which transformations might be multiple and inter-connected, which is one way to frame the ‘sustainability’ in SI. Table 1 is quite evenly spread but demonstrates some topical issues:

- Social SI types produce social transformations but also many ‘individual’-level and environmental transformations.
- Service SI types appear to have a strong focus on economic and ‘infrastructure’ systems, suggesting a positive link with possible policy implications. Governance types also have this link but it is weaker.
- Product and System SI types are shifted away from social and government types towards infrastructure, environment and economic transformations.
- Organisational and Marketing SI types appear very weak in government as well as environment and resource systems.

Examples (see references to CASIPEDIA at the end of the report) include: The Rediscovery Centre (IE) achieves multiple transformations in environmental, social and economic domains. Smart Grid Island (MT) is a complete system of smart meters and grid management for energy and water across a small island, again with multiple transformations. In contrast, Less Plastics in Bottled Water (RO) is a specific improvement with 25% embodied carbon reduction in the product.

Implications: for policy makers and managers of infrastructure, it is significant that ‘Services’ are the most significant SI type; this suggests that ‘sustainable infrastructure’ is not only a physical function but a set of services and ‘relationships’ between stakeholders. Likewise, for managers of environmental and resource systems, System SI types appear very strong, which suggests that the systemic approach to complex inter-connected problems is the most effective.

<table>
<thead>
<tr>
<th>Economic system</th>
<th>Social SI</th>
<th>Service SI</th>
<th>Product SI</th>
<th>Governance SI</th>
<th>Organisational SI</th>
<th>System SI</th>
<th>Marketing SI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>16%</td>
<td>20%</td>
<td>26%</td>
<td>20%</td>
<td>27%</td>
<td>25%</td>
<td>28%</td>
</tr>
<tr>
<td>Infrastructure system</td>
<td>13%</td>
<td>18%</td>
<td>19%</td>
<td>17%</td>
<td>16%</td>
<td>18%</td>
<td>32%</td>
</tr>
<tr>
<td>Government system</td>
<td>6%</td>
<td>9%</td>
<td>9%</td>
<td>17%</td>
<td>9%</td>
<td>11%</td>
<td>1%</td>
</tr>
<tr>
<td>Social system</td>
<td>22%</td>
<td>17%</td>
<td>9%</td>
<td>17%</td>
<td>16%</td>
<td>8%</td>
<td>14%</td>
</tr>
<tr>
<td>Individual development</td>
<td>24%</td>
<td>17%</td>
<td>12%</td>
<td>14%</td>
<td>17%</td>
<td>9%</td>
<td>11%</td>
</tr>
<tr>
<td>Environment and resource</td>
<td>18%</td>
<td>19%</td>
<td>26%</td>
<td>15%</td>
<td>15%</td>
<td>29%</td>
<td>12%</td>
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Table 1: Types of transformation in the mapped CASI cases

100% 100% 100% 100% 100% 100% 100%
3.3. Assessment of common players’ roles in sustainable innovation

The role of sponsors

National and regional governments are the principal sponsors of SI (see Diagram 1). Our mapping also shows a high rate of sponsorship among business actors. Not-for-profit organisations and the European Union present only moderate figures. Very few sponsoring initiatives have been identified in research and education, which doubtless indicates how weak are the connections between research and innovation in higher education institutions. The low rate shown among civil society actors reflects the fact that society is nowadays still a recipient of innovation rather than an initiator of it. Although CASIPEDIA also shows interesting society-led initiatives, the figures show that, thus far, citizens still feel more comfortable in adopting a passive role.

As for the sponsoring modalities, the most important activity is the financing of innovation (see Diagram 2). Open calls and grants from government are currently used by regional and national authorities as useful supply-side instruments to foster innovation. Public finance decisions are normally channelled through research councils and funding agencies. Sponsored themes configure the public research agenda and largely depend on exercises of participatory governance like foresight and stakeholder consultations. Another important sponsoring function relates to the endorsement of research and innovation activities. In other cases, public institutions facilitate the convergence and gathering of innovators’ common interests around a shared representation of interests. This may contribute to achieving a more consistent and stronger position of innovators to deal with political lobbies and to negotiate further support from European authorities and public funders.
The role of innovators

Business is the actor that presents the biggest number of innovation initiatives. This is not a surprising result, especially since innovative firms cover a very wide spectrum of sectors and economic areas. Regardless of the new types of innovation that have emerged during the past decade (innovation nowadays embraces very different solutions to societal problems, e.g. from social, service, organisational, marketing, or technological perspectives) companies remain the principal actors in terms of innovation management. This applies both to knowledge-intensive or purely industrial and manufacturing firms. All the other actors, with the exception of the European Union, which may be exclusively considered a sponsor, have similar level of innovativeness (Diagram 3).

When analysing functions and roles, we may find that the most important activity is clearly related to the development of innovation. This implies different subsequent activities inherent to the innovation process, like financing the innovation, designing the innovation process, testing and piloting solutions, creating staff capacities and building new capabilities, and disseminating and commercialising the innovation. The low percentage associated with accreditation and IPR aspects is quite surprising, especially if we consider the critical role that certification and regulation aspects have when introducing innovation to some sectors, like agro-food or pharmaceuticals, or the relevance that intellectual property rights have (in all sectors) for the successful completion of the commercialisation of innovation in foreign countries (Diagram 4).
The role of users

Civil society is the chief user of innovation. This is based on the fact that civil society embraces consumers’ and users’ associations. We should also note that business actors, apart from being very active innovators, are also important adopters or consumers of innovation, which to some extent reflects the strength of business-to-business innovation modalities. Diagram 5 also shows that national and regional governments are important users of innovation. Non-state actors and research and education institutions make only moderate use of innovative solutions.

Diagram 5: Users of innovation

Diagram 6 shows the practical utilisation of innovation to be the main benefit of every innovation process. Making pragmatic use of innovation is a consequence or a reaction to the practical difficulties generally associated with the innovation endeavour. In fact, it seems that getting practical benefits from innovation has more relevance for the innovator than other benefits like establishing and consolidating a good reputation, improving networking, or improving one’s abilities and skills for market competition. Disseminating activities are also considered important and relevant tasks in the innovation diffusion process, inasmuch as they rely intensively on the activity of users and consumers. A good and responsible conception of innovation among users and consumers is critical, and constitutes an aspect over which the innovator needs to have permanent and adequate control.

Diagram 6: Benefits of innovation
The role of supporters

Businesses are the actors that most strongly support SI processes. This may be a consequence of their entrepreneurship and a reasonable answer to every innovator’s ambition to make innovation outcomes long-lasting. National and regional governments, non-state actors, and research and education actors show similar levels of innovation support. In comparison with other actors, civil society and the European Union present the lowest supporting levels (Diagram 7).

Supporting and incentivising innovation is associated with the activity of multiple actors, for example venture capital institutions, credit institutions, research funding institutions, national and local governments, crowd-funding associations, non-profit organisations, technology transfer offices, training organisations, networking organisations, IPR facilitators, and accreditation and certification entities. According to Diagram 8, dissemination activities are probably the most important activity in supporting innovation, together with other endorsement and capacity-building initiatives.
3.4. Assessment of common features of sustainable innovation

From the overview of seven types of sustainable innovation above, the next step is to explore the evidence from CASIPEDIA.

This takes the form of a cross-cutting analysis, mapping across SI types to stakeholder types, upstream factors, downstream factors and final outcomes. From the analysis of the 202 full cases and 548 ‘nomination’ cases, some common features are clear. The patterns are shown mainly by analysis of ‘counts’, or in some cases ‘rating scales’, across all cases in CASIPEDIA, based on 10 main analytical views. These include:

- Stakeholder involvement in the design/development of SI;
- Stakeholder involvement in using/benefiting from SI;
- Degree of mutual learning processes;
- Common factors of success;
- Common drivers/trends;
- Common barriers;
- Common strengths and weaknesses;
- Common opportunities and benefits;
- Common threats and risks;
- Common impacts and transformations.

In each case, we show a few selected examples to illustrate the findings and explore some key implications for SI policy. Then the matrix shows in colour graphics the statistical correlations between SI types and other fields (generally with green=positive or strong links, and red=weak or negative linkages).

This type of analysis brings some topical issues and ongoing questions on SI to the surface:

- Many SI cases are not easy to put into simple categories; rather they cross over between social, service, policy or system types.
- This suggests that these seven categories of ‘SI type’ are just a starting point, and that the inter-connections between them demonstrate a more significant picture of SI potential.
- More widely, this reflects the nature of the SI problem. For instance, the example of Actyva (ES) shows that ‘food’ is a hugely complex field with global/local, technology/social/economic/policy, consensus and conflict, and many more issues all tangled together. A typical SI will address part of this bigger picture, but to fully succeed in its aspirations it will aim for wider system-level influence.
- This makes an individual SI possibly riskier and vulnerable to failure, even while the potential rewards and transformations are wider.
- It also means that assessment or evaluation of impacts is not only a technical measurement task, but a more complex issue which calls for evidence from right across the TEEPSE categories (which in reality is generally very patchy).

In the background there is a general issue on common innovation types found in different categories above, or which are on the borderline between them. That is to say the categories and SI types are not always well suited to reality. For instance, ‘design innovation’, like building design, cultural or ecological design, is often seen by designers as real innovation, and may in reality be a strong component of SI, but it is not always recognised as innovation by SI policy. ‘ICT innovation’, in many cases is the catalyst for many of the above SI cases. Here there is a huge range of activities, such as social media, smart phone/mobile technology, machine-learning and big data algorithms, smart grid/city/education applications, etc. Many of these are fundamental to SI types, particularly in social, service or system types, but again they don’t feature directly in the SI literature. Future Emerging Technologies and various kinds of Blue Skies innovation do not often appear in the CASI cases. The scope and mandate of the first round of cases mapped in CASI was drawn more around visible SI in their implementation and diffusion stages, rather than
the conceptual and piloting phases. Nevertheless, a few exceptions were made to make sure at least six cases per EU Member State were included.

3.4.1. Stakeholder involvement in the design/development of SI

Here we look at which types of stakeholder are the most active in the early stages of design and development.

The most common SI types are the Social SI, followed by the Service SI (see Table 2). However, many cases identify more than one type, so it is possible that SI based on ‘systems thinking’ is more common than is suggested by these numbers. Overall, there are significant differences in the origins, design and development of SI cases. Social SI are mainly from the CSO sector, with many also from RES and NSA. The largest source of Service SI and Product SI is the private sector (i.e. BUS), followed by RES and GOV. Governance SI types originate first in the CSO sector, and then with GOV, (with the EU lower down). Organisational and System SI cases are spread between BUS and GOV, with CSO and EU developers also quite common. So for the bigger picture:

- Business and CSO are the most important developers of SI: BUS appears in all types, and CSO particularly in Social and Governance types.
- RES is highly involved in Product but also in Social SI.
- GOV is particularly important for System SI: with implications for SI promoters.
- The EU and NSA appear less important: it seems likely they are more involved at the agenda-setting and funding stages (upstream) or policy-implications and transfer stages (downstream).

Some examples will demonstrate our point: Community Shops (UK) originates in the CSO and cooperative sector; Blue Shock Bikes (LT) originates from BUS and its success is in participative design and development; Participatory Budget (SK) originates from GOV and involves others in systems thinking on priorities.

Some implications: clearly all sectors are important in the design and development of all types of SI. The role of the Governance sector is highlighted for System level SI, i.e. to generate innovation which is beyond the remit of any other sector. The role of the CSO sector is, as expected, crucial for Social SI, and would benefit from support and stability in funding regimes.

### Table 2: Stakeholder involvement in designing/developing the SI

<table>
<thead>
<tr>
<th></th>
<th>CSO</th>
<th>BUS</th>
<th>RES</th>
<th>GOV</th>
<th>EU</th>
<th>NSA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social SI (47 cases)</strong></td>
<td>83%</td>
<td>53%</td>
<td>62%</td>
<td>38%</td>
<td>26%</td>
<td>60%</td>
</tr>
<tr>
<td><strong>Services SI (43 cases)</strong></td>
<td>51%</td>
<td>79%</td>
<td>49%</td>
<td>53%</td>
<td>40%</td>
<td>30%</td>
</tr>
<tr>
<td><strong>Product SI (37 cases)</strong></td>
<td>22%</td>
<td>81%</td>
<td>73%</td>
<td>57%</td>
<td>38%</td>
<td>19%</td>
</tr>
<tr>
<td><strong>Governance SI (25 cases)</strong></td>
<td>80%</td>
<td>60%</td>
<td>44%</td>
<td>72%</td>
<td>36%</td>
<td>48%</td>
</tr>
<tr>
<td><strong>Organisational SI (22 cases)</strong></td>
<td>59%</td>
<td>68%</td>
<td>45%</td>
<td>55%</td>
<td>45%</td>
<td>18%</td>
</tr>
<tr>
<td><strong>System SI (16 cases)</strong></td>
<td>56%</td>
<td>81%</td>
<td>63%</td>
<td>88%</td>
<td>56%</td>
<td>31%</td>
</tr>
<tr>
<td><strong>Marketing SI (3 cases)</strong></td>
<td>67%</td>
<td>100%</td>
<td>33%</td>
<td>67%</td>
<td>33%</td>
<td>33%</td>
</tr>
</tbody>
</table>

**Key:** CSO: Civil Society Organization; BUS: Business actor; RES: research and education; GOV: Government; EU: European Union; NSA: Non-state actor
3.4.2. Stakeholder involvement in using/benefiting from SI

This profile of ‘users and beneficiaries’ of SI provides an interesting view of how we understand ‘involvement in using/benefiting from SI’: it includes businesses who sell a product innovation, the customers who buy it and policy-makers with wider goals for society (see Table 3).

- Overall, the CSO sector appears to be the most common user/beneficiary type, not only for Social SI as expected, but for Services, Products and Governance SI types.
- Business is not far behind as a user and beneficiary, with very high interests in System SI.
- The RES and GOV sectors are less prominent, in contrast to their more upstream role as designers and developers of SI.
- The EU is involved with 50-60% of SI, which perhaps reflects the wider social/environmental objectives of many SI cases.
- The NSA sector appears the least involved in most types, except for Social SI cases: this suggests a possible non-flexibility and lack of capacity in organisational change to respond to other SI types.

Examples: WAI (ES) is a business producing recycled materials with benefits for all sectors; Goldfinger (UK) is a CSO operation with benefits for the deprived, artists and environment managers; Tallinn Free Transport (EE) is a government scheme with benefits for many stakeholders across the city.

Implications: CSOs, with their typical ‘sustainability’ mandate, seem the most capable of mobilising and realising the potential benefits of various SI types, particularly for Social SI. In contrast, the NSAs appear not to be well connected with the benefits of most SI, and this could be a policy agenda for the future. Meanwhile the System SI types are strong in the BUS sector, which suggests that business can be more forward-thinking with the right incentives.

Table 3: Stakeholder involvement in using/benefiting from the SI

<table>
<thead>
<tr>
<th></th>
<th>CSO</th>
<th>BUS</th>
<th>RES</th>
<th>GOV</th>
<th>EU</th>
<th>NSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social SI (47 cases)</td>
<td>98%</td>
<td>68%</td>
<td>70%</td>
<td>55%</td>
<td>49%</td>
<td>68%</td>
</tr>
<tr>
<td>Services SI (43 cases)</td>
<td>88%</td>
<td>81%</td>
<td>49%</td>
<td>60%</td>
<td>49%</td>
<td>30%</td>
</tr>
<tr>
<td>Product SI (37 cases)</td>
<td>81%</td>
<td>84%</td>
<td>76%</td>
<td>51%</td>
<td>62%</td>
<td>27%</td>
</tr>
<tr>
<td>Governance SI (25 cases)</td>
<td>92%</td>
<td>76%</td>
<td>68%</td>
<td>64%</td>
<td>48%</td>
<td>24%</td>
</tr>
<tr>
<td>Organisational SI (22 cases)</td>
<td>73%</td>
<td>82%</td>
<td>64%</td>
<td>59%</td>
<td>59%</td>
<td>23%</td>
</tr>
<tr>
<td>System SI (16 cases)</td>
<td>88%</td>
<td>94%</td>
<td>69%</td>
<td>81%</td>
<td>50%</td>
<td>31%</td>
</tr>
<tr>
<td>Marketing SI (3 cases)</td>
<td>100%</td>
<td>100%</td>
<td>67%</td>
<td>67%</td>
<td>67%</td>
<td>67%</td>
</tr>
</tbody>
</table>
3.4.3. Common factors of success

Each case in CASIPEDIA listed its ‘success factors’, i.e. positive inputs, influences, resources, communities, institutions and other effects, and these factors were classified by the TEEPSE framework. In some cases there are questions on the definition of ‘success’, (i.e. for whom, where, how much, etc). Table 4, giving the ‘Most Common Factors of Success’, shows a concentration in the Social, Environmental and Economic types on the left hand side.

- Social Factors of success appear in over 90% of Social SI; they also score highly in other SI types, except for Product SI.
- Environmental Factors are found in 60-70% of all SI types, with the exception of Organisation SI.
- Economic Factors are found in all SI types, although less in Social SI. This suggests that economic viability is an important factor for most, except purely non-profit or voluntary sector cases.
- Technology Factors are very concentrated in the Product SI types. Likewise, Policy Factors are focused on Governance SI types, with little overlap to others.
- ‘Spatial’ Factors, in the sense of local or urban/rural proximity, did not feature so highly.
- ‘Ethical’ Factors appear to have less influence, with only 28% of Social SI, and it seems that ethical factors have more output than input (with the exception of marketing cases).

Some examples: Living Lab Stapeln (SE) is a cultural space for creative sustainability, with strong social factors. Energybook (BE) is a social/economic innovation to enable technology/policy innovation. Global Forest Watch (USA) is a global platform with all-round success factors, including social, environmental, economic, technology, policy, spatial and ethical.

Some implications: Social factors such as human relations, human resources, user communities, supply chain networks, and so on, seem to be the overall priority, and this fits with current thinking on business or social enterprise models which prioritise the human side. Environmental factors are strong in the System cases, Economic factors in the Service cases, and Tech factors in the Product cases: all this suggests that a systemic view of environmental innovation policy should focus on these inter-connections.

Table 4: Common factors of success

<table>
<thead>
<tr>
<th></th>
<th>Tec</th>
<th>Eco</th>
<th>Env</th>
<th>Pol</th>
<th>Soc</th>
<th>Eth</th>
<th>Spa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social SI (47 cases)</td>
<td>21%</td>
<td>49%</td>
<td>64%</td>
<td>19%</td>
<td>91%</td>
<td>28%</td>
<td>28%</td>
</tr>
<tr>
<td>Services SI (43 cases)</td>
<td>47%</td>
<td>79%</td>
<td>67%</td>
<td>44%</td>
<td>72%</td>
<td>23%</td>
<td>16%</td>
</tr>
<tr>
<td>Product SI (37 cases)</td>
<td>76%</td>
<td>70%</td>
<td>68%</td>
<td>19%</td>
<td>32%</td>
<td>14%</td>
<td>24%</td>
</tr>
<tr>
<td>Governance SI (25 cases)</td>
<td>40%</td>
<td>68%</td>
<td>64%</td>
<td>68%</td>
<td>72%</td>
<td>4%</td>
<td>28%</td>
</tr>
<tr>
<td>Organisational SI (22 cases)</td>
<td>32%</td>
<td>59%</td>
<td>45%</td>
<td>32%</td>
<td>77%</td>
<td>23%</td>
<td>14%</td>
</tr>
<tr>
<td>System SI (16 cases)</td>
<td>56%</td>
<td>63%</td>
<td>88%</td>
<td>44%</td>
<td>63%</td>
<td>6%</td>
<td>25%</td>
</tr>
<tr>
<td>Social SI (47 cases)</td>
<td>33%</td>
<td>67%</td>
<td>67%</td>
<td>0%</td>
<td>67%</td>
<td>67%</td>
<td>0%</td>
</tr>
</tbody>
</table>
3.4.4. Common drivers/trends

The ‘drivers/trends’ analysis provides a contrasting view to the ‘success factors’: it looks at the context, landscape and motivations for each SI case in CASIPEDIA, for each stage of the process, i.e. from conception to design, development, deployment and diffusion. Table 5 shows how the Economic and Social drivers are predominant:

- Services SI cases are mainly linked to Economic drivers/trends, suggesting a focus on business opportunities.
- Product cases are focused on Environmental drivers/trends, with priority for environmental improvements.
- Governance cases are driven by policy objectives and aspirations, but also by Social innovation opportunities.
- Organisational SI are both Economic and Social in origin, while System SI cases are spread around various categories.

Some examples: Mobil4you (DE) is a responsive transport system, driven by demographic trends and mobile tech advances. Meal-Up (IT) is a smart school catering system, driven by public efficiency pressures and changing diet patterns. Circular Economy 100 (INT) is driven by awareness of planetary boundaries, cost saving in business, and public policy for employment and local economies. Quantum Storage (IE) builds on trends in materials science to provide a system-level energy infrastructure.

Some implications: SI policy and innovation systems need to be aware of these drivers/trends, in order to target their support. Where Economic drivers are dominant, i.e. cost savings or business opportunities, the SI will be shaped around them. If Social drivers are important then Governance and Organisational SI types can benefit from that linkage. For Policy objectives it appears that System-type SI also brings opportunities.

Table 5: Common drivers

<table>
<thead>
<tr>
<th>SI Type</th>
<th>Tec</th>
<th>Eco</th>
<th>Env</th>
<th>Pol</th>
<th>Soc</th>
<th>Eth</th>
<th>Spa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social SI (47 cases)</td>
<td>9%</td>
<td>28%</td>
<td>43%</td>
<td>17%</td>
<td>66%</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Services SI (43 cases)</td>
<td>21%</td>
<td>56%</td>
<td>30%</td>
<td>28%</td>
<td>28%</td>
<td>7%</td>
<td>2%</td>
</tr>
<tr>
<td>Product SI (37 cases)</td>
<td>22%</td>
<td>41%</td>
<td>57%</td>
<td>24%</td>
<td>19%</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Governance SI (25 cases)</td>
<td>12%</td>
<td>32%</td>
<td>20%</td>
<td>60%</td>
<td>56%</td>
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<td>0%</td>
</tr>
<tr>
<td>Organisational SI (22 cases)</td>
<td>18%</td>
<td>45%</td>
<td>18%</td>
<td>36%</td>
<td>41%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>System SI (16 cases)</td>
<td>25%</td>
<td>56%</td>
<td>31%</td>
<td>44%</td>
<td>13%</td>
<td>0%</td>
<td>6%</td>
</tr>
<tr>
<td>Marketing SI (3 cases)</td>
<td>67%</td>
<td>67%</td>
<td>67%</td>
<td>33%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
3.4.5. Common barriers

The ‘barriers’ to the SI cases often require more investigation, as public communications or corporate websites often look only at successes. In CASI, complete ‘failures’ were not studied directly, however a closer look at the cases shows that: (a) many experience difficulties during or after the innovation process; (b) some are quite short-lived and actually demonstrate ‘what can go wrong’; (c) some are apparently long-lived because they fail to achieve deployment in the mainstream, and stay in the ‘innovation’ box. Table 6 on ‘Barriers’ shows an interesting contrast to the previous table:

- Economic barriers are clearly the most challenging for 60-70% of SI cases in most types. The majority of Social SI cases clearly struggle with funding, but it is noticeable that Product SI and System SI also do so. However, Services SI and Organisational SI show fewer problems with economic barriers.
- Social barriers (with various definitions) start with Social SI types, suggesting that personality conflicts or ideological splits are common in such cases, particularly in the CSO sector. Social barriers are also problematic in Governance and Organisation SI, where the structural/behavioural problems of policy implementation and organisational change can be very challenging.
- Technology barriers are a top issue only for Product SI, but also affect Systems SI and Services SI types: various cases mentioned problems of scale or deployment, particularly with larger technology systems and infrastructures.

Some examples: in the National Industrial Symbiosis Program (NISP) (UK) a very successful model seemed to be misunderstood by government departments and crossed their boundaries, so public funding was stopped. Humana-Nova (CR) is a social enterprise for disabled people, with logistical and funding barriers. V-Feather (EU) is a complete electric modular vehicle system, with barriers to overcome in technology lock-in and sunk industrial investments.

Implications: funding is generally at the top of the list of barriers, as expected for most SI types, for concept stage, R&D or deployment. However, Services SI and Organisational SI seem to be less affected, and this might suggest that, where money is tight, there might still be ways forward in the innovation process. Social-type barriers are also high in many cases with communications and human resource problems. This calls for future research on management models, guidance and templates to manage the typical social stresses of SI. Such research should also look at new opportunities to overcome funding barriers, e.g. crowd-funding, ecosystems service payments, community finance, etc.

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Tec</th>
<th>Eco</th>
<th>Env</th>
<th>Pol</th>
<th>Soc</th>
<th>Eth</th>
<th>Spa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social SI (47 cases)</td>
<td>9%</td>
<td>62%</td>
<td>11%</td>
<td>23%</td>
<td>55%</td>
<td>2%</td>
<td>15%</td>
</tr>
<tr>
<td>Services SI (43 cases)</td>
<td>28%</td>
<td>44%</td>
<td>9%</td>
<td>35%</td>
<td>30%</td>
<td>2%</td>
<td>5%</td>
</tr>
<tr>
<td>Product SI (37 cases)</td>
<td>43%</td>
<td>73%</td>
<td>0%</td>
<td>22%</td>
<td>19%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td>Governance SI (25 cases)</td>
<td>12%</td>
<td>48%</td>
<td>4%</td>
<td>60%</td>
<td>56%</td>
<td>0%</td>
<td>4%</td>
</tr>
<tr>
<td>Organisational SI (22 cases)</td>
<td>18%</td>
<td>36%</td>
<td>0%</td>
<td>36%</td>
<td>45%</td>
<td>0%</td>
<td>9%</td>
</tr>
<tr>
<td>System SI (16 cases)</td>
<td>31%</td>
<td>69%</td>
<td>25%</td>
<td>13%</td>
<td>25%</td>
<td>0%</td>
<td>6%</td>
</tr>
<tr>
<td>Marketing SI (3 cases)</td>
<td>33%</td>
<td>67%</td>
<td>0%</td>
<td>0%</td>
<td>33%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
3.4.6. Common strengths and weaknesses

The range of ‘strengths and weaknesses’ vary from case to case: the list below is drawn from the innovation literature and from user feedback. It aims to describe the underlying innovation qualities of the SI outcomes (rather than their direct and tangible results), along the innovation process from conception and design to deployment and diffusion. Table 7 shows the average of all case ratings, with strength/weakness on a common scale (it is possible that ‘weaknesses’ might be under-reported, as with ‘barriers’). Generally:

- Geographical replicability is a major strength across all SI types, suggesting a good selection of SI cases (i.e. avoiding those which only work in one place or country). To follow this up needs further study of the ‘innovation transfer’ effect, particularly for smaller countries or remote areas, which may import ideas which are mainstream but innovative in that location.
- Novelty and timing are also major strengths (although this may be embedded in the criteria for innovation and case selection).
- Reconfiguration and ‘rewriting the rules’ are strengths in some and lacking in other SI cases.
- Complexity and IPR protection are on average significant weaknesses (although ‘major weaknesses’ are rare in the selected cases); organisational complexity shows up here, and IPR issues in service SI types.

Examples: Reparatur-und-Service (AT) is a model for repair and re-use for resource efficiency and social inclusion, with strengths in replicability and reconfiguration of production and consumption. The Sustainability Observatory (Porto) (PT) has strengths in robust platform design and sectoral applicability. In contrast, some common weaknesses are shown by Hollerich Village (LU), where integrated sustainability appears very complex and raises IPR questions, and by myEcoCost (EU) which aims to communicate complex technical details from a very large database.

Implications: innovation policy could adapt and extend its scope, to cover sustainability issues and their typical strengths and weaknesses. For instance, Replicability/transfer/exchange mechanisms could be improved, particularly for Social SI types with very similar versions in different countries. Reconfiguration is the aim of many Social and Systems SI types, but needs Governance innovation to support it. IPR protection is a weakness, particularly in the Service SI types, and new models of IPR are called for.

Table 7: Common strengths and weaknesses of SI initiatives

<table>
<thead>
<tr>
<th></th>
<th>Soc SI</th>
<th>Ser SI</th>
<th>Pro SI</th>
<th>Gov SI</th>
<th>Org SI</th>
<th>Sys SI</th>
<th>Mar SI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographical replicability</td>
<td>2.5</td>
<td>2.6</td>
<td>2.1</td>
<td>2.0</td>
<td>2.9</td>
<td>2.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Novelty</td>
<td>1.8</td>
<td>2.3</td>
<td>2.5</td>
<td>1.8</td>
<td>2.0</td>
<td>2.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Timing</td>
<td>1.8</td>
<td>2.3</td>
<td>1.8</td>
<td>1.2</td>
<td>1.6</td>
<td>1.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Reconfiguring production/distribution/consumption</td>
<td>1.5</td>
<td>1.2</td>
<td>1.6</td>
<td>1.3</td>
<td>1.5</td>
<td>1.8</td>
<td>1.3</td>
</tr>
<tr>
<td>Rewriting the rules</td>
<td>1.1</td>
<td>1.2</td>
<td>1.4</td>
<td>0.9</td>
<td>0.8</td>
<td>1.3</td>
<td>1.0</td>
</tr>
<tr>
<td>Robust/platform design</td>
<td>0.8</td>
<td>1.3</td>
<td>1.0</td>
<td>0.6</td>
<td>1.1</td>
<td>1.7</td>
<td>0.7</td>
</tr>
<tr>
<td>Sectoral applicability</td>
<td>0.8</td>
<td>0.9</td>
<td>1.0</td>
<td>1.1</td>
<td>1.7</td>
<td>1.1</td>
<td>0.3</td>
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<tr>
<td>Complexity</td>
<td>0.1</td>
<td>0.6</td>
<td>0.7</td>
<td>0.3</td>
<td>-0.5</td>
<td>0.3</td>
<td>-1.7</td>
</tr>
<tr>
<td>IPR protection</td>
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<td>-0.3</td>
<td>1.3</td>
<td>-0.1</td>
<td>0.0</td>
<td>0.4</td>
<td>-0.3</td>
</tr>
</tbody>
</table>

Key: -3 = major weakness, -2 = moderate w., -1 = minor w., 0 = not applicable, 1 = minor strength, 2 = moderate s., 3 = major s.
3.4.7. Common opportunities and benefits

In this analysis the ‘opportunities/benefits’ assessment refers to the top three direct results of the SI case, e.g. financial gain, cultural enrichment and technology advances (in contrast to the final outcomes in ‘transformation’ or ‘impact’). These are classified using the TEEPSES system, with the most popular shown on the left side of Table 8. In each case the benefits need to be validated (and if possible quantified) by a recognised assessment method, not always clear from the documentation.

- Social SI types bring Social opportunities in nearly all cases, followed by Economic and Environmental opportunities. Governance SI types are similar.
- Services SI types are focused more on Economic and Environmental opportunities.
- Product SI types are more about Economic and Environmental benefits.
- Environmental benefits are most clearly concentrated in Organisational SI types.
- Meanwhile, System SI benefits are spread evenly.

Some examples: AirCarbon (US) products based on CO₂ sequestration technology create specific benefits in climate mitigation, raw materials and resource efficiency. Wiener Tafel (AT) by contrast is a Social SI which distributes waste food, providing benefits in waste reduction, resource efficiency, poverty relief and healthy diets, and also helping to build social inclusion. Ponnod Prime (SI) is an industrial-ecology use of waste heat as a resource for food grown with aquaponics, with benefits to the local economy and community.

Implications: generally, two general approaches can be observed in SI. The first looks for convergence on specific solutions and single benefits, which might create a powerful influence downstream. The second aims more towards integrated systems (social or technical), multi-functionality and multiple benefits.

For the first type, the implication is that specific policy mixes focus on issues such as finance, deployment, IPR and market access. For the second type, one implication is for SI policy and practice to combine the economic/environmental benefits of Product eco-innovation with the social benefit potential, or for Governance SI types to look for multi-functionality/multiple benefits as criteria for support.

### Table 8: Common opportunities

<table>
<thead>
<tr>
<th>Common opportunities</th>
<th>Tec</th>
<th>Eco</th>
<th>Env</th>
<th>Pol</th>
<th>Soc</th>
<th>Eth</th>
<th>Spa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social SI (47 cases)</td>
<td>11%</td>
<td>36%</td>
<td>45%</td>
<td>21%</td>
<td>89%</td>
<td>4%</td>
<td>2%</td>
</tr>
<tr>
<td>Services SI (43 cases)</td>
<td>30%</td>
<td>47%</td>
<td>51%</td>
<td>16%</td>
<td>40%</td>
<td>2%</td>
<td>16%</td>
</tr>
<tr>
<td>Product SI (37 cases)</td>
<td>22%</td>
<td>54%</td>
<td>65%</td>
<td>16%</td>
<td>19%</td>
<td>3%</td>
<td>11%</td>
</tr>
<tr>
<td>Governance SI (25 cases)</td>
<td>16%</td>
<td>48%</td>
<td>48%</td>
<td>28%</td>
<td>68%</td>
<td>0%</td>
<td>16%</td>
</tr>
<tr>
<td>Organisational SI (22 cases)</td>
<td>9%</td>
<td>86%</td>
<td>50%</td>
<td>5%</td>
<td>41%</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>System SI (16 cases)</td>
<td>38%</td>
<td>38%</td>
<td>56%</td>
<td>13%</td>
<td>50%</td>
<td>0%</td>
<td>19%</td>
</tr>
<tr>
<td>Marketing SI (3 cases)</td>
<td>67%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>33%</td>
<td>0%</td>
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</tbody>
</table>
3.4.8. Common threats and risks

Here we have the counterpart to the ‘opportunities’: perceived threats/risks cover all negative factors, now or anticipated in the future, which could affect the outcome of the SI case. At any point in the innovation process from conception/design to deployment/diffusion, there could be: financial gaps, technology lock-in, social unrest, unplanned side-effects, climate change, lack of infrastructure and others. The first of these is by far the most significant, but other topical issues also appear in Table 9:

- As for Social SI types, the clearest threat is from Economic factors, i.e. lack of funding or viability in the business model. This also applies to Product types.
- As for Services SI types, the threats are more evenly spread, and include Technology risks such as systems failure or unplanned side-effects.
- As for Governance SI types, the most significant threats are from Social factors, which could include ideological arguments, leadership problems, community mobilisation, policy deployment, etc.
- As for Organizational types, there are Policy risks, i.e. in policy changes, regulatory risks, implementation failures, etc. In contrast, the System types see Technology factors as the largest source of threat/risk.

Examples: Step2Save (NL) is an energy advice and local enterprise scheme: possible risks include loss of public funding, technology advances and competition from other social enterprises. ECOverified (GR) is an ecotag and certification system with very positive aims, but also with risks where businesses are not able to invest, or from possible legal problems or technical challenges. Fairphone (BE) is a sustainable mobile phone system which risks technology competition or shifting levels of consumer/user interest.

Implications: many sustainability initiatives and innovations are in reality quite ‘unsustainable’, i.e. short-lived, so the analysis of threats/risks is very topical. Economic viability and funding gaps are the most common threat, for both Social (mainly non-profit/CSO), and for Services and Product types (mainly private sector). The implication is that SI policy should look closely at how financial or viability gaps might be bridged. Options include accountancy changes (multi-year budgeting, etc); valuation/evaluation methods (social/ecological impact, service assessments, etc); crowd-funding, crowd-collateral and crowd-marketing via social media; and co-production of public services by CSOs. While Product types appear more in mainstream innovation support systems, these and similar options may also help to bridge the gaps.

Table 9: Common threats

<table>
<thead>
<tr>
<th>Common threats</th>
<th>Tec</th>
<th>Eco</th>
<th>Env</th>
<th>Pol</th>
<th>Soc</th>
<th>Eth</th>
<th>Spa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social SI (47 cases)</td>
<td>11%</td>
<td>66%</td>
<td>9%</td>
<td>21%</td>
<td>28%</td>
<td>2%</td>
<td>9%</td>
</tr>
<tr>
<td>Services SI (43 cases)</td>
<td>16%</td>
<td>47%</td>
<td>9%</td>
<td>21%</td>
<td>26%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Product SI (37 cases)</td>
<td>35%</td>
<td>78%</td>
<td>8%</td>
<td>5%</td>
<td>16%</td>
<td>5%</td>
<td>0%</td>
</tr>
<tr>
<td>Governance SI (25 cases)</td>
<td>4%</td>
<td>32%</td>
<td>8%</td>
<td>40%</td>
<td>56%</td>
<td>0%</td>
<td>8%</td>
</tr>
<tr>
<td>Organisational SI (22 cases)</td>
<td>23%</td>
<td>32%</td>
<td>5%</td>
<td>45%</td>
<td>23%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>System SI (16 cases)</td>
<td>50%</td>
<td>38%</td>
<td>13%</td>
<td>25%</td>
<td>25%</td>
<td>6%</td>
<td>13%</td>
</tr>
<tr>
<td>Marketing SI (3 cases)</td>
<td>0%</td>
<td>33%</td>
<td>33%</td>
<td>0%</td>
<td>67%</td>
<td>33%</td>
<td>0%</td>
</tr>
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</table>
There is further evidence and context for the policy agenda on SI risk management, shown in the ‘Top 15 threats/risks’ matrix below.

Economic problems include not only viability against competition, as above, but also problems of scale and capacity, i.e. in the deployment and diffusion stages of SI. There’s an interesting issue on ‘conformism’ in abandoning R&I activity, i.e. settling for lower-risk, better known products and markets.

Social SI types are frequently vulnerable to financial crisis, but this is not always because of a simple lack of cash. Here ‘dependence on volunteering’ and ‘beneficiary awareness’ are highlighted, where instability or change leads to financial gaps further down the line.

Policy-type risks often arise where government priorities change: but there may be more insidious kinds of threats, where there is a collision between an SI case and vested interests (landowners, infrastructures, public services of various kinds).

Technology risks bring the usual failures such as breakdown or maintenance problems, alongside competition in the sense of product or service imitation.

Finally, there is an interesting take on the ethical dimension, where corporate social responsibility (CSR) or ethical measures in the corporate or philanthropic sector are often attacked by the CSO, NGO and academic sectors.

**Top 15 ‘Threats/risks’ identified in CASIPEDIA**

| Economic | • Lack of adequate business model to face competition  
|          | • Lack of capacity to meet demand  
|          | • Economies of scale constraints  
|          | • Conformism: abandoning R&I activity |
| Social   | • Dependence on volunteering  
|          | • Sustainability of beneficiaries’ awareness  
|          | • Inefficient social impact assessment |
| Political | • Government priorities change  
|          | • Collision with vested interests |
| Technological | • Breakdown and maintenance issues  
|          | • Risk of imitation |
| Environmental | • Ecological collateral effects |
| Spatial   | • Unfavourable location for business continuity/experimentation |
| Ethical   | • Users’ exclusion  
|          | • Questioning corporate SI rationales |
3.4.9. **Degree of mutual learning processes**

Most SI cases involve a wider community or ‘innovation ecosystem’, where success depends on synergy, collaboration and ‘mutual learning’ among all the actors involved. Such an ecosystem might be in the supply chain, innovation policy, public service infrastructure or local community. This analysis looks at how different activities and channels for mutual learning are distributed across the different SI types, with a list generated from the literature and from the cases (see Table 10). Generally:

- Learning-by-doing is the most widely used mutual learning process across all SI types (there may be various definitions of what this means).
- Capacity-building, training courses, etc. are used especially by Social, Services and Organisational SI.
- Conferences and Seminars are common learning tools, particularly for System SI.
- Web 2.0 interactions and social networking are significant for Social, Governance and Systems SI types (in many cases Web functionalities are built into the case, not the mutual learning which supports it).
- Prototyping/piloting is key for both Product and System SI.

Examples: Let’s do it Romania (RO) is a national scheme involving 300,000 citizens in environmental clean-up, with a range of mutual learning processes. Actyva (ES) is a sustainable farming system which combines agri-tech with mutual learning between farmers, distributors and consumers. Pannonpower (HU) is a biomass energy system with rapid mutual learning between farmers, technology developers, builders, housing managers and residents.

Implications: in some SI cases, such as the NISP (previous section), the objective of the scheme is mainly focused on the mutual learning, with systems of communication, networking, training etc. This can then enable environmental action downstream. In other cases, such as Actyva (above), there is an immediate activity focus which can be supported by mutual learning systems ‘upstream’. The general implication for SI policy is: (a) to ensure space and resources for learning-by-doing and capacity-building (i.e. not to demand fixed outcomes and capacities at the start); and (b) to allow prototyping and piloting, especially for Product and System types.

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</tr>
</thead>
<tbody>
<tr>
<td>Learning-by-doing/interacting</td>
<td>96%</td>
<td>74%</td>
<td>84%</td>
<td>76%</td>
<td>68%</td>
<td>81%</td>
<td>67%</td>
</tr>
<tr>
<td>Capacity building/training/tutorials</td>
<td>83%</td>
<td>70%</td>
<td>62%</td>
<td>60%</td>
<td>73%</td>
<td>63%</td>
<td>0%</td>
</tr>
<tr>
<td>Conferences/seminars</td>
<td>57%</td>
<td>63%</td>
<td>68%</td>
<td>52%</td>
<td>64%</td>
<td>81%</td>
<td>33%</td>
</tr>
<tr>
<td>Networking events</td>
<td>68%</td>
<td>63%</td>
<td>57%</td>
<td>48%</td>
<td>64%</td>
<td>63%</td>
<td>67%</td>
</tr>
<tr>
<td>Web 2.0 interactions</td>
<td>77%</td>
<td>53%</td>
<td>57%</td>
<td>64%</td>
<td>41%</td>
<td>63%</td>
<td>67%</td>
</tr>
<tr>
<td>Prototyping/piloting</td>
<td>47%</td>
<td>42%</td>
<td>86%</td>
<td>36%</td>
<td>64%</td>
<td>88%</td>
<td>33%</td>
</tr>
<tr>
<td>Stakeholder workshops</td>
<td>57%</td>
<td>67%</td>
<td>43%</td>
<td>52%</td>
<td>36%</td>
<td>75%</td>
<td>67%</td>
</tr>
<tr>
<td>Collaborative research</td>
<td>45%</td>
<td>42%</td>
<td>73%</td>
<td>36%</td>
<td>41%</td>
<td>75%</td>
<td>33%</td>
</tr>
<tr>
<td>Stakeholder interviews</td>
<td>45%</td>
<td>42%</td>
<td>51%</td>
<td>32%</td>
<td>27%</td>
<td>38%</td>
<td>33%</td>
</tr>
</tbody>
</table>

Table 10: Mutual learning processes
4. Key SI management dimensions: An inductive approach

The identification of critical sustainable innovation factors followed an inductive process. Bottom-up and inductive approaches are often utilised in research to create ground theories that help explain complex social problems. In our case, we were trying to identify the most important aspects that delimit or influence the action of SI management. It seemed therefore reasonable to design and develop a research process that included a thorough revision of initiatives mapped in CASIPEDIA. The process basically consisted of the following steps:

1. Practices mapped in CASIPEDIA were reviewed and analysed so as to identify those positive and negative factors that have an influence on innovation processes, i.e. increasing or decreasing their likelihood of success. The output of this review was a list of preliminary SI critical factors.
2. The previous list of factors was treated with content-analysis software to support and facilitate a preliminary factors clustering. This task also incorporated word-counting and analysis of key terms.
3. Three interactive expert group discussions were held at the University of Manchester to validate and agree on the most relevant clustering decisions. As a result, two levels of clustering were defined. Critical factors description and denomination were also agreed through these discussions.
4. The results (groups of critical issues) were contrasted and compared with the findings obtained through the CASI stakeholder survey (conducted by ARC Fund). Thus, critical factors were more precisely defined and enriched. This comparative process finally gave rise to 50 critical issues that were grouped into 10 sustainable innovation key aspects (momentum, SI foresight, SI resources, actor mobilisation, people’s aptitude and attitude, SI catalysing and fostering aspects, SI capacity of transformation and SI sustainability) and four sustainable innovation dimensions (SI context, people, resources and impact). The whole process is shown in Diagram 9.

Diagram 9: An inductive approach to SI management dimensions

Cases

Si cases (193) reviewing

List of preliminary SI factors

CONTENT ANALYSIS & WEB-BASED KEY TERMS IDENTIFICATION

SI FACTORS CLUSTERING

Expert group @ The University of Manchester Reviewing identified factors & further SI factors analysis

Comparative analysis of ARC FUND survey results

Final validation & clustering of SI critical factors

50 CRITICAL FACTORS

DIM 1

DIM 2

DIM 3

DIM 4

Aspect 1

Aspect 2

Aspect 3

Aspect 4

Aspect 5

Aspect 6

Aspect 7

Aspect 8

Aspect 9

Aspect 10
4.1. SI Management Dimension 1: Context

The success of Sustainable Innovation depends greatly on its context. First, the ‘momentum’ reflects a potential space for innovation; the expectations of entrepreneurs and other actors; the political drive from regulators or procurement; exemplars from other ecological or social enterprises; and the perception of ‘problems’ which call for solutions. Second, the critical factor of ‘foresight’ shows the capacity to anticipate, to strategise and to overcome gaps in the innovation curve. Third, ‘resources’ simply shows the necessary combination of skills, finance, location, markets, etc. Fourth, ‘mobilisation’ is the capacity for action, as in public participation, community support, institutional support, champions and facilitators, public–private partnerships, research and education engagement.

The SI Context dimension consists of four key aspects: Momentum; Foresight; Resources; and Mobilisation.
4.1.1. **SI Management key aspect 1: Momentum**

By *momentum* we mean the force that gets a sustainable innovation moving forward. The three most common critical factors in SI *momentum* are: political setting (including regulations, decisions, rules, policies, guidelines); exemplars (including pioneering or leading models, standards, prototypes, examples) and problems (including challenges, complications and difficulties as drivers of change).

The SI Momentum key aspect consists of three critical factors:

- Political setting
- Exemplars
- Problems

### 4.1.1.1. SI Critical factor 1: Political setting

**Political setting:** Clearly the political and policy context can send strong signals for or against SI. Political changes such as elections may shift policy and resources towards or away from ‘Low-carbon and environmental goods and services’ (LCEGS). Pre-conceived political agendas and insider lobbying may make environmental policy stronger or weaker (e.g. the current controversy over the Volkswagen diesel emissions ‘defeat’ technology seems connected with the intensive efforts of car manufacturers to dilute environmental regulation). Coupled with this are doubts and uncertainties on real rationales (e.g. the UK government’s changes and uncertainties on renewable energy subsidy have caused major damage to the wind and solar industries).

### 4.1.1.2. SI Critical factor 2: Exemplars

**Exemplars:** Where there are exemplars, best practices, showpieces, demonstrations, prototyping labs and similar, these can have a powerful effect on the success of SI. Following mainstream innovation theory, several types of effects can be defined. First, entrepreneurs will have mental models to follow, and financiers and ‘first users’ will perceive lower risks. Second, the SI (both technology and social innovation) can be seen in action so that adjustments and refinements can be made. Third, there is a greater chance of bridging the ‘valley of death’-type gaps between prototype and full deployment at scale. Finally, the whole innovation ecosystem has a low-risk opportunity to engage in the mutual learning and reframing which is essential for progress, for both large and small SI.

### 4.1.1.3. SI Critical factor 3: Problems

**Problems:** The problems of adverse evidence and experiences are a necessary but challenging factor in the SI process. There may be technical problems and glitches; financial problems and over-runs in cost and time; social and behavioural problems with users; supply chain problems; or regulatory problems. Often these are all combined. In principle, a detailed and systematic mapping of problems and adverse experiences should help the success rate of SI. In reality, ‘best practices’ are reported in glowing terms, while ‘worst practices and failures’ are shut away out of sight. In a forward-thinking SI policy and ecosystem, this would change.
4.1.2. **SI Management key aspect 2: Foresight**

By *foresight* we understand the future-oriented strategic driver of a sustainable innovation. There are three critical factors in SI *foresight*: a horizon scanning-based approach (proactive identification of opportunities and forward-looking goals); trends-based approach (reacting to current developments); and strategic targets approach (aligning objectives with future priorities of innovation systems).

The SI Foresight key aspect consists of three critical factors:

- Horizon-scanning approach
- Trends-based approach
- Strategic-targets approach

### 4.1.2.1. **SI Critical factor 4: Horizon scanning**

**Horizon scanning:** Horizon scanning refers to the set of instruments that permits innovators to detect incipient market opportunities and social gaps. These weak signals may come from other sectors or geographical zones and can be identified through different sources, e.g. literature review, conferences, interviews, expert workshops or database analysis. This proactive behaviour enables the early conception or adaptation of technical, social, organisational or environmental solutions, and facilitates a competitive sponsor’s pioneering position. Horizon scanning is also used by firms to gather information on competitors’ reactions, especially when their innovations substitute existing products and services.

### 4.1.2.2. **SI Critical factor 5: Trends**

**Trends:** It would be an interesting exercise to discern how and to what extent innovators’ activity is actually influenced by social and economic trends. Although global and societal challenges are highly diverse, SI solutions are quite frequently concentrated in a few (and strong) strands of research and innovation. Following trends may increase knowledge sharing and can have positive synergising effects on innovation but there is a risk that other relevant SI problems will remain ignored.

### 4.1.2.3. **SI Critical factor 6: Strategic targets**

**Strategic targets:** In principle the SI entrepreneur and the SI ecosystem takes a strategic overview of the goals, objectives and targets, with a pathway or road-mapping approach to mobilisation of resources, alignment with policy, and so on. In reality, many of these are unclear, uncertain or in conflict. For instance, for a typical SI product, the objectives of low carbon/low emissions/low waste may be in conflict with each other, and with other criteria such as low capital cost, low running costs and a long life cycle. This is particularly noticeable in SI public procurement, where the public authorities are often under strict instructions to achieve the lowest short-term price, putting other socio-ecological goals into second place.
4.1.3.  SI Management key aspect 3: Resources

By resources we refer to means that can be drawn on by a sustainable innovation to be designed, developed implemented and diffused. There are five critical factors in SI resources: geographical setting (consisting of specific environmental and demographic conditions); funding sources (internal and external); infrastructure (physical and virtual); data sources (including intelligence); and scalability (potential to grow).

The SI Resources key aspect consists of five critical factors:

- Geographical setting
- Funding sources
- Infrastructure
- Data sources
- Scalability

4.1.3.1.  SI Critical factor 7: Geographical setting

Geographical setting: Geographical setting factors include those particular demographic and location characteristics that make possible the right development of the SI innovation. In some cases, understanding and piloting innovation processes are, respectively, better obtained or carried out in conditions of isolation. For example, islands or remote places offer similar conditions to in-lab scientific experiments. In other cases the innovator seeks diversity or geographical heterogeneity, while on other occasions the success of the innovation largely depends on the availability for specific natural resources.

4.1.3.2.  SI Critical factor 8: Funding sources

Funding sources: Funding availability is considered one of the most critical factors for innovation success. Besides the high costs associated with the initial launch stages of an innovation (research, prototyping, piloting, etc.) financial sustainability must also be ensured to warrant scalability and diffusion. The allocation of funds throughout the innovation process requires a clear definition of objectives and the development of investment needs plans. A crucial aspect of innovation management is related to the sponsor’s ability to identify funding alternatives, e.g. business angels and crowd-funding sources.

4.1.3.3.  SI Critical factor 9: Infrastructure

Infrastructure: Innovation is normally a complex and multidisciplinary process. Thus innovative solutions are sometimes only possible through the development of different and complementary areas of research. In many cases, innovation is actually hindered by the lack of adequate facilities or infrastructure, e.g. battery charge networks to facilitate the implementation and diffusion of electric vehicles. In such cases, innovation processes evolve in parallel and suffer from mutual dependency. From a different perspective, another risk to be considered when promoting innovation refers to the possibility that new solutions lead a country or region to underuse or overlook existing (and still effective) infrastructures.
4.1.3.4. **SI Critical factor 10: Data sources**

**Data sources:** Access to information is a crucial factor along the entire innovation process. In earlier stages, for example, empirical or market information brings about new ideas and sustainability opportunities. Similarly, during the development phase data availability is essential to launch and consolidate solutions. At later innovation stages, the use of strategic data is also essential to revitalise or expand market horizons. Data management requires the ability to deal with fragmented data sources, and the capacity to discern (and avoid) over-information situations. In some cases, the innovator must warrant an adequate (and confidential) use of private information.

4.1.3.5. **SI Critical factor 11: Scalability**

**Scalability:** Many SI technology initiatives stop at the ‘valley of death’ gap in the innovation curve, between the prototype/demonstration stage and deployment at scale. There is a strong case for targeted finance, procurement, IP and regulatory support to help achieve economies of scale. In social enterprise-type SI, the situation is a little different; here ‘scale’ is not so much about the market as about embedding in social or policy institutions. The relationship of public authorities and public services to innovation (as in policy innovation, service innovation, enterprise model innovation) needs to be a more central part of the public policy debate. Meanwhile, there is a small paradox to be observed in the CASIPEDIA collection: if an SI is successful, it will achieve deployment at scale, and rapidly shift from ‘innovation’ to ‘mainstream’. However, if it is only a partial success or a failure, the SI will continue its efforts under the innovation banner. For instance, ‘car-sharing clubs’ were first proposed in the 1980s; the technology has since moved on rapidly, but they are still some way from being mainstream at full scale, and hence still counted as ‘innovations’.
4.1.4. **SI Management key aspect 4: Mobilisation**

By *mobilisation* we mean the capacity of a sustainable innovation to reach and involve key stakeholders. There are six critical factors in SI *mobilisation*: champions and facilitators (for better outreach), civil society engagement (to achieve social embeddedness); government engagement (to tackle common challenges); business engagement (to address market issues and opportunities); research and education engagement (to promote evidence-based decision-making) and proactive participation (to meet society’s demands through multi-stakeholder mobilisation and mutual learning).

The SI Mobilisation key aspect consists of six critical factors:

- Champions and facilitators
- Civil society engagement
- Government engagement
- Business engagement
- Research and education engagement
- Proactive participation

**4.1.4.1. SI Critical factor 12: Champions and facilitators**

**Champions and facilitators:** The role of champions, leadership, enablers and facilitators is much discussed in the literature. The case for champions is stronger if we focus on sustainable SI, rather than mainstream (unsustainable?) innovation. In the SI case there are likely to be multiple actors, each with different interests, to be aligned and balanced. The nature of SI involves a diversity of goals: not only technical innovation which leads to a profitable business model, but social or cultural factors, ecological objectives, political and policy goals, and so on. The nature of a typical SI, with potentially higher financial risk, calls for other types of values to balance this, as seen with ethical investment, CSR benchmarks, supply chain accreditation, sustainable source certificates, etc.

**4.1.4.2. SI Critical factor 13: Civil society engagement**

**Civil society engagement:** The relationship between sustainable innovation and social communities demonstrates an interesting mutual effect. On the one hand, SI experiment and development phases may strongly benefit from the existence of integrated and consolidated communities. Indeed, communities can promote a faster adoption of innovations by most of their members, e.g. by putting into practice new social or behavioural initiatives in parishes, associations or citizens’ congregations. On the other hand, the learning-by-doing processes associated with SI help to reinforce the existing linkages between community members, thus fostering people’s interaction, knowledge exchange and collaboration.

**4.1.4.3. SI Critical factor 14: Government engagement**

**Government engagement:** One important government duty is proposing and financing those areas of research and innovation that can eventually contribute to solving sustainability problems. Achieving institutional support is, however, more difficult for those private initiatives which, while also tackling SI challenges, are not sufficiently aligned with formal calls or tenders. In these cases, innovators usually have to overcome additional political and institutional resistance. In general, barriers to innovation take the form of regulatory hurdles and bureaucratic obstacles. In this respect, in recent years the EU has self-imposed strict objectives on the simplification of red tape. Whether driven by this simplification or not, there is plenty of evidence in CASIPEDIA that reveals the strong attraction that EU R&I funding support now exerts on sustainability innovators.
4.1.4.4. **SI Critical factor 15: Business engagement**

**Business engagement:** The above ‘balancing act’ of actors’ interests is seen most clearly in the emergence of public–private partnerships, or in extended public–private–civic consortiums. For many examples – such as community renewable energies, sustainable local food, and education or health initiatives – it is clear that neither the market nor public administration on its own is well equipped to take on these multiple goals. Hence, the current space of experimentation and innovation in public–private businesses, procurement models, investment models, knowledge sharing or risk-sharing models. Where these also combine with organisations in the civic or third sectors, such as cooperative, mutual, crowd-sourcing, syndicate, guarantee companies or partnership models, the possibilities seem endless. Digital social media are also a powerful enabler of new forms of collective action, decision-making and investment.

4.1.4.5. **SI Critical factor 16: Research and education engagement**

**Research and education engagement:** The support of academia and experts support is essential from both policy-makers’ and innovators’ perspectives. Government support is often based on scientific or academic advice, which serves to justify the prioritisation of certain R&I areas. Similarly, experts’ opinions are relevant for the definition of firms’ research and innovation roadmaps and technology strategies. Furthermore, the engagement of academia gives innovators a broader access to knowledge sources. The engagement also catalyses firms’ innovation processes, thanks to better access for firms to research facilities, university labs and R&I infrastructures.

4.1.4.6. **SI Critical factor 17: Proactive participation**

**Proactive participation:** Sustainability problems are global in nature and their impacts are sometimes irreversible. Consequently, SI solutions can only be adopted once their consequences for the public have been sufficiently consulted, analysed and agreed upon with the actors affected. The extent to which citizens are predisposed and open to change is an important success aspect to be considered by innovators. Given that societal initiatives and sustainable actions frequently come together, an additional challenge relates to the need to discern real and rational societal demands from small interest groups’ or individuals’ emotions.
4.2. SI Management Dimension 2: People

The role of people – actors, stakeholders, players, intermediaries etc, acting as individuals, households, groups, firms, professions, communities or sectors – cannot be underestimated. Many policy objectives would be unfulfilled if they did not connect with or mobilise the right people, or did not provide the right incentives and enabling factors for those people. In parallel there is a focus of attention on ‘the entrepreneur’ or ‘leadership’ as the first and foremost critical factor. However, in a complex knowledge-based supply chain, or a complex social community with multiple needs, it seems that the vital qualities of entrepreneurship or leadership are likely to be distributed, networked, risk-shared and team-based. For sustainable SI (in contrast to mainstream innovation) there may be a stronger case for such qualities as emergent from the wider innovation ecosystem, even while the traditional ‘heroic’ image of the lone innovator continues. This has implications for SI-related innovation policy, which may take a conventional MBA-type approach, or look more widely to the community in context.

The SI People dimension consists of two key aspects: Aptitude and Attitude.
4.2.1. SI Management key aspect 5: Aptitude

By Aptitude we refer to the actual skill set or competences of people involved in the design, development, implementation and diffusion of a sustainable innovation. There are four critical factors linked to this aspect: leadership (to guide the innovation team); charisma (to inspire and mobilise key people); creativity (to find original and innovative solutions); and knowledge (to make sound and informed decisions).

The SI Aptitude key aspect consists of four critical factors:

- Leadership
- Charisma
- Creativity
- Knowledge

4.2.1.1. SI Critical factor 18: Leadership

Leadership: As above, the qualities of ‘leadership’ are seen as crucial to success in any kind of innovation, but maybe more so in sustainable varieties. The image of the leader-entrepreneur as a deviant and outlier from established mainstream systems suggests that large firms and policy/civic institutions could do more to identify and facilitate the leaders in their midst, in order to adapt and innovate themselves as large organisations otherwise at risk of stagnation. Meanwhile, the CASIPEDIA collection shows an inspiring range of cases, from those created by highly individual leaders, to those which are clearly more collective in nature (Parkin, 2010).

4.2.1.2. SI Critical factor 19: Charisma

Charisma: One of the less understood qualities of leadership is that of ‘charisma’ with its qualities of personal empathy, resonance or mobilisation of subliminal incentives. There is a new realisation of the importance of ‘emotional intelligence’ in the management literature, and a degree of hero-worship of individuals (such as Steve Jobs). We need to understand more of how charisma and empathy can work in more extended teams, supply chains and social enterprise models. Many ‘sustainability’ schemes are in practice quite short lived and ‘unsustainable’, in that the people involved are more suited to creation than to long-term consolidation and management. The traditional image of a social innovator as ‘inspired but hard to work with’ still stands; this suggests the need for a new kind of facilitation or capacity-building, to bridge the gap between charismatic persons and systematic teamwork.

4.2.1.3. SI Critical factor 20: Creativity

Creativity: The role of creativity for successful innovation is much studied. In the case of sustainable SI, we need to understand more about how creativity can work best, not only in single-issue technical challenges or social projects, but in complex distributed and inter-connected types of problems. Some of the ‘creativity’ cases in CASIPEDIA are quite obvious, for instance where creative arts are mobilised in combination with social or ecological action. Others are more fundamental and distributed, as where new social-community structures are enabled to respond to complex inter-connected problem-combinations, for example climate adaptation, flood design, local food and local ecosystems management. Meanwhile, many real-life SI stories illustrate how a real-time creative process is not only a flash of inspiration, but often a test of perseverance and continued action over a decade or more.
4.2.1.4. **SI Critical factor 21: Knowledge**

**Knowledge**: Knowledge is a fundamental criterion for any innovation. But in the case of sustainable ‘SI’ innovation, one could ask how the required knowledge is different to that of the mainstream, and how it might be enhanced. The principles of SI could be identified as multiple goals/values with multiple interconnections for multiple stakeholders (see the section on definitions). It follows that the kind of knowledge which is most relevant is not only technical knowledge or business knowledge, but awareness of ecological and social impacts, awareness of ethical and cultural debates, awareness of extended supply chains and extended user communities, and so on. Such knowledge does not often appear in professional education and training, and is often seen as tacit, acquired and embedded. Again there is a strong case for identifying such knowledge requirements and building capacity for learning and dissemination.
4.2.2. SI Management key aspect 6: Attitude

By *Attitude* we mean the type of behaviour of people responsible for the design, development, implementation and diffusion of a sustainable innovation. There are four critical factors linked to this aspect: enthusiasm (to spread interest and excitement); empathy (to be more responsive to the needs of potential SI users and beneficiaries); involvement (to promote cooperation and networking); and commitment (to achieve shared ownership).

The SI Attitude key aspect consists of four critical factors:

- Enthusiasm
- Empathy
- Involvement
- Commitment

4.2.2.1. SI Critical factor 22: Enthusiasm

**Enthusiasm:** This issue divides into two main strands: first enthusiasm or positive thinking and, second, its maintenance. There are many examples (some in CASIPEDIA) of typical social innovation projects set up with a rush of enthusiasm that then proves hard to maintain for the duration. There are other examples, for instance in the construction-products sectors, of genuine SI products which have taken 10-15 years from a blue-sky proof-of-concept, to becoming a commercial product on the market. Taking a closer look, there are some stories where (between the lines), positive enthusiasm for social innovation is encouraged by the public authorities, which then keep the required resources just out of reach of the community or social group. The current wave of austerity in Europe has brought this type into focus. All this goes to show that, where enthusiasm can be cultivated, mobilised, resourced and sustained, then the success rate of SI will rise.

4.2.2.2. SI Critical factor 23: Empathy

**Empathy:** The quality of ‘empathy’ was seen in the leadership section above, and in some cases it is possible to see signs of a conflict between emotions and rationality. This is not unique to sustainability-type SI. Rather, there are many examples of businesses where ‘group-think’, based mainly on institutional emotion, has led to major technological failures and corporate scandals. Likewise, there are examples where apparent ‘rationality’, based on narrow short-term objectives, has led to corporate failure to adapt and innovate - for example, the near death of Kodak in relation to digital camera technology. One could draw conclusions for SI, in terms of its multiple inter-connected goals, and say that emotion and rationality could and should be able to work together in a coordinated fashion.

4.2.2.3. SI Critical factor 24: Involvement

**Involvement:** Volunteering practices are recurrent in many SI innovation processes. This sort of involvement is principally observed in socially oriented innovation cases. The predisposition to cooperate regardless of any immediate economic rewards is a characteristic inherent to almost all social innovators in the early stages of the innovation process. Although voluntarism largely responds to the innovator’s identification with sustainability objectives, it may also be understood as the answer and the natural reaction to the absence of financial support. In any case, certain levels of professionalism need to be developed through the innovation process in order to avoid voluntarism-dependency and to reduce the levels of uncertainty associated with volunteer availability.
4.2.2.4. **SI Critical factor 25: Commitment**

**Commitment:** Stakeholders’ commitment goes beyond actors’ engagement or involvement. In contrast to simple involvement, committed actors recognise that all innovation processes frequently entail high risks and have higher consequences. Commitment needs to be based, therefore, on a clear understanding of SI objectives, as well as on a realistic vision of expected impacts. The level of commitment of SI actors varies greatly alongside the innovation process, and can be very different depending on the volume and type of actors’ resources brought into play.
4.3. SI Management Dimension 3: Process

Innovation is widely accepted to be a complex, participatory and multifaceted process. In particular, the CASIPEDIA analysis confirms that a large number of actors and perspectives need to be considered in the study of innovation projects. Our SI process assessment therefore needs to be based on the interpretation of many influencing factors and their potential combination. Given the varied possibilities of clustering, and in order to simplify, we have decided to group these SI process factors into two sets: first, we will comment on the ‘catalyst aspects’ category, i.e. those factors that activate and launch the innovation; then we will introduce the ‘fosterer aspects’ set, which includes those factors that make possible the continuity and consolidation of SI actions.

The **SI Process dimension** consists of two key aspects: Catalysts and Fosterers.
4.3.1. SI Management key aspect 7: Catalysts

By Catalysts we refer to key enablers of the design and development phases of a sustainable innovation process. There are seven critical factors linked to this aspect: compressibility (to offer user-friendly solutions); crowdsourcing (to achieve truly bottom-up financial support); learning-by-doing (to promote more assertive evolution and incremental innovation); support services (to deal with specific bottlenecks in the innovation process); absorptive capacity (to generate and act upon valuable information or intelligence); ex-ante impact evaluation (to recognise and measure important benefits and possible risks); and piloting and experimenting (to avoid disappointments and manage expectations).

The SI Catalyst key aspect consists of seven critical factors:

- Comprehensibility
- Crowd-sourcing
- Learning-by-doing
- Support services
- Absorptive capacity
- Ex-ante impact evaluation
- Piloting and experimenting

4.3.1.1. SI Critical factor 26: Comprehensibility

Comprehensibility: Particularly for social and policy types of innovation, there is a case that successful SI should be able to turn the complexity of social needs and relations into simple, comprehensible, transferable and replicable models for business and enterprise. There is also a very practical criterion for ‘bankability’, i.e. that the financial structure of equity, risk and reward should be as clear as possible to investors and managers, and robust against contingencies, thus being able to attract finance at all stages in the innovation curve. For technology-focused SI there is a parallel case that the most powerful transformative/disruptive innovations should be those which take a complex set of challenges and constraints and break through to a new level of simplicity and usability.

4.3.1.2. SI Critical factor 27: Crowd-sourcing

Crowdsourcing: This is defined as ‘the process of obtaining needed services, ideas, or content by soliciting contributions from a large group of people, and especially from an online community, rather than from traditional employees or suppliers’ (Mirrriam-Webster, 2015). It has a special significance for all forms of SI, given its features as complex and inter-connected, multi-objective and multi-stakeholder. First, conventional sources of finance may not be suitable to represent and capture value from different stakeholders with different value sets, including social, economic and ecological. Second, the focus on societal values and collective forms of knowledge suggests that a wider and more distributed network for finance and knowledge is more effective. Third, the transition to new social-type enterprise models calls for a crowd-sourcing approach not only for production but also on the user and demand side, to understand user requirements and wishes, and adapt the supply/value chain to them.
4.3.1.3. **SI Critical factor 28: Learning-by-doing**

**Learning-by-doing:** Successful SI are not only stand-alone products, but more like whole systems of transformative socio-technical behaviour. CASIPEDIA contains examples, such as the Global Forest Watch, which shows how a technology platform application can enable new forms of regulation, self-organisation, supply chain management and fair trade certification. In each of these areas there is a ‘learning-by-doing’ circular effect, in the sense that each of the stakeholders and users can only evolve the model by mutual learning, and the model evolves only through the ‘learned’ behaviour and value chain models of the users.

4.3.1.4. **SI Critical factor 29: Support services**

**Supportive services:** Sometimes SI solutions are not able to overcome the research-to-commercialisation path on their own. Then innovators have to adapt and reinforce their development and dissemination strategies in order to reach targeted markets and users. Among others, improved customer services and credit facilities may make the offer stronger and facilitate a more fluent diffusion of innovative products and technologies.

4.3.1.5. **SI Critical factor 30: Absorptive capacity**

**Absorptive capacity:** Strongly related to the capacity to penetrate the market is the ability to generate relevant information or intelligence, understand it and act upon it in a timely manner. Absorption depends, among other factors, on the complexity of offered solutions or intelligence. However, it is important to note that, whereas a high level of complexity may be acceptable in technology (in some cases complexity is technically unavoidable), the same does not apply in other types of sustainable innovation. In fact, user-friendliness and a real understanding of the SI problem, which are connected to the need for raising citizens’ awareness, are essential to obtain societal acceptance and promote wider SI utilisation.

4.3.1.6. **SI Critical factor 31: Ex-ante impact evaluation**

**Ex-ante impact evaluation:** In general, our sample has shown the low importance placed by innovators and sponsors on predicting and understanding the future impact of their solutions. This does not mean that there is a lack of objectives or expectations; nevertheless ex-ante evaluation initiatives are frequently undertaken informally and unsystematically. Most innovation cases would benefit, for example, from a pre-evaluation of their social and ethical impact rather than focusing exclusively on economic and environmental consequences. It has also been observed that, maybe because of an excess of enthusiasm, innovators tend to overestimate the real impact of their initiatives. To avoid this, a clear definition of realistic objectives is needed and an evaluation plan must be developed that draws on measurable parameters and transparent criteria.

4.3.1.7. **SI Critical factor 32: Piloting and experimenting**

**Piloting and experimenting:** The analysis of SI cases reveals that the limits between piloting phases and real SI practices are often vague and unclear. Strictly speaking, we should not refer to innovation before ensuring that, after the piloting and testing phases, a real and effective application has been proven and achieved in real contexts. We can notice, for instance, that some SI cases are described as innovations when their real definition should be that of mere experimentation. From this perspective, it is absolutely reasonable to call into question the real impact of ‘apparently’ successful practices, e.g. experiments carried out in islands or remote villages, in as much as they have not yet been implemented in non-isolated circumstances. Some sustainable solutions have not been tested in industrial environments, thus their real efficacy cannot be taken for granted.
4.3.2. SI Management key aspect 8: Fosterers

By Fosterers we refer to key supporters of the implementation and diffusion phases of a sustainable innovation process. There are seven critical factors linked to this aspect: incentives (to further position the innovation); coordination (to manage the relationship between the innovation team, sponsors, supporters and beneficiaries); networking and synergy (to better capitalise momentum-related critical factors); knowledge management (to reinforce the innovation capacity of the team); intellectual property management (to improve the competitive advantage of the innovation); ex-post impact evaluation (to promote improvements through learning and to demonstrate the positive environmental, social and economic impacts of an innovation); and communication and dissemination (to increase sectoral and geographical transferability).

The SI Fosterer key aspect consists of seven critical factors:
- Incentives
- Coordination
- Networking and synergy
- Knowledge management
- Intellectual property management
- Ex-post evaluation and monitoring
- Communication and dissemination

4.3.2.1. SI Critical factor 33: Incentives

Incentives: Apart from the obvious recognition of success that, for an innovator, market introduction represents, there are several relevant instruments that can be used by authorities to endorse and reinvigorate innovation processes. For example, governments may decide to issue product/services certificates in order to pave the way for firms to introduce and develop their innovations in specific sectors and markets. In other cases, the government’s endorsement strategies may consist in awarding companies’ performance, thus recognising their innovation best practices and contributing more generally to consolidating their positioning in markets and their business reliability.

4.3.2.2. SI Critical factor 34: Coordination

Coordination: The coordination of multiple players in innovation projects is a complex challenge because it requires the assimilation of shared objectives and the development of varied and synchronised activities. This difficulty is even more important when the stakeholders affected by the process present different grades of involvement and commitment. Innovation managers’ leadership and empathy is essential in these cases to facilitate actors’ interaction and reduce tensions. Coordination complexity may also explain why effective and fluent multiple-actor cooperation is frequently only achieved in the very early innovation planning phases, that is, when positive and promising expectations are still predominant in the discussions and the real risks associated with the project have not yet been fully perceived. In fact, critical coordination problems usually arise when promising and optimistic studies need to be translated into action and turned into more market-oriented plans.

4.3.2.3. SI Critical factor 35: Networking and synergy

Networking and synergy: The ‘synergies’ framing of SI provides a powerful insight into its dynamics and scope. Where new enterprise models depend on new synergies between new configurations of users and
producers, this calls for incentives and effective institutional structures to support the synergies. Here the new social media, including ‘wiki-nomic’ types of distributed co-production and peer-to-peer value chains, can be a powerful enabler. There is also an important distinction between social innovation and activism, or between technology innovation and ‘outliers’. Activism can be seen as a material challenge to an established order, whether political, economic or ideological, leading to competition or conflict. In contrast, social innovation can be seen as collaborative, consensual, mediating conflict and developing cooperation. This may also raise some risk of being co-opted, manipulated or ‘bought out’ by the system of established interests, so there is a fine line between the two. We can also observe some generic life-cycle effects in theory and practice, which could possibly be framed within the ‘panarchy’ model (Folke et al., 2002). In this concept, a visionary idea takes shape, gathers resources and a project/programme grows rapidly; a climax state of project success and prosperity is achieved. Then there is an internal or external crisis or falling apart. There follows a restructuring or regrouping, where some people and some resources have to find new ways of generating value. Finally, the cycle returns to the start point.

4.3.2.4. **SI Critical factor 36: Knowledge management**

**Knowledge management:** An efficient utilisation of explicit and tacit knowledge explains, in many SI cases, the generation of ideas. Exploring available data and information enables creative people and teams to reinforce their innovation capacities, for example: a) by recovering, understanding and analysing past practices innovators can adapt and apply existing solutions to present-day challenges; or b) by studying problems associated with other areas innovators can devise solutions for their specific area. This can be seen as a knowledge-brings-knowledge virtuous cycle. However, knowledge is not easy to manage, especially when large volumes of data are available. One success factor for the innovator therefore relates to the ability to discern what sort of data is useful and what information is dispensable. In this respect, innovators should also be aware of risks associated with over- or under-analysis of information. Only when data and information are systematically gathered and analysed to support innovation management actions can we properly consider knowledge management as a key component of an innovator’s strategic intelligence.

4.3.2.5. **SI Critical factor 37: Intellectual property management**

**Intellectual property management:** The protection of ideas, solutions, designs or corporate brands is one of the most important concerns of innovators. IP management actually enables firms and individuals to reinforce or develop business strategies, e.g. technology, product or services roadmaps or licensing plans. Leaving aside the need for protection, a smart use and analysis of existing IP databases provides the innovator with a better picture of competitors’ activities and sectoral trends, as well as the possibility to innovate incrementally. Despite the strategic importance of IP decisions and the national initiatives carried out to simplify IP regulation, intellectual property management unfortunately remains a complicated and costly task, especially for SMEs. Some IP regulation requirements in Europe, like the requirement to register patents in every country separately, seem to be inconsistent with the EU’s long-time desire for integration. Efforts in this direction are currently being made but improvements are only slowly being achieved.

4.3.2.6. **SI Critical factor 38: Ex-post evaluation and monitoring**

**Ex-post evaluation and monitoring:** The CASIPEDIA analysis reveals that impact evaluation is generally not a priority task in innovation processes. In this respect, it seems important to note that, although real impacts cannot be measured in the early stages of the innovation cycle, there are few real obstacles preventing firms from defining, at a minimum, a plan for systematically monitoring and evaluating their
innovation operations. This resistance to monitoring is more observable in cases with a high social weight, probably because, in contrast to technology innovation, social innovation gains are frequently difficult to identify and assess. Another controversial question is that of the real consistency between achievement and objectives. Indeed, when defining ex-post impact evaluation, it is important to ensure that the effects of innovation are aligned with firms’ initial SI challenges. There is a risk, for example, that a project originating from a distinct sustainability perspective eventually becomes a social initiative whose objectives, though beneficial, are different from those envisaged at the project’s initial conception.

4.3.2.7. SI Critical factor 39: Communication and dissemination

**Communication and dissemination**: Dissemination for sustainability-type SI may be extended from that of mainstream innovation, which is focused on market share and customer segments. For the challenge of SI as complex and inter-connected, multi-objective and multi-stakeholder, the communications and dissemination agenda is wider in scope. First, as the community of users, producers and stakeholders is more multifarious, communications will be wider and more multi-channel. Second, there are multiple objectives (social, technical, economic, environmental, etc.), which call for a communications and dissemination effort that can respond to different cultures and communities (e.g. talking to both hard business and green activists). Finally there is a normative agenda to spread (disseminate) the enterprise model (social and/or technical) and the underlying value models of sustainability to policy, to business and to civil society.
4.4. SI Management Dimension 4: Impact

The impact of sustainable innovation may be analysed from two different perspectives. On the one hand, we may focus on those ‘system transformation-oriented’ or structural objectives whose fulfilment would indirectly suppose a positive contribution to sustainability challenges, e.g. changes in lifestyle, actions for economic growth, initiatives to reinforce a sense of community, entrepreneurship-oriented and knowledge-sharing strategies, among others. On the other hand, impacts may respond to narrower sustainability-problem-oriented actions. Thus the effect of sustainability actions should be measured in terms of their social, economic or environmental sustainability. CASIPEDIA analysis has shown that SI projects usually combine both transformational and sustainability strategies.

The SI Impact dimension consists of two key aspects: Transformation and Sustainability.
4.4.1. SI Management key aspect 9: Transformation

By (multi-agent) Transformation we mean the positive changes in the quadruple helix of SI and knowledge production. There are six critical factors linked to this SI key aspect: stakeholder and community development (to consolidate new/existing players and promote spin-offs and networking); knowledge-based products and services (to increase academic, cultural or scientific advances); values and lifestyle changes (to promote knowledge- and media-based cultural and behavioural change); multi-challenge approaches (to better manage the complexity of dynamically changing socio-technical systems, visions and paradigms); capacities and skills (to support workforce development, competences and jobs); and entrepreneurship (to innovate and create new business opportunities).

The SI Transformation key aspect consists of six critical factors:

- Stakeholders and community development
- Knowledge-based products and services
- Values and lifestyle changes
- Multi-challenge approaches
- Capacities and skills
- Entrepreneurship

4.4.1.1. SI Critical factor 40: Stakeholders and community development

Stakeholders and community development: Sustainable innovation requires the participation and interaction of multiple stakeholders. Innovation processes contribute, through such interaction, to stakeholder capacity-building. In fact, knowledge sharing helps to enrich their intellectual capital and consolidate their innovation competences. Another benefit of SI in relation to stakeholders concerns its capacity to stimulate the creation of new players and roles. The combination of both effects reinforces innovation systems, whose actors will thus communicate better and be more inter-connected.

Interestingly, there are also some SI initiatives whose mission consists of facilitating actors’ alliances, which makes the reinforcement effect of the innovation system reinforcement even more pronounced. In parallel to ‘economic growth’ comes ‘social and community development’ or ‘community sense’, as another high-level goal of both social and technical SI. Community development is equally important but less directly measurable. Many schemes have emerged in recent years, including social return on investment, the liveability index, community resilience index, sustainable community indicators, and so on. Some of these are useful for benchmarking SI projects or programmes, to enable decision-making on investment, subsidy, human resource development or other policy issues. However, the most realistic and effective method may be self-evaluation, as in the social innovation exchange. Some of these may be relevant to some technology innovations, as and where there is an active interface with social and user communities.

4.4.1.1.1. SI Critical factor 41: Knowledge-based products and services

Knowledge-based products and services: The counterpart of the social/mutual learning process above, is the outcome and end-result of the SI project, programme policy or initiative (i.e. patents, publications, databases, protocols and tools). In principle, where knowledge circulates, then synergies can be formed, value chains can be managed and grown, further innovation can be disseminated, and so on. In reality there are many gaps and barriers: one example is the construction industry, well known for inertia, resistance to change, skills gaps and professional in-fighting. Some of the CASIPEDIA cases illustrate not only the direct effects of a technical or industrial innovation, but also, ‘between the lines’, the barriers and resistance to knowledge-sharing and networking. The success of a typical SI might, then, be measured not so much in its energy-efficiency but in its effect on a mutual learning community.
4.4.1.2. SI Critical factor 42: Values and lifestyle changes

Values and lifestyle changes: Changes in values and lifestyle – including social and cultural transformation – are at the heart of almost every social innovation, and of many forms of technology innovation. In reality this is often not simple: there is resistance to behavioural or cultural change which disrupts existing social models and patterns. New concepts, such as ‘nudge theory’ have emerged to provide a rationale and a practical guide to planned behavioural change. This also highlights the central role of awareness-raising and education. However, in practice, these are not always effective, particularly when coming top-down from large corporations or government. This calls for a new understanding of how social change can best self-organise from within at the community level, and how policy can provide the best incentives for its goals.

4.4.1.1. SI Critical factor 43: Multi-challenge approaches

Multi-challenge approaches: These may combine a technical leap (frequently enabled by social media or big data), with users’ social innovation, policy innovation in regulation and procurement, and organisational innovation, a leap which requires new structures and incentives to manage a whole new socio-ecological business/enterprise model. However, in reality there are many examples of ambitious schemes with unseen gaps or unrealistic objectives, and of impractical enterprise models, combined with personality conflict, ‘mission creep’, unreliable sponsors, and so on. All this calls for new ways of understanding and mapping the essential features of success or failure in various types of SI, in terms of objectives, resources, enablers, methods, feedback and so on.

4.4.1.2. SI Critical factor 44: Capacities and skills

Capacities and skills: The question of employment is highly topical for mainstream innovation, which can be disruptive and job-negative, at least in the short term. For social innovation there is an agenda which may question the structures of formal jobs and competences in relation to community prosperity or liveability, the social/cultural economy, or the informal/grey economy. The implication is a huge diversity of possible social enterprise models and value chains. For technology-focused SI, the first objective here is focused on environment and climate goals, in which an increase in employment is often seen as an inevitable outcome. However, there is visible tension between a top-down, capital- or skills-intensive mode of SI - for instance with large wind turbines which may create relatively few jobs - and a more community-focused programme, for instance in housing retrofit, which is naturally labour-intensive.

4.4.1.1. SI Critical factor 45: Entrepreneurship

Entrepreneurship: Sustainable innovation, like the majority of innovation projects, promotes entrepreneurship. This premise, which is generally accepted, can nevertheless be questioned and challenged. CASIPEDIA observation and analysis confirms, for example, that there may be SI cases in which the positive effects of entrepreneurship in one sector are neutralised by job destruction consequences in other sectors. Another controversial aspect of debate is well illustrated by the following question: are sustainability awareness and/or social concerns the innovators’ real leitmotifs? Conversely, are self-employment and personal development pressing needs that actually induce innovation initiatives? In principle, it seems reasonable to argue that decisions to innovate need to balance both perspectives, thus getting the best of collective and personal motivations.
4.4.2. SI Management key aspect 10: (Systemic) Sustainability

By (Systemic) Sustainability we refer to any incremental or radical change in the innovation ecosystem that leads to positive transformations in societal, economic, environmental, government or infrastructure systems, without compromising the needs and welfare of future generations. There are five critical factors linked to this aspect: societal sustainability (to improve social cohesion/interaction, community sense, education); economic sustainability (to improve consumption, production, labour conditions, trade, etc); infrastructure sustainability (to improve the energy, water and food supply system, waste management, settlements and cities, transportation, distribution and knowledge-transfer channels); environmental sustainability (to protect cultural/ecological heritage, species, resources, environmental protection laws and policies); and government system sustainability (to improve public participation and democracy).

The SI Sustainability key aspect consists of five critical factors:

- Societal system sustainability
- Economic system sustainability
- Environmental system sustainability
- Government system sustainability
- Infrastructure system sustainability

4.4.2.1. SI Critical factor 46: Social sustainability

Social system sustainability: This takes into account positive societal transformations using the following systemic change criteria: Population development and composition; Income distribution and class structure; Social security and ageing provisions; Social interaction and communication; Social behaviour; Civil liberties and human rights; Gender, social class and group equity; Individual autonomy and self-determination; Education and qualifications; Human health; and Individual behaviour.

4.4.2.2. SI Critical factor 47: Economic sustainability

Economic system sustainability: This takes into account positive economic transformations using the following systemic change criteria: Population development and composition; Income distribution and class structure; Social security and ageing provisions; Social interaction and communication; Social behaviour; Civil liberties and human rights; Gender, social class and group equity; Individual autonomy and self-determination; Education and qualifications; Human health; and Individual behaviour.

4.4.2.3. SI Critical factor 48: Environmental sustainability

Environmental system sustainability: This takes into account positive environmental transformations using the following systemic change criteria: Environmental protection laws and policies; Resource extraction policy and practice; Protection of renewable resources; Protection of species and ecological heritage; and Protection of cultural heritage and the rights of future generations.

4.4.2.1. SI Critical factor 49: Government system sustainability

Government system sustainability: This takes into account positive government transformations using the following systemic change criteria: Government administration; Public finances and taxes; New Governance institutions; Political participation and democracy; Conflict control and resolution; Population and immigration policy; Government intelligence; International assistance and aid policy; and Industry and Technology policy.
4.4.2.1. SI Critical factor 50: Infrastructure system sustainability

Infrastructure system sustainability: This takes into account positive infrastructure transformations using the following systemic change criteria: Settlements and cities; Transportation and distribution; Waste management; Health services; Communication and media; Energy, water and food supply systems; other goods supply systems; Services supply systems; Creation, destruction or modification of research, technology development and innovation (RTDI) institutions/organisations; Knowledge-transfer channels; and RTDI wiring up and collaborative connections.
5. Key SI management considerations: Lessons from CASIPEDIA and beyond

5.1. Rationales and methodology

The objective of this analysis was to use different CASI sources to elaborate a set of SI management common considerations. Given that sustainable innovation is highly diverse and can take the form of product, service, social, organisational, governance, system and marketing innovation, it was agreed that these considerations should be generic, concise and adopt a straightforward recommendation style.

The following CASI sources were utilised in the analysis: 1) initiatives mapped in CASIPEDIA; 2) CASI stakeholder analysis; and 3) the sustainable innovation literature. Diagram 10 shows how different sources have provided different types of information.

The information obtained from these sources was observed from SI conception, process and motivation perspectives. Where SI conception is concerned, two important categories emerged: while SI factors of success are those aspects that facilitate the conception and launch of SI projects, SI barriers refer to those elements that make this phase difficult. With regard to the SI process, the analysis adopted a traditional SWOT approach, thus differentiating SI opportunities and strengths (which contribute to keeping the SI process alive) from SI threats and weaknesses (which hinder the innovation process). In relation to SI motivations, several SI drivers have been recovered from the innovation literature.

Drawing on the previous information, a set of 60 common considerations has been formulated. They have emerged as individual answers to questions like: how can innovators take advantage of existing factors of success? How can they overcome SI barriers? How can they capture the opportunities that facilitate the innovation process? How can SI threats be avoided? How should innovator’s strengths and weaknesses be analysed and considered? How should SI innovators understand the influence of SI drivers and align them with their own SI objectives?

Diagram 10: Sources for identifying SI common considerations
5.2. Linking inductive and cross-cutting approaches

5.2.1. Technological considerations

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<thead>
<tr>
<th>SI COMMON CONSIDERATIONS</th>
<th>CONTEXT</th>
<th>PEOPLE</th>
<th>PROCESS</th>
<th>IMPACT</th>
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<tbody>
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<td>1 Analyse dependence on other technologies</td>
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<td>2 Develop an IPR strategy</td>
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<td>3 Elaborate technology development plans</td>
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<td>4 Identify and assume protection and imitation costs</td>
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<td>5 Make a plan for digital and social media communication</td>
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<td>6 Guarantee an easy use of innovation</td>
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<td>7 Create maintenance and contingency plans</td>
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<td>8 Reinforce technical capabilities and capacities for technological anticipation</td>
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<td>9 Ensure an adequate level of novelty in both radical and incremental innovations</td>
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<td>10 Develop supporting infrastructures</td>
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<tr>
<td>11 Comply with tech standards and get the right level of complexity</td>
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<td><strong>Total</strong></td>
<td>4 7 9 7 10 5 6 10 5 9</td>
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</tbody>
</table>

**Context-related considerations**

The context analysis reveals the importance of elaborating long-term innovation plans. Such plans could take the form of technology roadmaps. It may help to visualise current and estimated inter-dependences with other supporting and complementary technologies, and support technical development and strategic IPR decisions. By involving key staff and selected stakeholders in roadmaps, construction innovators can also capture different socio-technical perspectives.

**People-related considerations**

Participatory planning strengthens staff’s strategic skills and technical creativity, and may also be useful for motivating personnel. It is also important to note the benefits of engaging final users in the whole innovation process, as they may facilitate the discovery of technical pitfalls, the identification of potential obstacles to innovation utilisation, and the creation of more effective product-updating plans.

**Process-related considerations**

Long-term technology and IPR plans need to be regularly monitored and updated. Thus innovators are more effectively committed to forward-thinking throughout the whole innovation projects. These plans also constitute an instrument for communicating the potential of the innovation to customers and investors.

**Impact-related considerations**

Technology plans also contribute to the sustainability of innovation initiatives. The analysis shows, for instance, that, by anticipating users’ needs or assuming the development of future supporting infrastructures, the innovation process may become more socially, economically and environmentally effective.

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3 Cells marked with 1 represent linkages between common SI considerations and aspects.
### 5.2.2. Economic considerations

<table>
<thead>
<tr>
<th>SI COMMON CONSIDERATIONS</th>
<th>CONTEXT</th>
<th>PEOPLE</th>
<th>PROCESS</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elaborate market expansion plans</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Create realistic business strategies</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Design capacity enlargement and production adjustment plans</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Differentiate between mass production and differentiation strategies</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Define economic benefits targets, where applicable</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Define cost reduction objectives, where applicable</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Elaborate a strategy for local development</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Assess the possibilities and implications of self-employment</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Make a clear estimate of initial investments</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Evaluate the availability of resources needed for the future</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Ensure the stability of funds during the SI process</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Increase/maintain adequate efforts in R&amp;I</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4</td>
<td>8</td>
<td>11</td>
<td>6</td>
</tr>
</tbody>
</table>

#### Context-related considerations

The analysis of sustainable innovations reveals that SI initiatives are not always based on realistic objectives. To be more realistic, these objectives need to take into account, among other things, the existing local opportunities, and to assess the potential of innovation to reinforce local growth. Integrating SI strategies with local/regional development plans may allow a more precise idea of future economic needs and ensure long-lasting financial stability.

#### People-related considerations

Business plans are often too strongly influenced by innovators’ or sponsors’ optimism and motivation. In these cases, there is a high risk that plans and targets will become unreachable. Human resources strategies are costly, so clear hiring plans are necessary to ensure staff motivation and commitment to SI, while ensuring the sustainability of the whole project (e.g. trying to find the right balance between voluntarism and professionalism).

#### Process-related considerations

Sustainable innovation often requires regular investments. These should be based on continually updating the analysis of local/national opportunities. Thus innovation processes can be adjusted and production capacities reconsidered. Special attention also needs to be paid to the maintenance of research activities, as a way of showing our commitment to innovation to potential funders and investors.

#### Impact-related considerations

We may affirm, while accepting that this is intending to be an axiom, that the SI capacity to promote social and environmental transformation depends heavily on the innovator’s economic nous and effort. This explains why the highest SI impacts are usually achieved by economically well monitored initiatives, e.g. those committed to updating their objectives, supervising costs, and adjusting their capacity/capabilities plans.
5.2.3. Environmental considerations

<table>
<thead>
<tr>
<th>SI COMMON CONSIDERATIONS</th>
<th>CONTEXT</th>
<th>PEOPLE</th>
<th>PROCESS</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>24 Understand the potential and implications of climate change adaptation and mitigation strategies</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>25 Identify those environmental elements where SI could make a better impact</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>26 Develop environmental ex-ante impact measuring tools</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>27 Evaluate the potential of SI to solve energy problems</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>28 Define and communicate how the innovation is contributing to promoting sustainable life styles</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>29 Evaluate potential ecological collateral effects</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

**Context-related considerations**
Sustainability problems are highly complex and their solutions normally have implications for other economic and social areas. We can see, for example, how sustainability issues are present in most of the Horizon 2020 societal challenges. Consequently, SI requires the identification of those aspects that may have a positive impact on environmental problems without presenting negative collateral effects. Communicating the potential of SI to solve environmental issues should include an acknowledgement of potential unintended damages and the way these have been evaluated and prevented.

**People-related considerations**
Although innovators’ predisposition and capacity to convince people of the benefits of leading a sustainable lifestyle are favourable aspects for improving and preserving the natural environment, the CASIPEDIA analysis also shows that attitude is not enough. Innovator’s aptitude, knowledge and, in general, the intellectual capital of organisations, play a very important role in the process of devising effective environmental solutions. These knowledge skills also help elaborate more reliable SI ex-ante impact assessments.

**Process-related considerations**
Environmental innovation processes should be (re)shaped according to the observed ongoing impact and the evolution of the targeted environmental problem. Taking timely and revitalising decisions (or adopting relevant strategy changes) helps innovators to reduce gaps between SI objectives and environmental achievements and to eliminate the risk of having any undesirable/unintended socioeconomic consequences.

**Impact-related considerations**
Environmental improvements only manifest in the long term. This explains why environmental innovation depends so much on social (e.g. civil actors’ understanding and engagement) and economic (e.g. availability of funding and resources) sustainability aspects. Other important factors that help to create the desirable environmental impact are those that make a wider use of the particular environmental innovation while, in parallel, promoting a more sustainable lifestyle. Unfortunately, implementing this kind of lifestyle-related initiative is a complicated task, as human behaviour is difficult to understand and changing it is normally beyond innovators’ capacity and scope.
5.2.4. Political considerations

<table>
<thead>
<tr>
<th>SI COMMON CONSIDERATIONS</th>
<th>CONTEXT</th>
<th>PEOPLE</th>
<th>PROCESS</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 Understand bureaucratic related processes</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>31 Acknowledge/influence government’s political position</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>32 Analyse policy agenda opportunities</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>33 Learn applicable regulation</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>34 Be regularly informed of current and potential regulation changes</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>35 Achieve sustainable political support</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>36 Get timely access to experts and policy advisors</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>37 Estimate and assess lobbyists’ and competitors’ reactions</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5</td>
<td>2</td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

**Context-related considerations**
Understanding the policy context is crucial for the innovator to position his/her SI project. It is particularly important to be informed of regulation changes and new policy definitions of R&I priorities. In this regard, access to academic lobbies and groups of experts should be a strategic priority. This may be complemented by an analysis of foresight studies and SI reports.

**People-related considerations**
The creation of influential networks has much to do with SI directors’ ability to participate in policy workshops and take part in stakeholder/competitor diverse fora, e.g. conferences, expert groups, trade fairs, etc. It is important that managing directors understand the policy discourse, and are thus able to develop convincing arguments to get government on board. This networking activity also helps to anticipate competitors’ behaviour and reactions.

**Process-related considerations**
The SI process has to be politically resilient. In other words, policy-related networking activity should not depend critically on political changes. By maintaining a stable and reliable network of informers, policy supporters and collaborators, the SI process will gain in stability. Similarly to technological and economic monitoring, innovators’ political activity should be informed and synchronised with the evolution of the political environment. Decisions taken in this respect will be different, however, at different stages of the innovation process, i.e. networking and lobbying strategies may largely differ during pre-market and innovation consolidation phases.

**Impact-related considerations**
In contrast to other types of innovation, the impact of SI depends heavily on the definition of policy priorities and declared government SI expectations. Sustainable innovation tackles wide and complex problems that can only be achieved through the combination and alignment of multiple initiatives around a common policy agenda. By keeping a distance from existing SI policy agenda, innovators could involuntarily be driven to a paradox where they dedicate too many resources to devise and formulate creative, smart solutions considered of low impact and little relevance by policy makers and potential public funders. If such a situation occurs, innovators may decide to anticipate their expansion plans and export their solutions to more favourable political contexts.
5.2.5. Social considerations

<table>
<thead>
<tr>
<th>SI COMMON CONSIDERATIONS</th>
<th>CONTEXT</th>
<th>PEOPLE</th>
<th>PROCESS</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elaborate a SI communication plan</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Establish realistic poverty-related targets, where applicable</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Establish achievable social-minorities-focused objectives, where applicable</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Establish realistic health targets, where applicable</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Establish realistic welfare and security targets, where applicable</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Interact with social actors with impact-oriented plans</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Devise instruments to measure the social impact of the innovation</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Design/Implement motivation techniques for personnel</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Balance the use of volunteering and professional resources</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Keep alive the interest of beneficiaries in the SI</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Coordinate the action of the actors involved</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Develop knowledge-transfer mechanisms and platforms</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Update and share objectives with partners</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Establish linkages/relationships with civil society organisations</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5</strong></td>
<td><strong>6</strong></td>
<td><strong>9</strong></td>
<td><strong>14</strong></td>
</tr>
</tbody>
</table>

**Context-related considerations**

One important factor to be considered when developing SI innovation is the innovator’s interaction with social actors. To facilitate this, it is useful to elaborate communication plans in which the SI objectives are realistically described. In this sense, it is important that social, economic and environmental targets are mutually compatible so as to generate interest and empathy among SI actors and potential clients. Measuring the social impact of the innovation, though difficult, also helps to keep stakeholders’ fully engaged.

**People-related considerations**

Given the importance of people’s awareness and interaction with them to target sustainability problems, SI is frequently associated with purely social processes. It is therefore essential that sustainable objectives are shared and agreed with every actor involved in the SI process. As for SI staff, different motivation techniques can be used to consolidate a common position on key social values and preferences.

**Process-related considerations**

In general, social-related decisions are fundamental for catalysing and sustaining SI projects. One relevant decision, for example, involves the development of (or participation in) knowledge-transfer platforms.

**Impact-related considerations**

The capacity of SI to address sustainability problems needs to be preceded by a reflection on possible unintended consequences. It is particularly important to avoid SI giving rise to social exclusion, e.g. difficult access to SI by minorities or disadvantaged social groups.
### 5.2.6. Ethical considerations

<table>
<thead>
<tr>
<th>SI COMMON CONSIDERATIONS</th>
<th>CONTEXT</th>
<th>PEOPLE</th>
<th>PROCESS</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>52 Make ex ante evaluation of the SI ethical consequences</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>53 Avoid SI bringing about the exclusion of specific user-groups</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>54 Develop a communication plan based on unambiguous organisational sustainability objectives</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>55 Identify and integrate all affected community members</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>56 Communicate how the innovation is aligned with social values</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

#### Context-related considerations

Innovations, principally disruptive ones, are frequently a source of controversial debates and ethical dilemmas. This is particularly evident in sustainable innovation, insofar as it normally presents clear linkages with social innovation and it is crucially influenced by human behaviour and lifestyles. In addition, the multiplicity of actors taking part in innovation processes makes the alignment of interests and personal preferences very difficult. To deal with these sorts of difficulty, innovators need to identify and integrate, all community members who could legitimately claim to be affected by the innovation in the project, as far as is possible.

#### People-related considerations

Individuals’ subjectivity and capacity for interpretation are two elements present in most ethical debates. In these debates discussants’ or activists’ strengths largely depend on their enthusiasm, empathy, grade of involvement and commitment. The analysis of CASIPEDIA initiatives shows that these sorts of attitude may have a stronger influence than other human aptitudes or abilities, such as leadership or creativity skills.

#### Process-related considerations

To keep alive the interest of customers and stakeholders in an innovation it is important to address and reduce every ethical controversy. It is, for example, essential to maintain user confidence alongside the whole innovation process, i.e. from the initial piloting phases to development and subsequent commercialisation. Confidence in and the reliability of the innovation can be consolidated and enhanced by developing transparent communication plans. These plans are useful to clearly differentiate not-for-profit environmental targets from other corporate and economic objectives. (In fact, this differentiation is often not well understood by users and consumers, and a firms’ real commitment to sustainability may be called into question.)

#### Impact-related considerations

The analysis confirms the importance that ethical aspects have for addressing transformation targets and for ensuring the sustainability of the innovation process. Conflicts with social values, like the exclusion of social minorities or disabled groups, may in practice invalidate any other environmental benefits of the innovation. Comprehensive ex-ante evaluations are therefore recommended, i.e. assessment needs to be carried out taking into account economic, social and environmental perspectives.
5.2.7. Spatial considerations

<table>
<thead>
<tr>
<th>SI COMMON CONSIDERATIONS</th>
<th>CONTEXT</th>
<th>PEOPLE</th>
<th>PROCESS</th>
<th>IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establish realistic demographic objectives, where applicable</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Align innovation with rural/local traditions</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Contemplate heritage preservation in the innovation conception</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Distinguish between local SI experimentation results and their application to other environments</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Context-related considerations
Sustainable innovation is sometimes specifically oriented towards the preservation or recovery of rural/local traditions and to the conservation of cultural heritage. In these cases, it is usually relatively easy to get the agreement of local authorities and citizens. In other cases, heritage- and culture-related actions are designed and implemented to complement and confer solidity on primary sustainability objectives.

People-related considerations
Aligning innovation with rural or popular traditions largely depends on innovators’ empathy and predisposition to conserve cultural values. This alignment is favoured by their capacity to understand cultural and historic roots. The sense of community is also an important factor to take into account in this alignment: innovations that protect heritage are more effectively supported and favoured by citizens when they consider popular heritage as ‘theirs’.

Process-related considerations
Spatial and demographic objectives need to be realistically delimited during the first stages of the innovation process. In this respect, the potential of innovation to solve demographic problems should also be regularly assessed and challenged. This assessment can be made by observing affected actors’ reactions and measuring how much the innovation has been able to show positive effects on the preservation of people’s traditions and on local demography. In sum, addressing spatial, demographic and heritage-related issues can definitely be a relevant factor in catalysing innovation projects.

Impact-related considerations
Apart from the aforementioned importance of defining consistent and achievable demographic and spatial objectives, there is another important aspect that must be considered in sustainable innovation impact analysis. This is the need to different innovation experimentation from the real implementation of innovation. It is broadly accepted that successful innovations sometimes occur only in very particular socioeconomic or geographical environments (e.g. isolated or remote spaces, islands, or very specific innovation user-groups, etc.). However, this success should not induce innovators to take it for granted that an innovation will work and will present the same type of impact in more complex contexts. Innovators should be aware of these sorts of problem and try to design flexible strategies that permit easier and more effective ‘replication’ processes.
6. Key findings and recommendations

6.1. Summary of findings

This report has shown the potential of CASI to build sustainable research and innovation intelligence. The work reflects how well-structured and systematic mapping exercises can be designed to get a comprehensive understanding and assessment of sustainable innovation from a practical perspective.

Based on such understanding, CASI also constitutes an effective channel through which CASIPEDIA-based insights can be provided to SI innovators, thus closing a feedback process that will eventually improve the efficacy of European SI management.

In addition, this understanding should also allow the formulation of SI policies that take more realistic account of the actual problems that sustainable innovators have to deal with, as well as permitting the definition of research and innovation funding agendas that consider innovators’ principal objectives and concerns more democratically. By supporting policies and R&I agendas CASI is actually aligning its rationales with the five principles of European good governance (EC, 2001): openness is mostly achieved by sharing SI initiatives widely through CASIPEDIA; participation is reflected in the way that CASI is currently able to engage SI stakeholders, innovators and experts; accountability relies on CASI’s dynamic assessment and tracking of SI best practices; effectiveness is illustrated through the generation of SI actions, based on a systematic analysis of SI case studies (see the CASI-F framework); and coherence is guaranteed as long as innovators and CASI analysts are co-producers of strategic, programming and operational advice.

The results presented in this work can be therefore summarised by the following three conclusion pillars:

- **SI assessment**: CASI has confirmed that SI initiatives can be mapped, structured and assessed to become a source of SI intelligence (as observed in Chapters 2 and 3);
- **SI management**: Lessons for SI management can be effectively extracted from previous SI assessment and analysis. In particular, they take the form of:
  - SI critical factors, grouped around SI aspects and SI dimensions (see Chapters 3 and 4); and
  - SI common considerations, clustered in technological, economic, political, social, environmental and ethical areas of consideration and recommendation (see Chapter 5).
- **SI policies**: A comprehensive analysis of SI innovators’ objectives has served to identify:
  - 76 research and innovation priorities by type of innovation (see Chapter 3). These represent those selected topics and areas that have been found explicitly by innovators to be relevant and strategic for the future of SI. These areas could therefore be considered in the discussions on the definition of a new European SI research agenda.
  - 10 research and innovation agendas, which represent a final reflexion or summary of the above-mentioned 76 R&I priorities. For this reason we present them in the next section of this chapter (section 6.2). An interesting cross-cutting analysis can also be found in Annex 3 of this report showing the alignment between these potential new R&I agendas and the current Horizon 2020 priorities.
  - Relevant and valuable background material, based on SI actors’ insights and the overall CASIPEDIA analysis. This material will be utilised in the elaboration of SI system-related policy advice. The generation of these SI policy recommendations constitutes a necessary further task and a natural sequence of the analysis presented in this report.
6.2. Recommendations for R&I policy agendas on sustainable innovation

To conclude this report with a more integrated approach to R&I agenda-setting, we have clustered the 76 priorities resulting from the systematic assessment of 500+ sustainable innovations into 10 R&I agendas. These are presented below in order of importance, based on a combined relevance assessment against the 22 H2020 priorities (see also Annexe 3) and the 27 citizens’ research priorities resulting from two rounds of CASI citizen panels and expert validation workshops (see also Annexe 4).

In the process of defining grand research and innovation policy priorities, up to five main and five supporting objectives per case (i.e. sustainable innovation initiatives), were clustered by type of innovation and analysed using Research Gate’s (Kapiche) text mining and analytical tool. The objectives are the real short-, medium- and long-term goals and aspirations of innovators, aiming to positively contribute to their sustainability agenda.

1. Strengthening eco-community empathy and crowd-funded development
2. Developing sustainable urban and rural infrastructures for biotechnology
3. Deploying responsible environmental and resource-efficiency strategies
4. Creating sustainable biofuel and renewable energy solutions
5. Promoting foresight for sustainability governance and intelligence
6. Advancing recycling and circular use of waste and raw materials
7. Embedding sustainability in cultural and holistic education models
8. Fostering eco-local-agriculture and bio-resources efficiency
9. Implementing sustainable transport and smart mobility innovations
10. Dealing with climate issues and managing greenhouse gas emissions

In the following subsections we provide a short description of each of these R&I agendas complemented by a list of related H2020 priorities and related citizens’ priorities.

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4 A vision, as defined in the CASI project, is a picture or imagination of a desirable future, which can be based upon hopes and dreams - but also upon concerns and fears in relation to problems or imagined threats that are not desirable. The CASI ‘Visions Bank’ ([http://www.casi2020.eu/visions-bank/](http://www.casi2020.eu/visions-bank/)) aims to share openly the results of a highly participatory citizens engagement process resulting in 50 visions on sustainable futures, with a time span of 30-40 years from now, developed during CASI citizen panels in the following 12 EU countries: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Finland, Germany, Italy, Poland, Portugal, Slovenia and the United Kingdom.
6.2.1. Strengthening eco-community empathy and crowd-funded development

The agenda for ‘eco-community empathy’, or the wider notion of ‘sustainable communities’, needs to balance aspirations with reality in a fragmented and often unequal world. At its roots, the notion of empathy is about inter-dependency and the building of reciprocity, solidarity and mutual aid. All this cuts across conventional boundaries around ‘economy’ or ‘society’; likewise the responses to this Agenda include all seven types of SI.

There is an economic dimension to SI types that engage stakeholders in sustainable and crowd-funded businesses, building local and regional economic prosperity and resilience, and cooperative business models which can re-invest in local communities and endogenous regional development. A governance dimension seeks new models of multi-stakeholder engagement in long-term sustainable development actions; multi-sector public services which can address inter-connected problems; and new models for citizen empowerment and gender/ethnic equality.

An ecological dimension seeks policies, programmes, partnerships and networks to protect natural resources in urban and rural areas, in which ICT innovation can help to mobilise social innovation, and vice versa. Each of these feeds into a social, cultural and psychological agenda, where ‘empathy’ is a driver of behavioural change and of the building of more sustainable institutions.

6.2.1.1. Related H2020 priorities

- Resource efficient sustainable lifestyles
- Climate change mitigation solutions
- Climate action by sustainable lifestyle
- Eco-innovation and green economy transition
- Strategic intelligence and citizens’ participation

6.2.1.2. Related citizens’ priorities

- Supporting local/regional agricultural production, distribution and consumption systems
- Supporting people to become producers of renewable energy
- New working models – new economic models
- Fair and participatory access to limited resources
- Ensuring inclusive and dynamic city centres
- Sustainable living environments
- Sustainable economics
- Unified ecological grading system
- Research on business models and changing institutions related to a sustainable energy economy
- Supporting an active civil society for sustainable development
- Supporting ‘Eco-preneurship’
- Access to natural resources as a human right
- Research on individual urban farming
- Co-developing green technology
- Impact of virtual communities in behavioural change
6.2.2. Developing sustainable urban and rural infrastructures for the bioeconomy

A sustainable economy means many things to many people, but a good place to start is with its infrastructures. Buildings and the built environment have huge potential for greening and material efficiency; the logistics and distribution systems of a complex economy can be tuned and restructured. Industrial supply chains can be managed through concepts of the ‘service’ and ‘sharing’ economy and consumption patterns can be reshaped in the light of new urban and rural infrastructure, promoting a circular bioeconomy.

However, all this goes far beyond technical issues, into the deeper waters of policy, behaviours, institutions, cultures, and so on. The SI types from CASI cover many angles of this; some are specific product solutions to specific problems, such as the technology of a green roof, but many more address system-level inter-connections, with services, organisational, governance, social and system SI types.

Future R&I agendas should explore this further and more systematically, and look at how SI and sustainable R&I can develop new social-economy, connected-economy or foundational economy models which then enable the technology and product innovations to reach their potential.

6.2.2.1. Related H2020 priorities

- Resource efficient sustainable lifestyles
- Climate change mitigation solutions
- Climate action by sustainable lifestyle
- Eco-innovation and green economy transition
- Climate action eco-innovation policies

6.2.2.2. Related citizens’ priorities

- Supporting local/regional agricultural production, distribution and consumption systems
- Supporting people to become producers of renewable energy
- Sustainable construction of buildings
- New working models – new economic models
- More green in cities
- Understanding and implementing sustainable electronics
- Sustainable living environments
- Sustainable economics
- Research on business models and changing institutions related to a sustainable energy economy
- Supporting Eco-preneurship
- Collaboration through shared space
- Co-developing green technology
- Impact of virtual communities in behavioural change
6.2.3. Deploying responsible environmental and resource-efficiency strategies

The environmental management agenda often creates conflicts between health and economic activity, between different social groups, or between costs and benefits. Often neither public policy nor the markets are well suited to the scale of the problems, so the possible responses are found in many types of SI. For example, governance innovations look at new regulations, trading schemes, charging schemes and public information systems as partial solutions. Product innovations focus more on the upstream issues of emissions control and monitoring, while many service innovations address whole systems such as transport or industrial supply chains, and the hotspots of residential areas and cultural assets. Water is likewise a cross-cutting issue, calling for new models of economic and social and informational exchange and inter-dependency.

Meanwhile, addressing the fundamentals of an urbanised society with widespread air and noise problems calls for systemic solutions to sustainable consumption, low-impact living and education for behavioural change. Similar approaches apply to water resource management, where system-level concepts such as ‘integrated catchment management’ raise the challenge of inter-dependency and collaboration in a multi-level and multi-sector governance situation.

6.2.3.1. Related H2020 priorities

- Resource efficient sustainable lifestyles
- Climate change mitigation solutions
- Climate action by sustainable lifestyle
- Eco-innovation and green economy transition
- Raw materials-conscious sustainable lifestyle
- Climate change adaptation solutions
- Solutions to water imbalances
- Solutions for cultural heritage assets
- Monitoring and understanding biodiversity
- Awareness of raw materials shortages
- Long-term raw materials availability

6.2.3.2. Related citizens’ priorities

- Fair and participatory access to limited resources
- Sustainable living environments
- Unified ecological grading system
- Access to natural resources as a human right
6.2.4. Creating sustainable biofuel and renewable energy solutions

Energy is the basis of a complex industrial society, and the SI agenda works equally on the supply, distribution and demand sides. Many of the SI types from CASI look at specific technologies such as biogas or anaerobic digestion. Many more look at the potential for social economic and governance models, such as community energy or eco-schools, which enable and encourage renewable energies on the supply side, or rapid efficiency improvements on the demand side.

As for future R&I agendas, there is the potential on the horizon for energy system transformation, in the sense of zero carbon supplies. More complex is the notion of energy cascades, both in technical terms, such as industrial ecology, and in design or behavioural terms in the usage of buildings, appliances and mobility.

6.2.4.1. Related H2020 priorities

- Resource-efficient sustainable lifestyles
- Climate change mitigation solutions
- Eco-innovation and green economy transition
- Eco-solutions to reduce raw materials use
- Solutions for exploring, extracting, processing and recycling
- Alternative raw materials
- Awareness of raw materials shortages
- Effective raw materials policies
- Long-term raw materials availability

6.2.4.2. Related citizens’ priorities

- Supporting people to become producers of renewable energy
- Enhanced physical activity for better quality of life and energy efficiency
- Improvement of European electricity transmission to increase renewable energy production
- Sustainable living environments
- Research on business models and changing institutions related to a sustainable energy economy
6.2.5. Promoting foresight for sustainability governance and intelligence

The institutions of governance were developed for a 20th century model of industrial society. Today the 21st century agenda for sustainability in a highly inter-connected world calls not only for marginal improvement but for new models of governance. Some of the SI priorities from CASI call for citizen engagement or new levels of policy integration, while some focus on resources in the public sector at a time of shrinkage. The potential of ICT and ‘datafication’ is huge in all of these.

For the future, new models of governance need to be explored more systematically, and applied in every sector where governance has a role. The SI cases in CASI so far are a good demonstration of the current state of the art. Some of them, though experimental, point towards alternative models and institutions for decision-making, representation and participation, active engagement of all sectors, sustainable resource management, and public services which can ‘do more with less’.

6.2.5.1. Related H2020 priorities

- Climate change mitigation solutions
- ICT systems improving resource efficiency
- Strategic intelligence and citizens’ participation
- Climate change adaptation solutions
- Climate action eco-innovation policies
- Solutions for cultural heritage assets
- Monitoring and understanding biodiversity
- Effective raw materials policies
- ICT to assess and predict climate actions
- Climate change projections and scenarios
- ICT for mapping natural resources and trends
- ICT systems to map raw materials trends

6.2.5.2. Related citizens’ priorities

- Fair and participatory access to limited resources
- Sustainable living environments
- Unified ecological grading system
- New spaces for public discourse
6.2.6. Advancing recycling and circular use of waste and raw materials

In the aspiration to a circular economy, waste is simply a resource in the wrong place but, in current realities, the pressures on large and small businesses and organisations seem to produce waste, which then has to be managed. Some waste streams are more viable than others for re-use, re-engineering or recycling. The CASI cases show a wide range of approaches, from the small scale of social enterprises, which train the unemployed in repair skills, to the large scale of national schemes for industrial symbiosis. They cover the full range not just of product innovations but also of social, service, governance, organisational, marketing and system innovations.

For the outlook, while the principles of a circular zero-waste economy are accepted on all sides, the practice depends on many challenges still to be addressed. The R&I effort should focus systematically on issues such as circular business and finance models, circular consumption systems in households and communities, and the implications of the sharing/experience economy and of globalised business and lifestyles.

6.2.6.1. Related H2020 priorities

- Resource-efficient sustainable lifestyles
- Climate change mitigation solutions
- Climate action by sustainable lifestyle
- Eco-innovation and green economy transition
- Eco-solutions to reduce raw materials use
- Raw materials-conscious sustainable lifestyle
- Solutions to explore, extract, process and recycle
- Alternative raw materials

6.2.6.2. Related citizens’ priorities

- Sustainable construction of buildings
- Sustainable living environments
- Collaboration through shared space
6.2.7. Embedding sustainability in cultural and holistic education models

Clearly a sustainable future is in the hands of the young and the education system which surrounds the theme, but it is also in the hands of citizens, workers and policy-makers at all levels, whose skill-base and knowledge-base can shape the world as it is. In this light, and defying the conventional trappings of a modern consumerist, high-mobility, high-impact society, the CASI evidence-base is particularly relevant in terms of the Citizens’ Panels, which seem to provide the foundations of an alternative and more sustainable model. This plays out in the SI cases, where not only school curriculum design but alternative notions of ‘what is a school’ are explored.

For the agenda in prospect, there are many trends and pressures, such as on-line education and gamification, the use of big data or social media in eco-feedback for citizens and businesses, pressure on education for ‘results’ and ‘impacts’ and, generally, countering the culture of globalised consumerism and distrust of governance. The CASI cases demonstrate some ways into this, but the next R&I programmes should systematically explore the potential and also the barriers to education for sustainability.

6.2.7.1. Related H2020 priorities

- Resource efficient sustainable lifestyles
- Climate change mitigation solutions
- Climate action by sustainable lifestyle
- Strategic intelligence and citizens’ participation
- Climate change adaptation solutions
- Awareness of raw materials shortages

6.2.7.2. Related citizens’ priorities

- Holistic education for a sustainable future
- Enhanced physical activity for better quality of life and energy efficiency
- Sustainable living environment
- Impact of virtual communities in behavioural change
6.2.8. Fostering eco-local-agriculture and bio-resources efficiency

Food and farming systems underpin almost every sector and community. On the supply side, farming and fisheries are deeply embedded in rural and coastal economies and societies, as well as in environment and climate issues. On the distribution and demand side, food is a deeply cultural and psychological issue, at the same time raising huge challenges in public health and education. A wide range of CASI cases demonstrates this inter-connectedness (although with fewer product types than elsewhere). Many of them focus on the local community level and aim for more feedback and circularity between producers and consumers. Some look at industrial ecology and alternative cultivation, such as aeroponics or aquaculture.

Are there transformational innovations or systems in prospect, beyond the small-scale experiments and community social innovations? Some ideas come directly from citizens themselves, such as ‘insect food’ or ‘edible towns’. Future R&I should explore the multi-scale questions more systematically, i.e. how to scale up the micro-innovations, and also how to influence global food systems for a post-oil sustainable food transition.

6.2.8.1. Related H2020 priorities

- Resource efficient sustainable lifestyles
- Climate change mitigation solutions
- Climate action by sustainable lifestyle
- Eco-innovation and green economy transition
- Monitoring and understanding biodiversity

6.2.8.2. Related citizens’ priorities

- Supporting local/regional agricultural production, distribution and consumption systems
- Innovating agriculture: the sustainability option
- A new European food culture
- Research on individual urban farming
- Exploring the introduction of insects as food
6.2.9. Implementing sustainable transport and smart mobility innovations

Sustainable mobility, accessibility and/or transport modal shift is a well-worn path of R&I, in technology, behaviour and governance. The CASI cases demonstrate the state of the art: many new opportunities are coming through smart cities and the use of big data and mobile technology. Other opportunities on the demand side or modal shift are in social innovation and ‘community empathy’. Vehicle technology continues to progress but in some cases meets a system-level barrier, as with deployment of electric or hydrogen-based vehicles. Urban design has made some progress towards pedestrian zones and accessibility planning, but there is much further to go.

The outlook raises challenges in several ways. One is that of technology determinism (as in smart cities systems), versus wider debates on ‘the right to the city’ (as in the reshaping of local communities, housing markets and local economies). Another is about the question of unlimited mobility as the foundation of a fluid, outsourced, globalised economy and society. Future R&I agendas should explore these tensions as an essential underpinning to practical initiatives on transport supply and demand.

6.2.9.1. Related H2020 priorities

- Resource efficient sustainable lifestyles
- Climate change mitigation solutions
- Climate action by sustainable lifestyle
- Eco-innovation and green economy transition

6.2.9.2. Related citizens’ priorities

- Sustainable transformation of existing traffic infrastructure in cities
- New working models – new economic models
- Sustainable living environment
6.2.10. Dealing with climate issues and managing greenhouse gas emissions

As climate change is perhaps the ‘grandmother’ of all environmental problems, and despite the agreement on aspirations at the Paris COP, complete solutions are not expected in the near future. There are uncertainties on costs and benefits, controversies on resources and restructuring of economies and infrastructure, and a continuing campaign of scepticism and denial, not only from lobby groups but also as a result of disconnections in the public mind and psychology. The CASI cases demonstrate this wide range of issues and possibilities, from practical technologies or business models to national infrastructures. Many also focus on the human side of education, feedback, ‘community empathy’ and cultures of inter-dependency and responsibility, as well as on practical social-finance business models or land-use regimes.

Future R&I agendas could take such initiatives and many others as a starting point, i.e. where climate solutions are not only a technocratic top-down type of ‘problem’, but more about opportunities distributed across many sectors and many levels. If we can systematically explore these wider inter-connections between multi-level and multi-sectoral opportunities, there is a better chance of shifting climate change from ‘problem’ to ‘opportunity’, and engaging all parts of society in a common aim.

6.2.10.1. Related H2020 priorities

- Climate change mitigation solutions
- Climate action by sustainable lifestyle
- Climate change adaptation solutions
- Climate action eco-innovation policies

6.2.10.2. Related citizens’ priorities

- Supporting local/regional agricultural production, distribution and consumption systems
- Sustainable economics
Annexes
7.1. Annexe 1: CASI project work packages and tasks structure

The work plan spanned a period of 42 months (3.5 years) and was structured into 11 work packages.

**WP1: Management.** This work package established the management structure and internal management procedures. A Steering Committee was established as an oversight mechanism for the project, and an Advisory Committee and Network of country correspondents was set up to expand the geographical outreach of the project.

- Task 1.1. Technical management
- Task 1.2. Financial management
- Task 1.3. Management procedures
- Task 1.4. Action Networks
- Task 1.5. Sustainability of the project

**WP2: State-of-the-art.** WP2 laid the foundation for the rest of the project. It involved a state-of-the-art report on research and innovation related to the Grand Challenge ‘Climate action, resource efficiency and raw materials’ (SC5). Review, analysis and mapping of sustainable innovation initiatives were carried out to establish a conceptual theoretical framework, complemented by empirical cases gathered across Europe, and to provide a section on working definitions and approaches to sustainable innovations. This WP is closely linked to WP3, WP4, WP5 and WP6.

- Task 2.1. To systematically identify and review key sustainable innovation (SI) case studies
- Task 2.2. To map key practices in SI case studies
- Task 2.3. To map key players in SI case studies
- Task 2.4. To map key outcomes in SI case studies
- Task 2.5. To develop robust SI conceptual and methodological frameworks

**WP3: Dialogue and Participation.** WP3 ran in parallel with WP2 and went beyond it, aiming to build a common understanding of sustainable technological and social innovation, as well as a common approach to SC5 among the CASI partners and country correspondents. It enhanced the dialogue among consortium partners, country correspondents and relevant stakeholders across Europe on sustainable innovation and environment-related issues through the involvement of citizens in research and innovation policy-making, and by identifying topics for future research.

- Task 3.1. Capacity-building for the consortium partners and the country correspondents
- Task 3.2. Stakeholder Mutual Learning Seminars (MLS)
- Task 3.3. Webinar for wider societal learning and participation
- Task 3.4. Citizens and experts meetings

**WP4: Common Framework for Assessment and Management of Sustainable Innovations (CASI-F).** The objective here was to develop a common framework for assessing the sustainability of innovations, i.e. their advantages, disadvantages, relevance, benefits and risks, particularly their social, environmental and economic dimensions, taking into account general public concerns. For this purpose, an online survey was launched, and CASI-F held consultations with relevant stakeholders in the 12 participating countries.

- Task 4.1. Online survey on the characteristics of SI
- Task 4.2. Draft proposal of CASI-F
- Task 4.3. Stakeholders workshops on the draft proposal of CASI-F

**WP5: Pilot projects on testing and validating CASI-F.** In order to avoid collecting irrelevant and useless data, the CASI partners conducted a pilot testing of CASI-F. CASI-F was applied to a number of technological and social innovation cases gathered in WP2, so as to (i) identify shortfalls and (ii) propose adjustments/corrective changes to the assessment methodology.

- Task 5.1. Technology innovation cases to be assessed via the CASI-F
- Task 5.2. Social innovation cases to be assessed via the CASI-F
WP6: Management of sustainable innovation. WP6 ran in parallel with WP5. The partners worked with the case study actors involved in WP5 (technology or social innovators) in order to verify and include the changes requested or suggested in the final version of CASI-F.

- Task 6.1. Interviews/working meetings with the developers of innovation cases
- Task 6.2. Revision and finalisation of CFAMSI

WP7: Policy Watch. This WP has established a common interface for easy monitoring of EU and national policy cycles in order to enable the streamlining of sustainable innovation measures into organisational, national and European strategic and policy planning processes. Throughout this WP, partners have been engaged in producing policy briefs. The immediate output of this WP has served as input for the elaboration and advancement of policy recommendations within WP8. A natural outcome is the European Network on Sustainable Innovation Policy Watch.

- Task 7.1. EU-level policy debates monitoring
- Task 7.2. National policy debates monitoring
- Task 7.3. Reports on policy developments and initiatives
- Task 7.4. Online policy blog

WP8: Policy Recommendations. Activities were focused on developing specific policy recommendations for stimulating wider societal engagement in sustainable innovation activities, for their assessment and improved public management, targeting different levels of governance.

- Task 8.1. Policy dialogues among relevant stakeholders on a national level
- Task 8.2. European-level policy conference on identifying common European priorities
- Task 8.3. Final report on national and European-level policy recommendations

WP9: Heritage. The main challenge was to ensure that stakeholders in Europe, both within and without the consortium, would benefit from CASI’s outcomes. Several approaches were employed so that the overall sustainability would be ensured beyond CASI’s formal duration.

- Task 9.1. Online training for the application of CASI-F
- Task 9.2. Promotion of CASI results and SI
- Task 9.3. Strategy to ensure the sustainability of the project and its results

WP10: Communication and dissemination. All communication and dissemination approaches to be applied during the project were listed in a communication strategy aiming both to raise awareness among all groups of stakeholders as to why it is necessary for them to interact, exchange ideas and participate in the process of sustainable innovations assessment, and to reach all targeted audiences.

- Task 10.1. Project web portal, homepage widgets, main modules and CMS access
- Task 10.2. CASI Knowledge platform – Online platform for internal exchange of knowledge
- Task 10.3. CASI Library – dissemination database
- Task 10.4. CASI Community – with social networking interfaces
- Task 10.5. CASI Communication Strategy
- Task 10.6. CASI Tutorials –Joint activities and education materials
- Task 10.7. Final national promotional events
- Task 10.8. Participation in EU-level events

WP11: Evaluation. This WP responded to the requirement of the call to establish systems for internal and external evaluation to ensure that project progress and results were in accordance with the work plan and met the objectives of the Science in Society programme.

- Task 11.1. External evaluation, made by independent experts
- Task 11.2. Internal observer
- Task 11.3. Internal evaluation by consortium partners
### 7.2. Annexe 2: Logos of types of innovation and critical issues

<table>
<thead>
<tr>
<th>Types of Innovation</th>
<th>Critical Issues</th>
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<tbody>
<tr>
<td>Product innovation</td>
<td>Technological issues</td>
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<td>Service innovation</td>
<td>Economic issues</td>
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<td>Social innovation</td>
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<td>Organisational innovation</td>
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<td>Marketing innovation</td>
<td>Spatial issues</td>
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<td>System innovation</td>
<td>Ethical issues</td>
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- **Technological issues**
- **Economic issues**
- **Political issues**
- **Social issues**
- **Environmental issues**
- **Spatial issues**
- **Ethical issues**
### 7.3. Annexe 3: Analysis of H2020 priorities vs. Grand R&I Agendas from CASIPEDIA

<table>
<thead>
<tr>
<th>22 H2020 priorities vs. Grand R&amp;I Agendas from CASIPEDIA</th>
<th>Strengthening eco-community and crowd-funded development</th>
<th>Developing sustainable urban and rural infrastructures for the bioeconomy</th>
<th>Deploying responsible, environmental and resource-efficient strategies</th>
<th>Creating sustainable biofuel and circular energy solutions</th>
<th>Advancing recycling and circular use of waste and raw materials</th>
<th>Embedding sustainability in cultural and holistic education models</th>
<th>Promoting foresight for sustainability governance and intelligence</th>
<th>Implementing sustainable transport and smart mobility innovations</th>
<th>Dealing with climate issues and managing greenhouse gas emissions</th>
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**Link to H2020 priorities**

| 5 | 5 | 11 | 9 | 12 | 8 | 6 | 5 | 4 | 4 |
27 Citizens’ research priorities vs. Grand R&I Agendas from CASIPEDIA

| Supporting local/regional agricultural production, distribution and consumption systems | √ | √ | √ | √ | 4 | 1 |
| Holistic education for a sustainable future | | | | | | |
| Supporting people to become producers of renewable energy | √ | √ | √ | 3 | 3 |
| Sustainable construction of buildings | √ | √ | 2 | 4 |
| Sustainable transformation of existing traffic infrastructure in cities | | | | | | |
| New working models – new economic models | √ | √ | √ | 3 | 6 |
| Innovating agriculture: the sustainability option | √ | 1 | 7 |
| More green in cities | √ | 1 | 8 |
| Understanding and implementing sustainable electronics | √ | 1 | 9 |
| Fair and participatory access to limited resources | √ | √ | √ | 3 | 10 |
| Enhanced physical activity for better quality of life and energy efficiency | √ | √ | 2 | 11 |
| Improvement of European electricity transmission to increase renewable energy production | √ | 1 | 12 |
| Ensuring inclusive and dynamic city centres | √ | 1 | 13 |
| Sustainable living environments | √ | √ | √ | √ | √ | √ | √ | √ | 8 | 14 |
| A new European food culture | √ | 1 | 15 |
| Sustainable economics | √ | √ | √ | 3 | 16 |
| Unified ecological grading system | √ | √ | √ | 3 | 17 |
| Research on business models and changing institutions related to a sustainable energy economy | √ | √ | √ | 3 | 18 |
| Supporting an active civil society for sustainable development | | | | | | |
| Supporting Eco-preneurship | √ | √ | 2 | 20 |
| Access to natural resources as a human right | √ | √ | 2 | 21 |
| Research on individual urban farming | √ | 2 | 22 |
| Collaboration through shared space | √ | √ | 2 | 23 |
| Co-developing green technology | √ | √ | 2 | 24 |
| Impact of virtual communities in behavioural change | √ | √ | √ | 3 | 25 |
| New spaces for public discourse | | | | | | |
| Exploring the introduction of insects as food | √ | 1 | 26 |
| Link to CASIPEDIA-based R&I Agendas | | | | | | |
| Link to H2020 priorities | 15 | 13 | 4 | 5 | 4 | 3 | 4 | 5 | 3 | 2 |

Link to H2020 priorities
8. Literature reviewed and references

8.1. Literature in CASI’s ‘Sustainable Innovation Conceptual Framework’ report


### 8.2. References to academic and grey literature


### 8.3. References to CASIPEDIA initiatives

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