PROJECT FINAL REPORT

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Table of Contents

4.1 Final publishable summary report

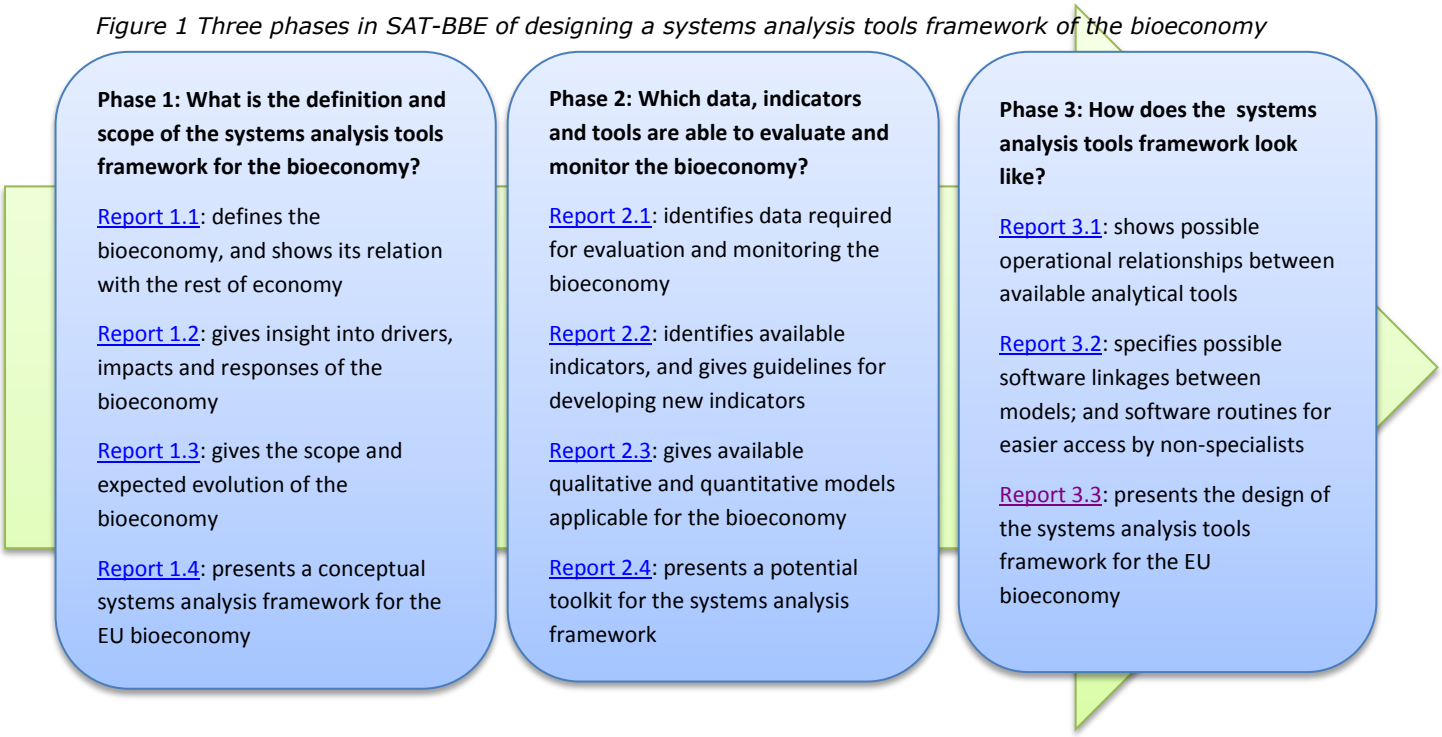
4.1.1 Executive summary

Background and objectives

One of the biggest challenges facing global society today is the provision of food, water, energy, healthcare and other resources and services to a world that will see its population increase by a third in the face of mounting environmental stresses over the next 20 years. SAT-BBE explored the data, indicators and models that help to assess the contribution of a bioeconomy in many of these areas to ensure long term economic and environmental sustainability. Given that the lead time for arriving at the solution to some key social and technological challenges is long, there is a need for a framework to structure long-term analytical capacity. This framework should provide guidance to the analysts and researchers studying the issues and problems. Such an analytical framework can also help in providing guidance and decision-support to the policy-makers responsible for the execution of consistent, coherent, and long-term strategies with desirable consequences, and on the bioeconomy as an increasingly leading part of the economic system. SAT-BBE brought together a consortium of internationally recognised and respected researchers who work on the bioeconomy and the topic of sustainability at both European and international levels.

The objective of SAT-BBE was to design a systems analysis tools framework, which must be useful to a) monitor the evolution of the bioeconomy in the EU, and b) to analyse the socio-economic and environmental impacts of the bioeconomy and its relevant policies. Figure 1 shows the three phases of SAT-BBE and includes links to the project reports.

Figure 1 Three phases in SAT-BBE of designing a systems analysis tools framework of the bioeconomy



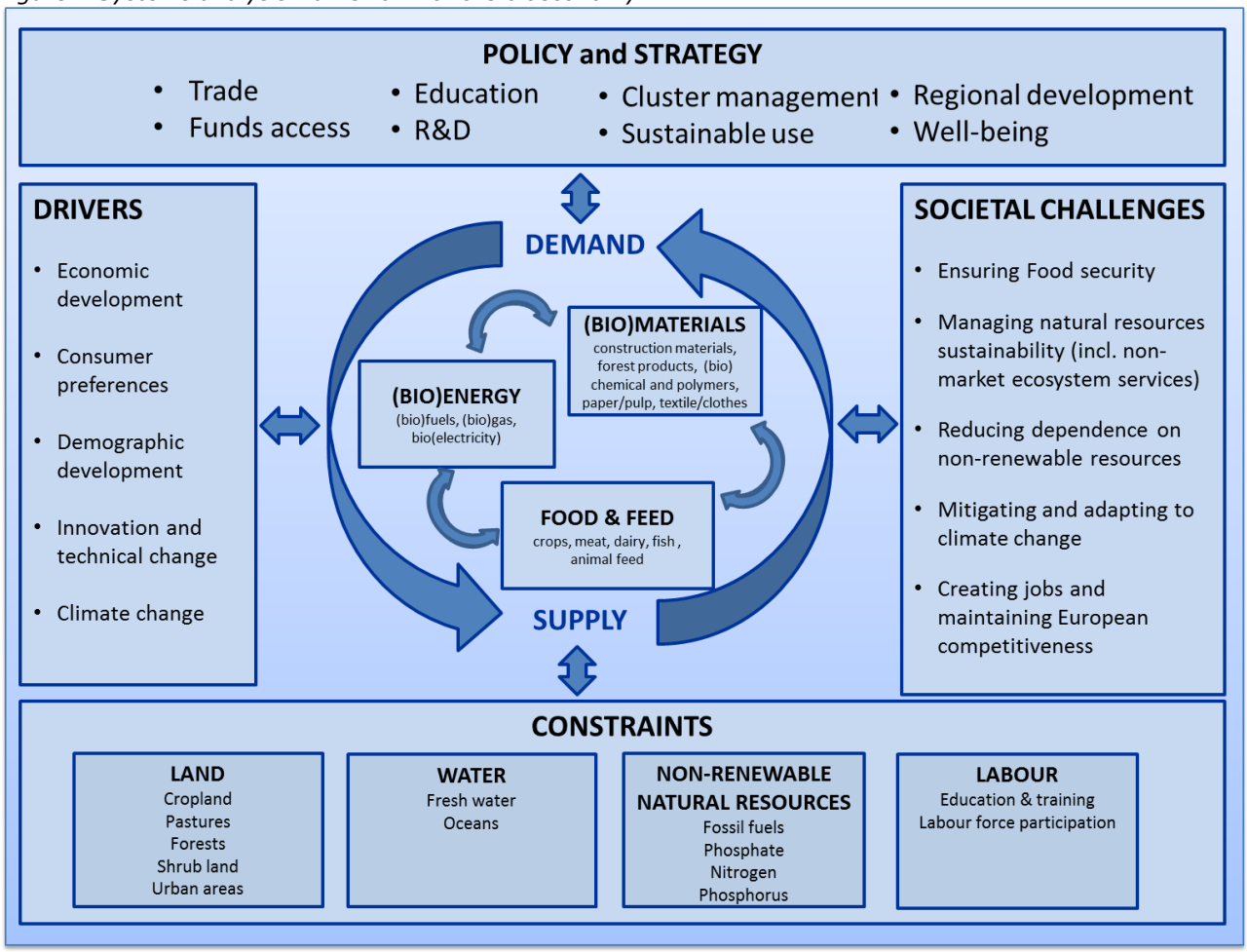
Key findings

First, the scope of the bioeconomy systems analysis tools framework has been defined using the relatively broad and generic definition of the EC (2012). '*The bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries.....*' Though not explicitly mentioned it is essential that the bioeconomy moves from a linear to a (more) circular economy and values non-market ecosystem services, and at the same time contributes to competitive opportunities of the concerned biobased sectors through innovation and technical change.

Second, a conceptual system analyses framework for the bioeconomy has been developed based on a supply-demand framework that connects the building blocks (drivers, impacts, responses) for analysing impacts, trade-off and synergy effects that go along with a transition to a biobased economy (see, Figure 2). The SAT-BBE consortium identified and

analysed the most important interactions and feedback effects between the bioeconomy and other parts of the economy (e.g. fossil and energy based industries), taking into account developments in system drivers (e.g. economic development, innovation and technical change) and constraints (e.g. land, water, non-renewable natural resources, labour). Impacts are measured in relation to the five societal challenges of the EC Bioeconomy Strategy: *ensuring food security*, *managing natural resources sustainability (incl. non-market ecosystem services), reducing dependence on non-renewable resources, mitigating and adapting to climate change,* and *creating jobs and maintaining European competitiveness*. Based on the impact of the bioeconomy on socio-economic and environmental indicators, policy and strategic management responses can be implemented in order to influence the demand and supply system drivers for meeting the targets of the Bioeconomy Strategy and other policies.

Figure 2 Systems analysis framework for the bioeconomy



Source: SAT-BBE consortium

Third, a systems analysis toolkit has been designed using existing data and model approaches (Figure 3). This figure shows the need to consider multiple scales and dimensions when monitoring the evolution and impacts of the bioeconomy. Tools are classified in General and Partial Equilibrium models (GE and PE), bottom up approaches and Integrated Assessment Models (IAM). Table 1 provides a more detailed description of these tools, in terms of their main applications, insights, and their strengths and limitations with respect to the assessment of biomass supply and its societal impacts. Table 2 indicates a number of operational models that are potentially suitable to monitor and evaluate the bioeconomy and its trade-offs. Existing models are currently extended to include more bioeconomy sectors (see, e.g. MAGNET and Globiom).

Table 1. Overview of four key mode types in SAT-BBE toolkit, for assessing biomass supply, demand and impacts: their applications, typical timeframes, key strengths, and limitations

	GE models	PE models	Bottom-up analysis	IAMs (models combination)
Application	Economy-wide impacts of overall bioeconomy and related policies, including (in)direct effects on value added, employment, land-use change and GHG emissions Competition with fossil based sectors and on factor markets induced by these policies.	Sectoral impacts of a bioeconomy sector (agriculture, forestry, energy system) and related policies. Focus on production, prices, land use and GHG emissions.	Wide variety of specific (technical) aspects of biomass production, conversion and use. Validation of other studies with a broader scope, such as PE and GE models, and IAMs	Bioeconomy resource potentials under different assumptions (incl. sustainability criteria). Contribution of bioeconomy to long-term climate policy. Impacts of bioeconomy policies on global land use, water and biodiversity
Strengths	Comprehensive coverage of economic sectors and regions to account for interlinkages. Explicit modelling of limited economic resources. Measuring the total economy wide and global effects of bioeconomy policies (including indirect and rebound effects)	Detailed coverage of sectors of interest with full market representation. Explicit representation of biophysical flows and absolute prices. Usually more details on regional aspects, policy measures and environmental indicators	Detailed insights into techno-economic, environmental and social characteristics and impacts of biobased systems	Integrating different relevant systems in one modelling framework. Possibility to analyse feedbacks between human and nature systems, and trade-offs and synergies of policy strategies. Built around long-term dynamics
Limitations	Level of aggregation that may mask the variation in the underlying constituent elements. Scope of GE models necessitates simplified, representation of agent choices, in particular favoring smooth mathematical forms and reduced number of parameters required to calibrate the models. Often no or little explicit representation of quantities for biophysical flows Do not deal with short run issues such as price volatility.	Optimization of agent welfare, but only the sectors in the model. No consideration of macroeconomic balances and impacts on not-represented sectors. Need large number of assumptions for long-term projections Do not deal with market failures wrt unemployment, price volatility, land management	No inclusion of indirect and induced effects outside the boundaries of the study, i.e. often deliberately ignore interactions with other sectors	High level of aggregation or too complex systems. Unsuitable for short-term assessments. Large number of assumptions (and the corresponding challenge in the clear) communication of these to the public)

Source: SAT-BBE consortium, adapted from Wicke et al. (2014)

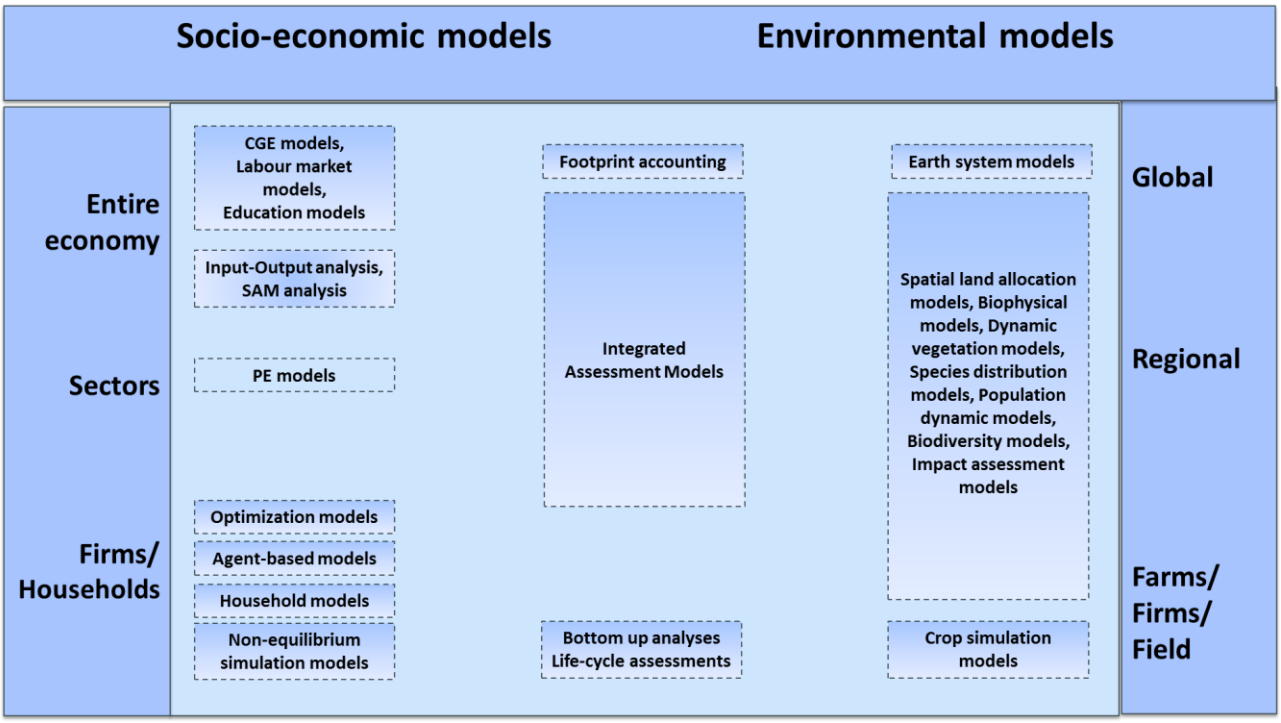
Table 2. Overview of key current models potentially suitable in SAT-BBE toolkit, for assessing biomass supply, demand and impacts: their regional and sectoral aggregation and main applications.

GE models & IAMs	PE models	Bottom-up analysis
GE models		
MAGNET *Regions:* 124 regions (incl. 28 EU MS) *Sectors*: 70 sectors, 12 primary agricultures, 8 food processing, forestry, fishery, various residues, plantations, wood pellets, wood products, paper industry, biodiesel & ethanol from various feedstock (1st and 2nd G), bioelectricity, bioplastics (PLA), bio-polyethylene *Focus*: CAP, biofuel policies, bioeconomy, trade policies, food security, food nexus, climate change	**AGLINK** *Regions*: EU28,OECD regions *Sectors*: agricultural commodities, biofuels *Focus:* CAP, biofuel policies	**Dyna-CLUE** *Regions:* high spatial resolution (global 5 minute, EU 1 km) *Sectors:* land use *Focus:* spatial allocation of land use change and ecosystem service impacts
MIRAGE *Regions*, 124 regions (incl. 28 EU MS) *Sectors*: 58 sectors, 12 primary agricultures, 8 food processing, forestry, fishery, wood & paper, biodiesel & ethanol from various feedstock *Focus*: trade policies, EU biofuel policies, food security	**AGMEMOD** *Regions*: 28 EU MS, Turkey Russia, Ukraine, Macedonia *Sectors*: 30 agricultural and food commodities, bioethanol, biodiesel *Focus:* CAP, biofuel policies	**EFISCEN** *Regions:* 38 European countries *Sectors:* Forestry *Focus:* Forest resource information, realizable biomass potentials under variable policy and management alternatives, sustainability and ecosystem service impacts
	CAPRI *Regions* : 75 countries, incl. detailed supply modules for 28 EU MS, Turkey and Western Balkans (NUTS3) *Sectors*: 50 agricultural sectors, biofuels *Focus:* CAP, environmental policies	**MARKAL/TIMES** *Regions:* Multi-regional (user dependent) *Sectors:* Energy (electricity, heat), transport, Industry (possible extension to other sectors) *Focus:* Cost optimization of (fossil, bio- and other renewable) conversion technology deployment pathways, CO_2 tax CO_2 CAP, EU renewable energy and biofuel policies, etc.
	EFI-GTM *Regions*: 58 global regions, incl 33 European regions. *Sectors*: woodworking (6 products), pulp and paper industries (16 products) electricity, heat energy. *Focus*: Trade and FLEGT policies, EU climate and energy policies, forest conservation policies.	

GE models & IAMs	PE models	Bottom-up analysis
IAM models		
IMAGE *(combination of IMAGE+MAGNET+TIMER)* *Regions:* 26 regions *Sectors:* depends on model component; e.g. 11 crop sectors, 12 primary energy carriers, 14 land cover types, *Focus:* climate change, land-use change, biodiversity loss, modified nutrient cycles, and water scarcity.	**GLOBIOM** *Regions:* 28 EU MS (NUT2); 30 Rest of World regions *Sectors:* 18 crops, vegetable oils and protein meals, DDGS, cereal straw, 7 livestock, 9 primary and processed wood products, 1st and 2nd G ethanol and biodiesel, biogas, bioelectricity, fuel wood *Focus:* climate change mitigation, food security, deforestation, bioenergy and biofuels, biodiversity protection, food-energy-water nexus	**TIMER** *Regions* : 26 regions *Sectors*: 12 primary energy carriers (incl. biomass), conversion technologies (incl. bioenergy/chemicals *Focus:* climate change, land-use change, biodiversity loss, modified nutrient cycles, water scarcity
GLOBIOM (*combination of* GLOBIOM+G4M+MESSAGE)	**IMPACT** *Regions:* 320 globally, EU relatively aggregated *Sectors:* agriculture commodities *Focus:* Ag tech growth, food security impacts, water-food linkages	

Source: SAT-BBE consortium

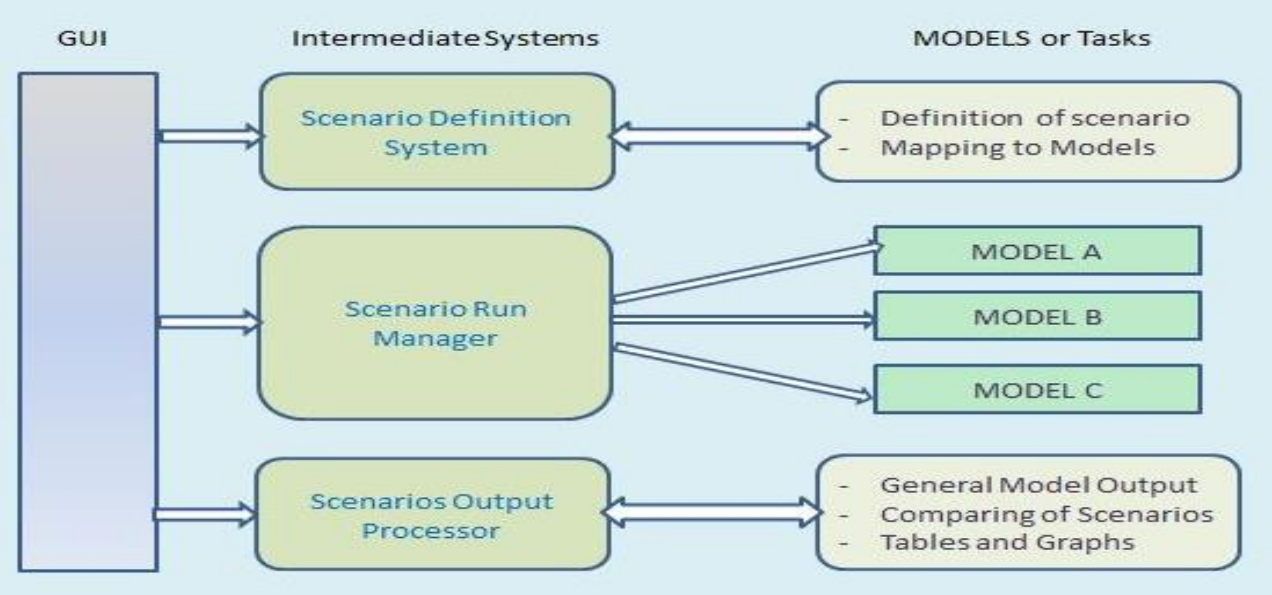
Figure 3 Overview of model types and groups presented in systems analysis tools framework of the bioeconomy



Source: SAT-BBE consortium

Fourth, it can be concluded that no 'super model' exists (nor should be designed) that covers all societal challenges and multi-dimensional relationships in the bioeconomy. Neither it is advisable to aim for such an all integrative model, as the system complexity is too high and such a fully integrative model may be overly complex and inaccessible. Instead, each model shown in Figure 3 has its specific strengths and weaknesses, which means that models needs to be linked in an operational, transparent and systematic way to monitor the evolution and impacts of the bioeconomy and to investigate impacts and potential trade-off and synergy effects, tailored to the specific aim of the analysis or policy question. For example, general equilibrium (GE) models and partial equilibrium (PE) models are essential components in the systems analysis tools framework, but are often not linked with bottom-up biophysical models and datasets (e.g. crop growth models, spatially explicit land use models, techno-economic feasibility studies). Linking of models through 'loose coupling', instead of integration of modules, is a suitable option to further operationalize the SAT-BBE framework and toolkit and provides the flexibility to include models based on the specific needs of the assessment (Figure 4). Graphical user interfaces (GUIs) can be used to facilitate loose coupling of models. GUIs also provide quality control and transparency to enable stakeholder participation in a targeted way.

Figure 4 Loose coupling of tools in the SAT framework



Source: SAT-BBE consortium

Fifth, Figure 5 shows for each of the five societal challenges of the EC Bioeconomy Strategy the required data and models, as well as the gaps in available and required data and models. In general it can be concluded that data, indicators and models are fairly well established for traditional sectors of the bioeconomy (agriculture, fishery, forestry, food, paper and pulp, textile), but less for the innovative sectors (e.g. bioenergy and biochemicals) and less for specific aspects, such as land use, employment, soil quality, etc..

Recommendations for further research

Research is required to test the applicability of the systems analysis tools framework and toolkit developed in SAT-BBE for various different research questions and policy assessments.

- Gaps exist especially for 'new' and innovative sectors of the bioeconomy regarding the availability of socio-economic indicators such as cost structures, break-even prices, value added, employment, technological potential of economies of scale and technological learning effects.
- Gaps exist for food security data regarding the availability of indicators such as consistent household income and expenditure data, nutrition intake data, own consumption and health data.
- 'Quality' aspects of natural resources like land and water must be captured in environmental models in order to assess how ecosystems impacts could result from alternative pathways driving towards a biobased economy. Feedbacks between environmental and economic models needs to be strengthened.
- Model collaboration is required to get a better understanding of land resource availability, land use intensity and costs to take land into production, and to make optimal use of available data and empirical evidence to make assessments correspond more closely to reality.
- Ecological limits and sustainable supply need to be better taken into account at the field/farm level up to the global level. This requires the formulation of sustainability criteria and guidelines on how sustainability criteria can be translated into targets, e.g. for land use, energy use and GHG emissions. The targets should become an integral aspect of a bioeconomy monitoring, whereby footprint indicators (like for land and emissions) could measure the distance-to-targets. Demands for other ecosystem services need to be better specified in scenarios to be able to value impacts on these.

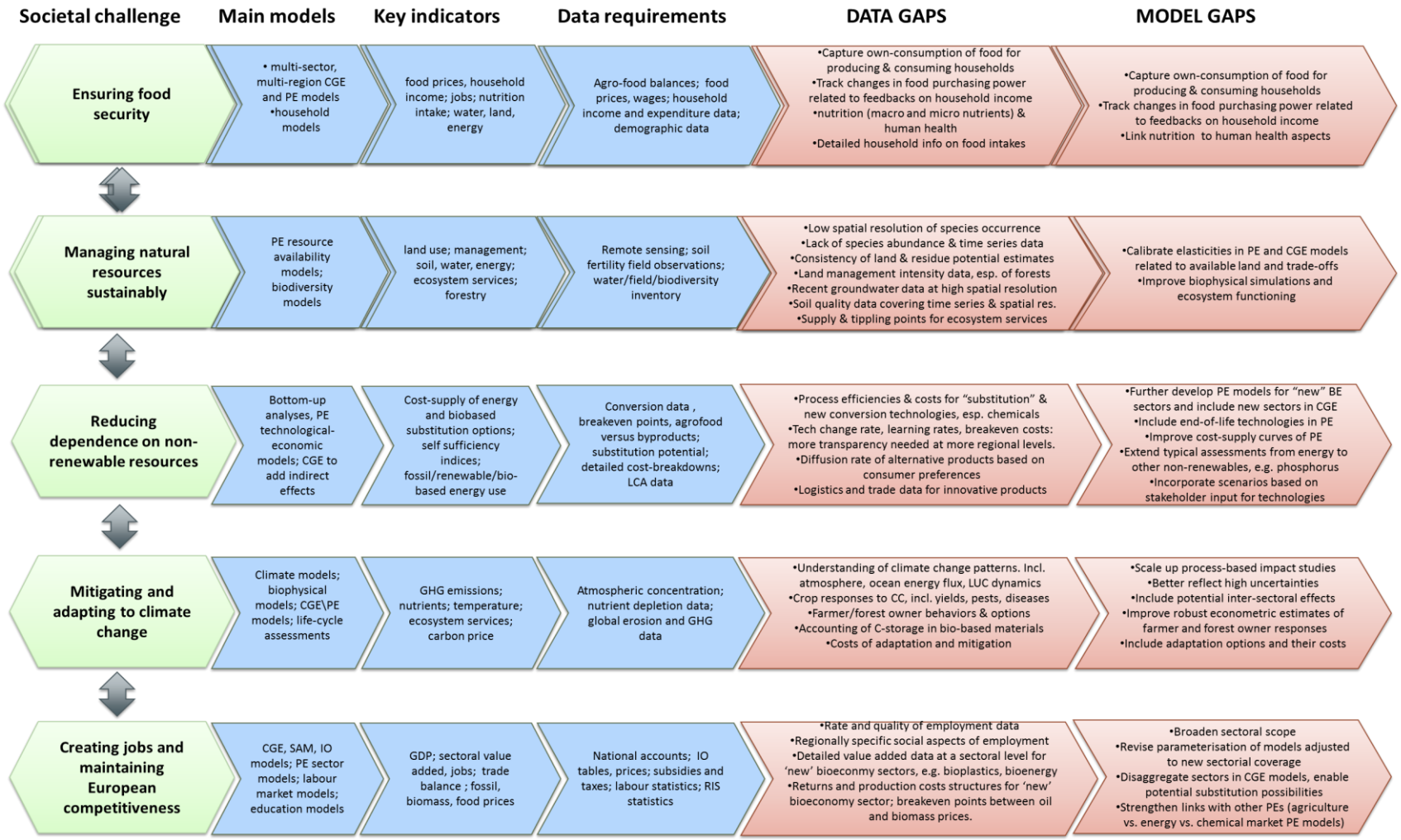
- Existing models cover already many aspects of the bioeconomy and are strong in the field of agriculture, forestry, energy or economy wide coverage. New biobased sectors are currently built in but data are limited available and weak. To cover the entire bioeconomy there is a trend in equilibrium models that GE models are extended with new and more detailed sectors and PE models are used in combination with one other.

- Improved collaboration between model types is essential to evaluate the evolution and impacts of the bioeconomy across different levels of aggregation (Figure 3). The selected models for collaboration depend on the research question, which means that linking of models through 'loose coupling', instead of integration of modules, is a suitable option to further operationalize the SAT-BBE framework and toolkit as long as essential feedbacks are accounted for.

- Scenarios and sensitivity analyses are needed in order to understand the impact range of uncertain factors such as technological progress, biomass availability, and fossil and biomass prices on the long term performance of the bioeconomy.

On top of private and scientific research initiatives, the development of coherent and integrated policies are needed to set incentives for the most efficient use of biomass, to strengthen the use of organic waste, to improve primary production practices, to mobilize domestic resources, and to support innovation to enable cost-effective deployment of biomass conversion technologies. It can be concluded that further data disaggregation and improved model collaboration are required to increase the usefulness of the designed systems analysis tools framework and toolkit developed in SAT-BBE for monitoring and evaluating the progress of the EU Bioeconomy Strategy.

Figure 5 Models, indicators and data requirements per societal challenge of the EC Bioeconomy Strategy



Source: SAT-BBE consortium

4.1.2 Summary description of project context and objectives

Project context
One of the biggest challenges of the coming decades is the sustainable provision of food, water, energy and other ecosystem services to a world that will see its population increase by a third during the coming two decades. In 2012, the European Commission (EC) launched the new strategy on the Bioeconomy[1], which consists of a Bioeconomy Strategy and an Action Plan. The Bioeconomy Strategy aims at tackling the key five societal challenges:

1. ensuring food security;
2. managing natural resources sustainably;
3. reducing dependence on non-renewable resources;
4. mitigating and adapting to climate change; and
5. creating jobs and maintaining European competitiveness.

The focus of the Action Plan is on 1) investing in research, innovation and skills; 2) reinforcing policy interaction and stakeholder engagement; and 3) enhancing markets and competitiveness in the bioeconomy.

Given that the time needed to realise social and technological solutions is often considerable, a framework is needed to structure long-term analytical capacity for providing guidance for designing and implementing consistent, coherent, long-term strategies for the bioeconomy. Therefore, the EC launched the "Systems Analysis Tools Framework for the EU Bio-Based Economy Strategy" (SAT-BBE) project to design an analysis framework for monitoring the evolution and impacts of the bioeconomy. Second, the EC started a complementary project, which is the 'Bioeconomy Information System Observatory' (BISO) project. The objective of BISO is to bring together the data, indicators and tools needed to monitor the progress, assess the impacts, and model future scenarios of the bioeconomy.

Project objectives
The objective of the SAT-BBE project was **to design a systems analysis tools framework that can be used to monitor the evolution of the bioeconomy in the EU and also the socio-economic and environmental impacts of the bioeconomy and relevant policies.**

The systems analysis tools framework needs to the ability to capture both the relevant policies and also other drivers of the bioeconomy and must be able to evaluate the impacts of the bioeconomy on the five societal challenges of the EC Bioeconomy Strategy.

The SAT-BBE project was carried out by a consortium of internationally recognized research institutes from the EU and the US. During the two and a half years project duration the SAT-BBE consortium designed a systems analysis tools framework, based on the broad experience available in the consortium with modelling socio-economic and environmental development and impacts. The SAT-BBE project consists of three phases shown in Figure 6.

Results
To achieve the above objectives the SAT-BBE project has provided a systematic overview of relevant data, indicators and modelling tools. From this overview a systems analysis tools framework and toolkit systems are compiled that can be used for both quantitative and qualitative analyses (e.g. foresight analyses) describing:

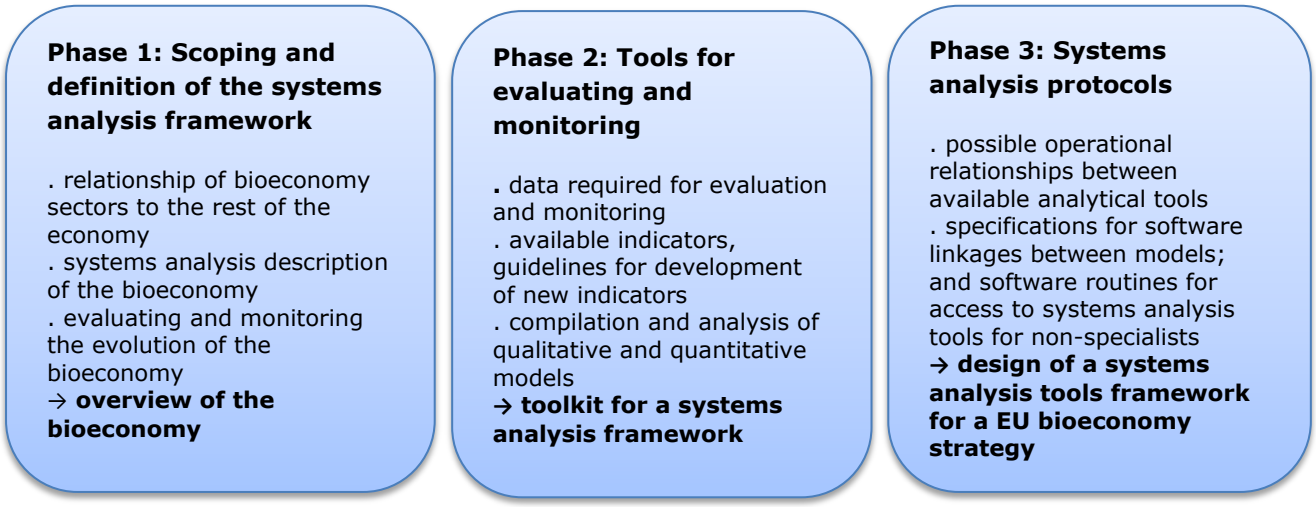
- the bioeconomy development in the European Union and its interactions between the rest of the economy;
- the impacts of bioeconomy development on main societal challenges such as food security, use and quality of environmental resources, and job creation and competitiveness.

The development of the systems analysis tools framework and toolkit contribute to a better conceptual understanding of the correlations and impacts and of the bioeconomy and potential synergy and trade-off effects. Future research

[1] Innovating for Sustainable Growth: a Bioeconomy for Europe (EC, 2012).

priorities are formulated regarding gaps in data and modelling capacity. The systems analysis tools framework designed in the SAT-BBE project provides a solid basis for further operationalisation and application of models and tools for evaluating the development and impacts of the bioeconomy.

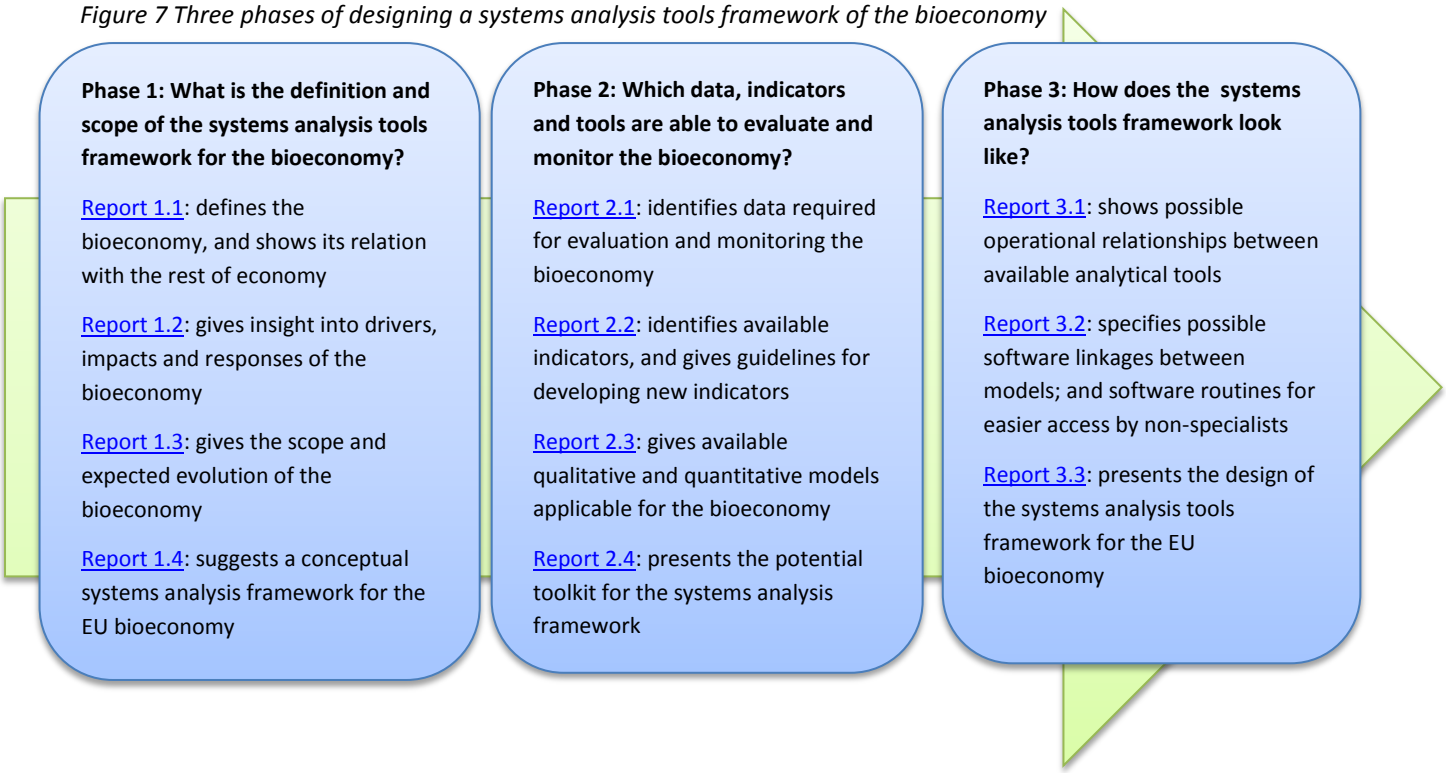
Figure 6 Schematic overview of the SAT-BBE work programme



4.1.3 Description of the main S&T results/foregrounds

The findings and conclusions dedicated to the three phases in the SAT-BBE work programme, as presented in Figure 6, have been reported in written documents. Figure 7 gives links to the reports.

Figure 7 Three phases of designing a systems analysis tools framework of the bioeconomy



4.1.3.1 WP1 - Scoping and definition of the systems analysis framework

Objectives

- To structure the concepts to be used in a bioeconomy strategy, including both the place of sustainability within the bioeconomy, and the biobased sectors and its drivers (principally bio-technology) in relation to the rest of the economy.
- To elaborate the foundations (in the sense of appropriate data and indicators) for a systems analysis framework to evaluate and monitor the implementation of a bioeconomy strategy, in particular in relation to other EU policies where there are interdependencies.
- To communicate the conceptual structure of a systems analysis framework as can be applied to an EU bioeconomy strategy.

Description of results

Defining the EU bioeconomy. The EC formulated the following definition that was published in the 'Communication on Innovating for Sustainable Growth: A Bioeconomy for Europe' (EC, 29 February, 2012):

> *''The bioeconomy encompasses the production of renewable biological resources and their conversion into food, feed, bio-based products and bioenergy. It includes agriculture, forestry, fisheries, food and pulp and paper production, as well as parts of chemical, biotechnological and energy industries. Its sectors have a strong innovation potential due to their use of a wide range of sciences (life sciences, agronomy, ecology, food science and social sciences), enabling and industrial technologies (biotechnology, nanotechnology, information and communication technologies (ICT), and engineering), and local and tacit knowledge.'*

This definition of the bioeconomy is sufficiently generic to capture the broad scope and goal of the SAT-BBE project and to make sustainability and the societal challenges of the Bioeconomy Strategy an integral element of the systems analysis tools framework that needs to be developed in this project, including related concepts such as the circular economy and (non-market) ecosystem services (see further Report 1.1).

Although not explicitly mentioned in the definition it implicitly takes into account the concept of a circular flow of materials and feedbacks within the economy and the role of (non-market) ecosystem services.

Scoping the EU bioeconomy. The SAT-BBE systems analysis tools framework aimed to monitor, model and assess the evolution and impacts of the bioeconomy from different perspectives (see further SAT-BBE Report 1.2 and Report 1.3):

- **multiple scales:** comprising the analysis of specific products, the wide array of sectors and processes at the level of entire economies;
- **local to global level impacts:** considering that impacts manifest differently at different scales of analysis, and taking in particular care to distinguish between impacts within the EU and impacts abroad in a systemic way that avoids leakage effects, i.e. problem shifting from one sector or region to another;
- **interlinkages between the economy, society and environment:** in particular taking into account how changes in demand and production affect food security or natural ecosystems, and vice versa;
- **possible futures in light of mega trends:** including consideration of factors outside the scope of modelling, like population growth, and how such trends and factors affect possible bioeconomy development pathways;
- **innovation:** in particular taking into account technological change in production and manufacturing (such as genetically modified organisms and advanced bioenergy and biochemical production systems), but also considering social innovation and changed behaviours in the context of the bioeconomy, like reducing food waste, and distinguishing between incremental and radical changes;

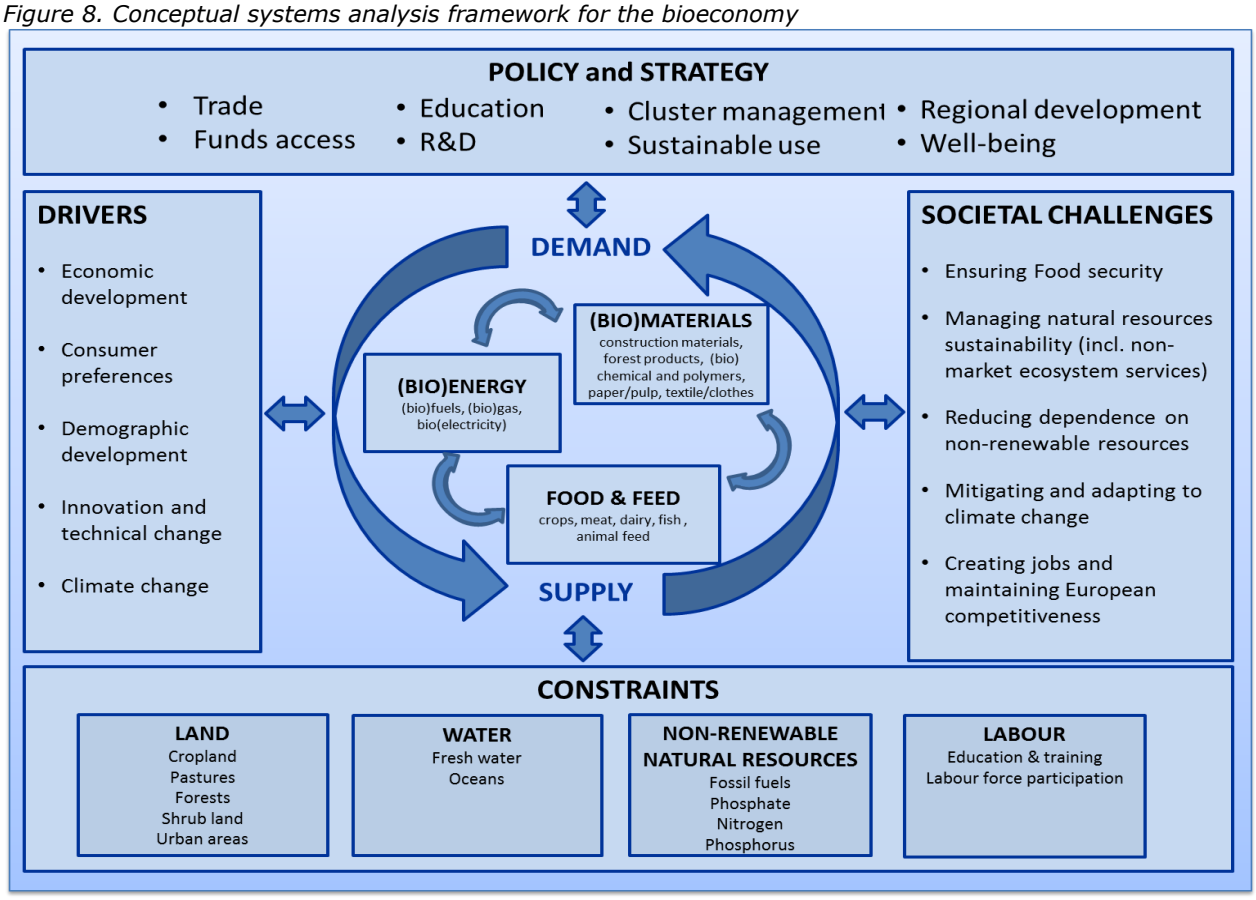
- **sustainability:** considering how the bioeconomy and processes within the bioeconomy contribute to reaching sustainability targets, like the sustainable development goals, and also developing indicators and targets to benchmark sustainability in a quantifiable way at different levels of analysis. Important thereby are (potential) trade-off and synergy effects of different sustainability targets;
- **policy relevant questions:** keeping in mind the key research questions and political relevance, in particular to help maintain focus and avoid becoming lost in the complexity of the system.

Designing a conceptual framework of the bioeconomy. A conceptual framework of the bioeconomy has been designed that shows the correlations between the bioeconomy and the rest of the economy using the Driver-Impact-Response (DIR) framework for the bioeconomy (Figure 8). This framework consists of three main elements: **drivers** and pressures, **impacts** and mechanisms, and **responses** and other policy issues. The key drivers and pressures (inc. constraints) of the bioeconomy are:

1. demographics (e.g. population growth, education, human capital);
2. consumer preferences (consumer behaviour);
3. economic development (employment, competitiveness);
4. global environmental change;
5. resource availability (e.g. land, water, non-renewable natural resources)

The framework also shows the importance of considering supply-demand mechanisms, which are crucial for evaluating the impact of the bioeconomy on the societal challenges. Important thereby is the impact of agriculture and forestry, energy and trade policy and other strategic decisions. The framework ensures that these elements are discussed in a comprehensive and consistent manner so that all direct and indirect trade-off and synergy effects are considered

Figure 8. Conceptual systems analysis framework for the bioeconomy



Source: SAT-BBE consortium

4.1.3.2 WP2 - Tools for evaluating and monitoring

Objectives

- To identify the data and indicators required for evaluating and monitoring the implementation of the EU bio-based economy strategy.
- To provide the knowledge references (in terms of data and indicators) both for the elaboration of the systems analysis tools framework in Phase 3 as well as for the work to complete the EU bio-based economy strategy in the future.

Description of results

Overview of data and indicators. First, an overview is compiled of datasets and indicators relevant when evaluating the evolution and impacts of the bioeconomy and especially the systems analysis framework (Report 2.1 and Report 2.2 respectively). **Gaps in availability and quality of data and indicators** are identified with respect to *spatial* (regional), *temporal* (times series) or *thematic* (sectoral, societal challenge) coverage. Gaps in data are especially relevant for innovative, new biobased sectors and specific issues (e.g. land use change, soil quality) and indicators. The availability and quality of social indicators is also an area of concern.

Overview of models and tools. Second, an **overview of the modelling tools** is made, whereby each model and tool is classified according to both the type, territorial scale, input data, output data and indicators and main application area (Table 3). Further, the strengths and weaknesses of different models and tools are confronted with linkages in the conceptual framework of the bioeconomy (Figure 4). Essential components of the systems analysis tools framework are economic models that consider supply and demand interactions and thereby also potential trade-off and synergy effects.

Global computable general equilibrium (CGE) models are especially suitable to evaluate economy-wide impacts of agriculture, energy and trade policies, including subsequent effects on GDP, employment, land-use change, GHG emissions etc. Key strengths are the comprehensive coverage of economic sectors and regions to account for inter-linkages and the explicit modelling of limited economic resources. Limitations are that the CGE models necessitates a simplified representation of agent choices, in particular favouring relatively simple and smooth mathematical forms which help to reduce the number of parameters required to calibrate the models.

Partial equilibrium (PE) models have a more detailed coverage of sectors and often explicitly show biophysical flows and absolute prices. PE models usually also have a high(er) level of detail with respect to regional aspects, policy measures and environmental indicators as well as a higher level of sectoral detail. Disadvantages are that the impacts and economy-wide linkages with other key sectors that are not represented are ignored and that macro-economic balances are thus not considered. The limited supply of key resources and inputs into productive activities within the economy (such as labour and capital) also tend to be ignored.

Bottom-up models deal with a wide variety of specific (often technical) aspects of biomass production, conversion and use. Bottom-up models are used to validate other studies with a broader scope, such as PE and CGE models and IAMs, and tend to be more process-based models with an engineering or biophysical focus.

Integrated assessment models (IAMs) integrate different relevant systems in one modelling framework. IAMs make it possible to analyse feedbacks between human and nature systems and also trade-offs and synergies of policy strategies. Disadvantages are the high complexity and the high level of aggregation (or other simplifications) necessary to maintain computational tractability.

The results of these deliverables have been summarised in Report 2.4. Although it is difficult to be accurate with the judgment of the data availability and quality, the SAT-BBE consortium members conclude that **major gaps and uncertainties exist in the availability of data, indicators and partially also in modelling capacity** (see also WP 3).

Table 3. Overview of key current models potentially suitable in SAT-BBE toolkit, for assessing biomass supply, demand and impacts: their regional and sectoral aggregation and main applications.

GE models & IAMs	PE models	Bottom-up analysis
GE models		
MAGNET *Regions:* 124 regions (incl. 28 EU MS) *Sectors*: 70 sectors, 12 primary agricultures, 8 food processing, forestry, fishery, various residues, plantations, wood pellets, wood products, paper industry, biodiesel & ethanol from various feedstock (1st and 2nd G), bioelectricity, bioplastics (PLA), bio-polyethylene *Focus*: CAP, biofuel policies, bioeconomy, trade policies, food security, food nexus, climate change	**AGLINK** *Regions*: EU28,OECD regions *Sectors*: agricultural commodities, biofuels *Focus:* CAP, biofuel policies	**Dyna-CLUE** *Regions:* high spatial resolution (global 5 minute, EU 1 km) *Sectors:* land use *Focus:* spatial allocation of land use change and ecosystem service impacts
MIRAGE *Regions*, 124 regions (incl. 28 EU MS) *Sectors*: 58 sectors, 12 primary agricultures, 8 food processing, forestry, fishery, wood & paper, biodiesel & ethanol from various feedstock *Focus*: trade policies, EU biofuel policies, food security	**AGMEMOD** *Regions*: 28 EU MS, Turkey Russia, Ukraine, Macedonia *Sectors*: 30 agricultural and food commodities, bioethanol, biodiesel *Focus:* CAP, biofuel policies	**EFISCEN** *Regions:* 38 European countries *Sectors:* Forestry *Focus:* Forest resource information, realizable biomass potentials under variable policy and management alternatives, sustainability and ecosystem service impacts
IAM models ***IMAGE*** *(combination of IMAGE+MAGNET+TIMER)* *Regions:* 26 regions *Sectors:* depends on model component; e.g. 11 crop sectors, 12 primary energy carriers, 14 land cover types, *Focus:* climate change, land-use change, biodiversity loss, modified nutrient cycles, and water scarcity. ***GLOBIOM (*** *combination of* GLOBIOM+G4M+MESSAGE)	**CAPRI** *Regions* : 75 countries, incl. detailed supply modules for 28 EU MS, Turkey and Western Balkans (NUTS3) *Sectors*: 50 agricultural sectors, biofuels *Focus:* CAP, environmental policies	**MARKAL/TIMES** *Regions:* Multi-regional (user dependent) *Sectors:* Energy (electricity, heat), transport, Industry (possible extension to other sectors) *Focus:* Cost optimization of (fossil, bio- and other renewable) conversion technology deployment pathways, CO_2 tax CO_2 CAP, EU renewable energy and biofuel policies, etc.
	EFI-GTM *Regions*: 58 global regions, incl 33 European regions. *Sectors*: woodworking (6 products), pulp and paper industries (16 products) electricity, heat energy. *Focus*: Trade and FLEGT policies, EU climate and energy policies, forest conservation policies.	
	GLOBIOM *Regions:* 28 EU MS (NUT2); 30 Rest of World regions *Sectors:* 18 crops, vegetable oils and protein meals, DDGS, cereal straw, 7 livestock, 9 primary and processed wood products, 1st and 2nd G ethanol and biodiesel, biogas, bioelectricity, fuel wood *Focus:* climate change mitigation, food security, deforestation, bioenergy and biofuels, biodiversity protection, food-energy-water nexus	**TIMER** *Regions* : 26 regions *Sectors*: 12 primary energy carriers (incl. biomass), conversion technologies (incl. bioenergy/chemicals *Focus:* climate change, land-use change, biodiversity loss, modified nutrient cycles, water scarcity
	IMPACT *Regions:* 320 globally, EU relatively aggregated *Sectors:* agriculture commodities *Focus:* Ag tech growth, food security impacts, water-food linkages	

Source: SAT-BBE consortium

4.1.3.3 WP3 - Systems analysis protocols

Objectives

- To identify the appropriate analytical tools (in terms of operational effectiveness and efficiency) to be used for a systems analysis of the bio-based economy within the EU.
- To specify (and to develop, as is reasonable within this project) the possibility for linking tools through software development.
- To elaborate the interfaces with the analytical tools for non-specialists, as is deemed practical.
- To communicate the solution found for the design of the systems analysis tools framework

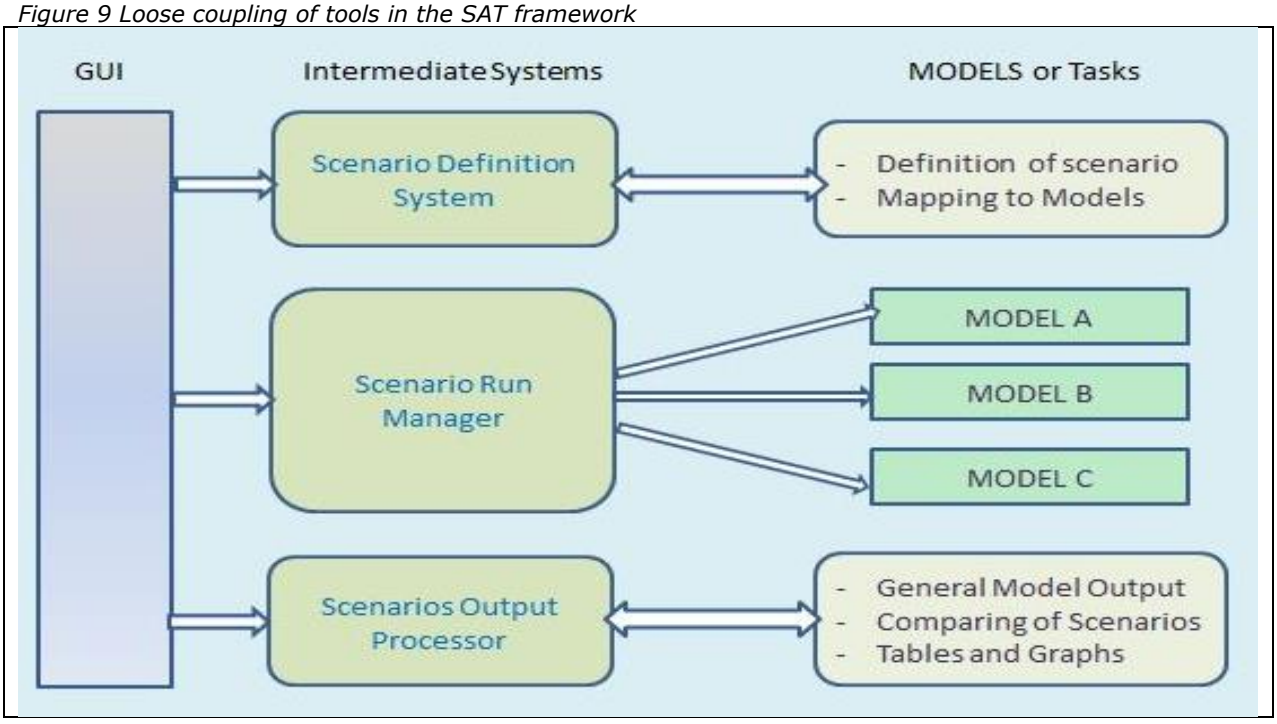
Description of results

An **inventory of appropriate analytical tools useful for the systems analysis framework of the bioeconomy** has been carried out and linkages between model components have been described (Report 3.1). The main entry points for linkages between models are **prices** or **quantities** that are crucial when evaluating supply demand interactions. Given the complexity of the global economy and biosphere and the inherent uncertainties when modelling these, it is

unrealistic to expect that a total harmonization of models would be possible, since each component of the global economy or eco-sphere requires a certain degree of specialization in the models that are trying to capture it. Instead, **software routines are required to link compatible models to provide for non-specialists** with the means to interact with the quantitative tools used within the framework (user interfaces for specific applications or enquires).

Linking of models can be done via **loose coupling or soft linking.** Soft links imply that models are connected exogenously by transferring the outcomes of scenario model runs from one component or model to another and hard links mean that models exchange information and are solved iteratively, meaning that the solutions are internally consistent between models. A graphical user interface (GUI) is used as a 'translation module' among the various model types in the framework. This GUI is model independent, and can be linked to intermediate operation systems such as a scenario definition system, the scenario run manager and the scenario output processor (Figure 9).

Figure 9 Loose coupling of tools in the SAT framework



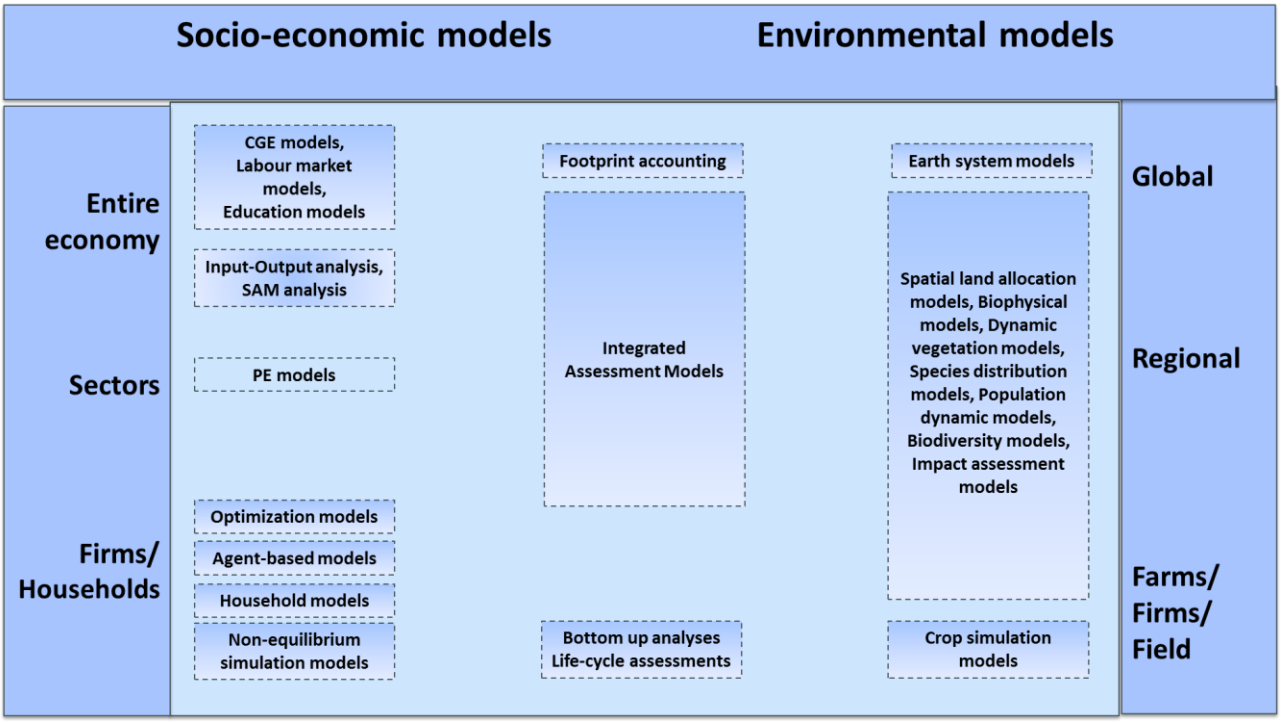
Source: SAT-BBE consortium

Three types of user interfaces can be distinguished, namely 1) interfaces to get access to statistical databases; 2) interfaces that give access to individual models; 3) interfaces to make integrated model results accessible for policy analysts and other non-specialist users. The last two types are relevant in order to make the SAT framework operational for researchers from different disciplines, as well as end-users of the tools output such as policy makers or other (non-researcher) stakeholders (Report 3.2).

Next, the results of the previous work packages have been combined into **a systemic framework for evaluating and monitoring the implementation of the EU bioeconomy strategy** (Figure 10; Report 3.3). This systems analysis framework for the bioeconomy has been based on the conceptual systems analysis framework for the bioeconomy (Figure 8) and complies with the policy topics or **societal challenges** highlighted in the Bioeconomy Strategy.

Data, indicators and models are fairly well established for the traditional sectors of the bioeconomy (agriculture, fishery, forestry, food, paper and pulp, textile), but **gaps exist for how 'new' and innovative sectors of the bioeconomy** are captured (materials, chemistry, energy and specific aspects, such as land use, employment, soil quality, etc. Especially data on value added, employment, cost structures, breakeven points, technological potential for scale economies, and learning effects are missing for the new bioeconomy sectors.

Figure 10 Design of the Systems Analysis Tools (SAT-BBE) framework for the bioeconomy



Source: SAT-BBE consortium

Table 1 (see page 5, in section Executive Summary) gave an overview of the models and tools in the systems analyses tools framework and toolkit, by looking at the following issues:

- **What are existing data and models that can monitor and evaluate the bioeconomy and its impacts?** These are considered from different perspectives (economic, environmental, geographic, sector detail);
- **What are the gaps in the availability of existing data and models?** Which bioeconomy related aspects can already be analysed with current data and models, which cannot yet be addressed.
- **What are options to close these gaps?** What is needed for additional data collecting and how should provide these additional data.

Finally, there is an urgent need to **develop (reference) scenarios** that can **describe the potential impacts of uncertainties (speed of technology change, biomass availability, oil and biomass prices) on the long-term development of the bioeconomy**, taking account of driving factors (assumptions) and a smart set of environmental and socio-economic criteria and indicators. The systems analysis framework and toolkit developed in the SAT-BBE project can be helpful to develop such as baseline scenario, whereby an essential prerequisite is that gaps in data and modelling capacity are systematically closed.

4.1.3.4 WP4 - Communication and Dissemination

Objectives

- Involvement of peer expertise from outside of the consortium.
- Timely dissemination of project output with the public and interested parties.
- Effective communication about the project (its ambitions, participants and outputs) outside of the consortium, especially with the Commission.

Description of results

To raise awareness of SAT-BBE, the consortium has created a **flyer** to be distributed through all partners to any dissemination event they participate in). This SAT-BBE flyer is also accessible and downloadable through the SATT-BBE website. Secondly, disseminations social media channels **Twitter** and **LinkedIn** have been linked to the SAT-BBE home page website. The progress of SAT-BBE has been regularly sent out by means of these social media channels.

Moreover, the **SAT-BBE project website** (SAT-BBE website) and **SAT-BBE logo** have been designed. Identification with relevant and interested audiences (e.g. the BioObservatory platform) and aligned EC based bioeconomy research (e.g. BERST project) have been established. The dissemination has been updated regularly for events, news and publication series related to the SAT-BBE project, in order to keep up with developments in and outside the project. The external SAT-BBE website contains an internal partner portal, meant to store joint, internal dissemination material (like internal reports, decisions made at internal project meetings).

A plan of the **dissemination** of the project output with the public and interested parties has been launched (Report 4.1). It includes the communication about the ambitions, participants and outputs of the project outside the consortium, especially with the Commission.

Liaison activities in the context of the SAT-BBE project have been sought among projects and initiatives with similar objectives, methodologies deployed and tools designed regarding the development of the EU bioeconomy. Close cooperation have been established with platforms and projects. Main aims of such liaison activities were to search for complementary activities, as well as to create synergy effects across those similarly projects and platforms. Most reflected a similar goal, like closing the knowledge gap with regard to data and tools that are able to monitor and evaluate the development of the EU bioeconomy. During the SAT-BBE project period, liaison activities have been performed with the following relevant platforms and projects:

- **BISO - Bioeconomy Observatory project, led by JRC-IPTS** (March 2013-Feb 2016). The SAT-BBE coordinator, Hans van Meijl gave a presentation named '**Systems Analysis Tools Framework for the BioEconomy**' (SAT-BBE presentation), with the objective to introduce the SAT-BBE project to the stakeholders participating in the First Stakeholders Round Table, organized for the Bioeconomy Observatory by the Joint Research Centre of the European Commission. It took place in Brussels on 26 November 2013. The presentation discussed the set-up of the SAT-BBE project and the project partners, introduced the stakeholders into the bioeconomy and its drivers, impacts and responses as defined within the SAT-BBE framework. Further, several examples were given of recent bioeconomy studies completed by the SAT-BBE teams, which illustrated the potential of relevant data and models for the assessments of bieconomies in various countries.

- **SCAR-SBGB – Standing Committee on Agricultural Research- Strategic Work Group on Bioeconomy.** This Work Group is advising the SCAR on opportunities and risks, research questions and actions needed in the new field of bioeconomy. Focus is on sustainability questions around the bioeconomy and strategic questions like the scope and playing field of the bioeconomy, the knowledge and innovation agenda. This is done in close cooperation with the Bioeconomy Observatory and the bioeconomy panel, but there are synergies with the SAT-BBE project as well. The coordinator of the SWG on bioeconomy invited the SAT-BBE team to participate in their stakeholder meeting of June 2014, and to give a presentation on SAT-BBE projects and its expected impacts. One of the objectives of this meeting was to search for possibilities to cooperate and to create synergies among both platforms.

- Within the **SCOPE** framework, the SAT-BBE coordinator Hans van Meijl from LEI Wageningen UR, joined an international Rapid Assessment Process (RAP) project, and led the production of a background chapter on **Bioenergy Economics**. With decreasing oil reserves, bioenergy's provide a promising alternative. The paper has been published in March 2015, and also uses some relevant findings from the SAT-BBE project. The project is initiated by FAPESP, the State of São Paulo Research Foundation Research (Brazil), through its BIOEN, Global Climate Changes, and BIOTA Programmes. The implementation of policy for the replacement of fossil fuel by

biofuels is a critical issue in many countries. Hans van Meijl also participated at the RAP workshop that was hold in Paris on 2-6 December 2013. More information about the Scope project can be found at: Scope - Bioenergy & Sustainability Project: Bridging the Gaps

- Several SAT-BBE partners participated in **SCAR 4th Foresight expert workshops** in Brussels aimed to explore potential future development paths of the bioeconomy. **The meetings took place** in November 2014 and February 2015. The 4th SCAR Foresight exercise explores the interactions between the primary sector and the bioeconomy. With an emphasis on the future, the exercise explores not only what will happen, but also what might happen by developing the paradigm of the bioeconomy, with the fundamental constraint of sustainability. Internal contradictions within sectors, and possible conflicts among sectors, are a major point of interest. The Foresight exercises proceeds in a participative way. For this purpose three interactive Brussels-based workshops have been organised with experts, members of the SCAR and its working groups, the European Commission and various stakeholders of the bioeconomy. These workshops in November 2014 and February 2015 explored and determine the key dilemmas governing the interactions between the primary sector and the bioeconomy and structuring the foresight work.

- **BERST - Bioeconomy Regional Strategy Toolkit FP7 project, led by LEI Wageningen UR** (Dec 2013-Nov 2015). The purpose of BERST is to explore the bioeconomy potential of EU regions. The main question is how to close the gap between the current and future bioeconomy potential of EU regions. The elaborated conceptual systems analysis framework for the EU bioeconomy, as described in Deliverable 1.4 of SAT-BBE, has been introduced and used as base for explaining the working of the regional bioeconomy system in the BERST project, in terms of criteria and indicators, and instruments and measures.

4.1.3.5 WP5 - Coordination and Project Management

Objectives

- Well-coordinated partner interaction.
- Timely delivery of quality output.
- Effective communication outside of the consortium, especially with the Commission.

Description of results

Project activities have been coordinated by the LEI Wageningen UR team. Examples of such activities were work package guidance, work programme progress monitoring (delivery of output on time at the desired level of quality), communication with partners and the European Commission, project reporting.

Project meetings have been organized. First, three external meetings were organised with participation of SAT-BBE consortium members, EC representatives and people from the Advisory Group. Second, three internal project meetings have been organized, to discuss the progress of the work packages. Finally, LEI Wageningen UR provided the consortium meeting minutes. Table 4 contains an overview of the meetings organised in the SAT-BBE project.

Table 4. Consortium meetings organized in SAT-BBE project

Title	Place	Date	No pers.
Project kick-off meeting	Brussels	16 Nov 2012	20
SAT-BBE Consortium meeting	Brussels, Atlas Hotel	25 April 2013	16
SAT-BBE Seminar: Foundations and initial proposals for the system analysis framework for the bioeconomy in Europe	Brussels, DG RTD	26 April 2013	26
WP2 meeting	The Hague	18 Nov 2013	5
SAT-BBE Seminar: Tools for evaluating and monitoring the bioeconomy in Europe	Brussels, DG RTD	13 March 2014	14
WP3 meeting	The Hague	13 Nov 2014	5+2 virtual
WP3 Skype conference		5 Dec 2014	6
SAT-BBE Seminar: Systems analysis protocols for the bioeconomy in Europe	Brussels, DG RTD	23 March 2015	30

4.1.4 The potential impact and main dissemination activities and exploitation of results

Scientific Results and impacts

The SAT-BBE project has made scientific contributions, and also wanted to build bridges to the policy community. The project provided the following **scientific innovations**:

- a review of the state-of-the art in systems analysis of the bioeconomy;
- the design of a systems analysis tools framework in itself is a methodological innovation; the consortium brought together a wide range of knowledge about the bioeconomy from the perspective of different regions and sectors.

These innovations have the purpose to affect and support the decision makers in the field of agricultural and trade policies, natural resource management, climate change and energy policies policy, and science and technology policies:

- to get a deeper understanding of the indicators and associated data requirements (and availability) that grasp the state of the bioeconomy and its future dynamics;
- to get a deeper understanding of the indicators and associated data requirements (and availability) that are able to measure the contribution of evolving bioeconomy sectors to sustainability goals of the EU and to those of the global community;
- to provide a conceptual analysis basis and decision platform for the assessment of policy measures linked to the EU Bioeconomy Strategy;
- to provide a conceptual basis for doing foresight and ex-ante analyses, that might help to identify future policy issues and help to improve the ability of decision makers to move towards a greener Common Agricultural Policy and a more responsible Common Fish Policy on the long term;
- to provide systems analysis for understanding and explaining observed impacts of policies.

The targeted audience are policy makers and other stakeholders in the EU facing the development of the bioeconomy. Dissemination work has been bundled into easy to read public papers (Report 1.4, Report 2.4 and Final report 3.3) for stakeholders, primarily oriented towards EU decision makers. The **key findings and recommendations** of SAT-BBE are:

- **Data, indicator and model gaps exist for 'new' and innovative sectors of the bioeconomy (construction, chemistry, energy).** With regard to the impact of the bioeconomy on **food security** there exist data gaps on **household** income and expenditure data, **nutrition intake, own consumption** and health data.

- **Agricultural PE models** make use of commodity balances. From the bioeconomy perspective, and in order to regard competition for different use of crops (waste), **more detail in the commodity balance is required (food, feed, seed, and material use)**. As **Eurostat** is responsible for providing agricultural commodity balances (at EU country level), this **disaggregation of the extended biomass use and supply options** might be a task of Eurostat as well. Hopefully this work would also extend to the international FAOSTAT database which is needed for global consistency in modelling international trade b/w the EU and the rest of the world.

- One **'super model' does not seem appropriate to tackle the multi-dimensional systemic relationships within the bioeconomy**. Instead, a variety of models and model types should be compared, combined and deployed as a toolbox for monitoring the bioeconomy.

- There is a need to **capture the impacts of the development of the bioeconomy on biodiversity and the non-provisioning, supporting, regulating and cultural ecosystem services,** and thus on the state of natural capital. This requires a better integration of 'quality' aspects of natural resources like land and water in environmental models in order to assess how important ecosystem impacts could result from alternative pathways driving from a fossil-based towards a more biobased economy.

- Need to **improve model collaboration and tools to better account for land resource availability** as well as land use intensity and make optimal use of the available data and empirical evidence to make the assessments correspond more closely to reality.

- Need to determine the **sustainable supply capacity of wastes and residues from a systemic perspective** as well as to further understanding of how different possible development pathways of the European bioeconomy will impact natural ecosystems across the planet.

- Need to **develop a baseline scenario that is able to describe the long-term development of the bioeconomy**, taking account of driving factors (assumptions) and a smart set of environmental and socio-economic criteria and indicators.

Societal implications

The SAT-BBE team briefed the project's main partners in the European Commission on the scientific progress in Brussels meetings on respectively 26 April 2013 (WP1), 13 March 2014 (WP2), and 23 March 2015 (WP3). Staff from DG AGRI, DG Growth, JRC-IPTS, DG ENERGY and DG Research & Innovation participated. The main conclusion of the meetings was that policy makers need insight in the availability of different tools to measure impacts of and to monitor the development of the bioeconomy. In view of the EC intention to establish a European bioeconomy strategy, the design of a systems analysis tools framework should provide the technical support for such a strategy, and must enable the EU to evaluate the impacts of its strategy as well as to monitor the trajectory of its evolution.

The SAT-BBE project has indicated what **the gaps are between requirements and availability of data and modelling tools**. Relevant questions included: What are the pros and cons of these tools? For which bioeconomy research questions could tools be applied and for which questions is that not yet possible? In this way, the **SAT-BBE project supports the Commission with targeting its research and development agenda, and assesses whether or not specific data and tools need new or further development.** Such targeting actions are essential to ensure that the current and future analyses and monitorings are captured in sufficient and efficient ways.

Liaison activities in the context of the SAT-BBE project have been arranged among projects and initiatives with similar objectives, methodologies deployed and tools designed regarding the development of the EU bioeconomy. Similar

goals referred to closing the knowledge gap with regard to data and tools that are able to monitor and evaluate the development of the EU bioeconomy. Following liaison activities have been performed (see more in section 4.1.3.4):

- **BISO - Bioeconomy Observatory project, led by JRC-IPTS** (March 2013-Feb 2016). The SAT-BBE coordinator, Hans van Meijl gave a presentation named '**Systems Analysis Tools Framework for the BioEconomy**' (SAT-BBE presentation), with the objective to introduce the SAT-BBE project to the stakeholders participating in the First Stakeholders Round Table, organized for the Bioeconomy Observatory by EC-JRC.

- **SCAR-SBGB – Standing Committee on Agricultural Research- Strategic Work Group on Bioeconomy.** This Work Group is advising the SCAR on opportunities and risks, research questions and actions needed in the new field of bioeconomy. This was done in close cooperation with the Bioeconomy Observatory and the bioeconomy panel, but there were synergies with the SAT-BBE project as well.

- Within the **SCOPE** framework, the SAT-BBE coordinator Hans van Meijl from LEI Wageningen UR, joined an international Rapid Assessment Process (RAP) project, and led the production of a background chapter on **Bioenergy Economics**. More information: Scope - Bioenergy & Sustainability Project: Bridging the Gaps.

- Several SAT-BBE partners participated in **SCAR 4th Foresight expert workshops** in Brussels aimed to explore potential future development paths of the bioeconomy. **The meetings took place** in Nov 2014 and Feb 2015. The 4th SCAR Foresight exercise explores the interactions between the primary sector and the bioeconomy.

- **BERST - Bioeconomy Regional Strategy Toolkit FP7 project, led by LEI Wageningen UR** (Dec 2013-Nov 2015). The purpose of BERST is to explore the bioeconomy potential of EU regions. The main question is how to close the gap between the current and future bioeconomy potential of EU regions. The elaborated conceptual systems analysis framework for the EU bioeconomy, as described in Report 1.4 of SAT-BBE, was introduced and used as base for explaining the working of the regional bioeconomy in the BERST project.

4.1.5 Public website and relevant contact details

The **SAT-BBE consortium** comprised eight partners and was coordinated by LEI-Wageningen UR.

	Short name	Full name	Country
1	LEI-WUR	Agricultural Economics Research Institute	Netherlands
2	UU	Utrecht University	Netherlands
3	EFI	European Forest Institute	Finland
4	WI	Wuppertal Institute	Germany
5	IIASA	International Institute for Applied Systems Analysis	Austria
6	VUA	Vrije Universiteit Amsterdam	Netherlands
7	TI	Johann Heinrich von Thünen Institut	Germany
8	IFPRI	International Food Policy Research Institute	USA

SAT-BBE logo

SAT-BBE website

The SAT-BBE website, established by LEI Wageningen UR, is regarded as central channel for dissemination purposes. It has been continuously updated along the whole project duration. The main goals of the SATT-BBE website were twofold:

- to provide information on the project's partners, activities, progress and outcomes; (public area):
  - *home* page; with project acronym, news and contact information about project coordination team (Figure 11);
  - *project* page, with objectives, approach, expected achievements, including a link to the SAT-BBE flyer;
  - *partner team* page, with information about the consortium teams, such as their expertise, the contact persons, and links to their institutional websites (Figure 12);
  - *news and events* page, containing SAT-BBE relevant events (in past and upcoming) as well as all project meetings;
  - *papers* page, for making accessible any related public documents, such as public deliverables, publications and dissemination material.
- to offer to project partners access to all documentation and deliverables produced in the course of the project (partner's area). This page is accessible only to consortium members through user authentication.

Moreover, project partners have linked the SAT-BBE project information to their own institutional websites (e.g. IIASA, WI, LEI WUR, EFI); and with private sector related websites, like RVO and sahyog.

Figure 11 Public area of SAT-BBE website (home page)

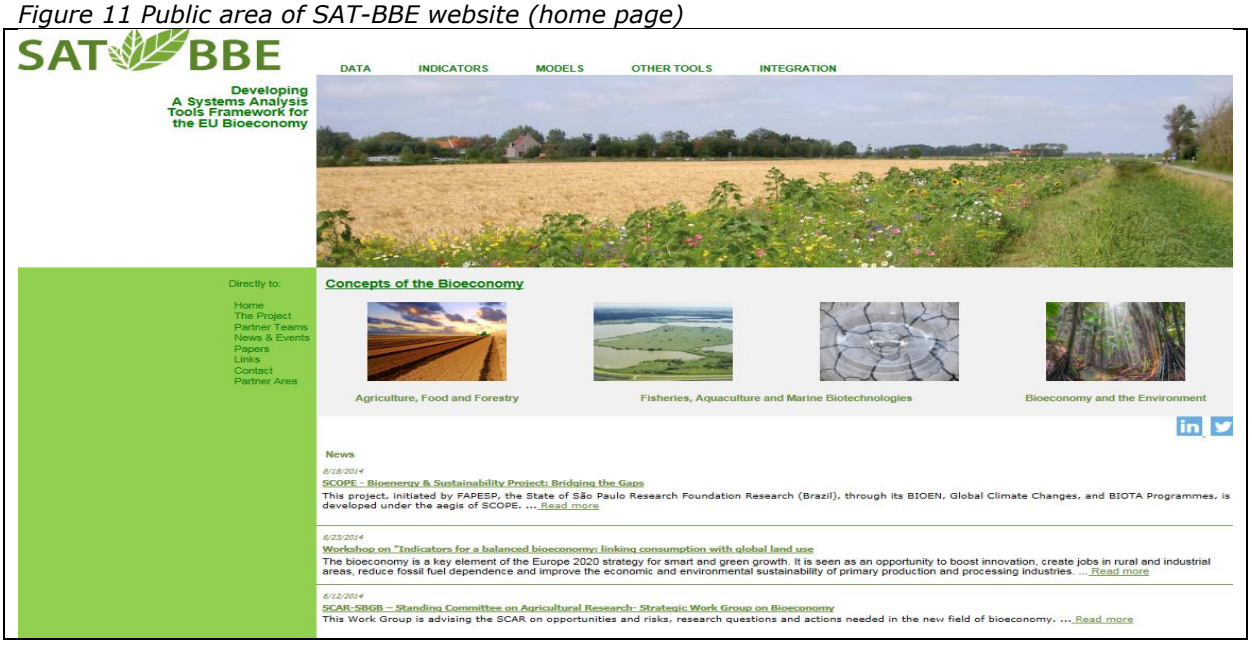
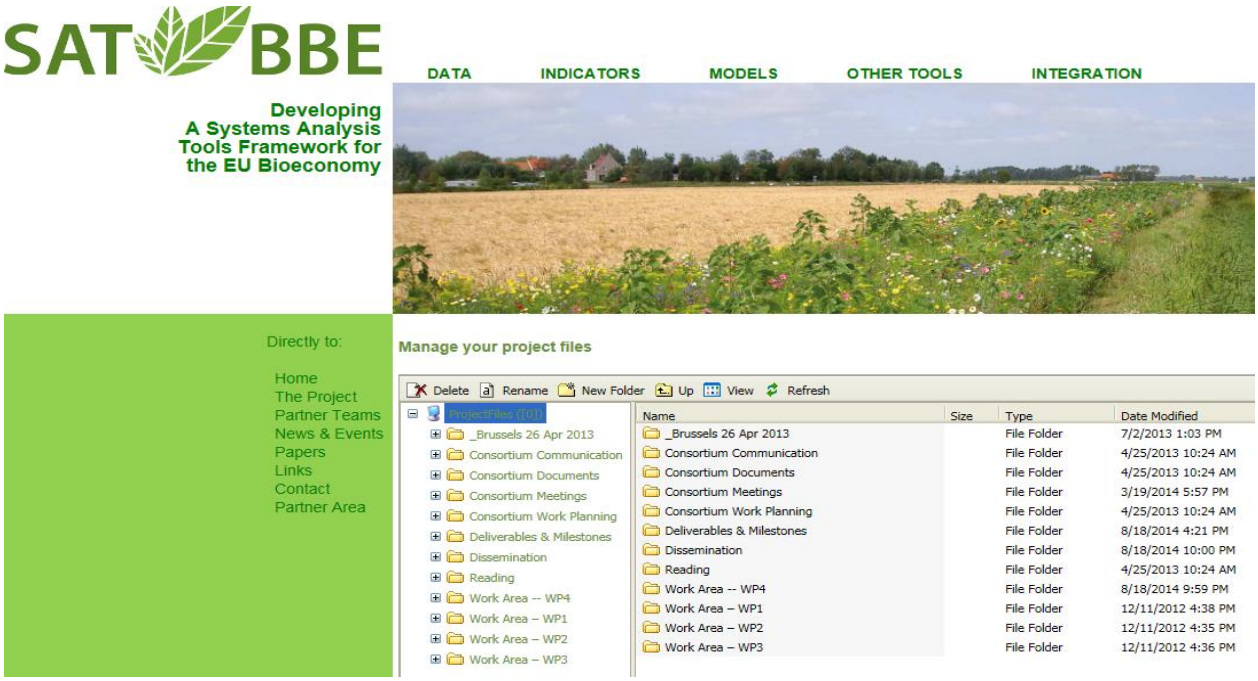


Figure 12 Partners' area of SAT-BBE website



4.2 Use and dissemination of foreground

A plan for use and dissemination of foreground (including socio-economic impact and target groups for the results of the research) has been established. It contains the use and dissemination of foreground and is consistent with the report on societal implications on the use and dissemination of foreground (section 4.3). The dissemination report consists of:

Section A

This section describes the dissemination measures, including any scientific publications relating to foreground. **Its content is available on the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

Section B

This section specifies the exploitable foreground and provide the plans for exploitation. All these data are public or confidential; the report clearly marks non-publishable (confidential) parts that have been treated as such by the Commission. Information under Section B that has not been marked as confidential is **available in the public domain** thus demonstrating the added-value and positive impact of the project on the European Union.

Section A and B Dissemination / Promotional Information

Section A. Scientific publications

No.	Partner	Date of publication/ submission	Title and authors	Name of the Journal	Non refereed literature	Peer-reviewed literature
1	WI	6 Feb.14	Bringezu, S. (2014). Carbon Recycling for Renewable Materials and Energy Supply: Recent Trends, Long-Term Options, and Challenges for Research and Development.	*Journal of Industrial Ecology.* doi: 10.1111/jiec.12099		x

Section B. Dissemination activities

No	Partner	Date	Title or Issue	Type					Dissemination level			
				Flyer/Brochure	Conference/ Workshop			Other	Worldwide	Europe wide	National	Local
					oral	+ abstrac	poster					
1	IIASA	26 Apr 13	Systems Analysis Description of the Bioeconomy (Hannes Böttcher). Seminar DG RTD		X					X		IIASA
2	UU	16 May 13	SAT-BBE WP1 – Deliverable 1.3					X				
3	VUA	9-12 Sept 13	Presentation about Land Use Data and Land Use Modelling within a session entitled 'Land use change in Europe: new understanding, better modelling, and road mapping to a desired future', IALE conference, Manchester		x					x		VUA
4	VUA	29 Sep- 2 Oct 13	Land availability for agricultural expansion – Current estimates and their role in future scenarios of global agricultural production.", David Eitelberg, Peter Verburg, Jasper van Vliet. Presented at First International Conference on Global Food Security, Noordwijk, the Netherlands		x				x			VUA
5	LEI	26 Nov 13	Key note Presentation at BISO workshop in Brussels; Hans van Meijl (EC-JRC-IPTS)		x					x		
6	WI	24 Jan 14	UNEP (2014). Assessing Global Land Use: Balancing Consumption with Sustainable Supply. A report of the Working Group on Land and Soils of the International Resource Panel. Bringezu, S., Schütz, H., Pengue W., O'Brien M., Garcia F., Sims R., Howarth R., Kauppi L., Swilling M., and Herrick J.					Report	X			
7	WI	19 March 14	Targets for sustainable land use: building the bridge between planetary boundaries and national consumption levels for forestry at the Global Land Project 2nd Open Science Meeting		x							

8	TI	24.06.2014	European Biofuel Policies – Under construction		x					x		
9	LEI	24 Jun 14	Presentation on Workshop 'Indicators for a balanced bioeconomy: Linking consumption with global land use; Wuppertal Institute					x		x		
10	EFI	24 Jun 14	Presentation "Perspectives on European forests and their role in a future bio-economy". Workshop 'Indicators for a balanced bioeconomy: Linking consumption with global land use; Wuppertal Institute, Wuppertal, Germany					x		x		
11	LEI	18 Nov 14	Participating in 1st SCAR Foresight workshop with experts, Brussels					x		x		
12	IIASA	18 Nov 14	Participating in 1st SCAR Foresight workshop with experts, Brussels		x					x		
13	WI	18 Nov 14	Participating in 1st SCAR Foresight workshop with experts, Brussels		x				x			
14	VUA	23-25 Sep 14	„Land system science: from understanding to sustainability solutions". Land Science Conferences, Taipei, Taiwan					X		X		
15	IIASA	24/06/2014	Indicators for a balanced bioeconomy – Workshop at Wuppertal Institute, Germany. Presentation title: Sustainability challenges of the EU bioeconomy: a bottom-up modelling perspective		x				x			
16	VUA	15 Jan 15	Seminar presentation of tools framework/land availability results at seminar North Carolina State University, USA					x		x		
17	LEI	Feb 15	Participating in 2nd SCAR Foresight workshop with experts, Brussels					x		x		
18	WI	Feb 15	Participating in 2nd SCAR Foresight workshop with experts, Brussels					x		**18**	WI	Feb 15

4.3 Report on societal implications

Replies to the following questions will assist the Commission to obtain statistics and indicators on societal and socio-economic issues addressed by projects. The questions are arranged in a number of key themes. As well as producing certain statistics, the replies will also help identify those projects that have shown a real engagement with wider societal issues, and thereby identify interesting approaches to these issues and best practices. The replies for individual projects will not be made public.

A General Information *(completed automatically when Grant Agreement number is entered.*	
Grant Agreement Number:	311880
Title of Project:	SAT-BBE
Name and Title of Coordinator:	M. van Leeuwen/ Dr H. van Meijl

B Ethics	
1. Did your project undergo an Ethics Review (and/or Screening)? • If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*	✓Yes 0No
2. Please indicate whether your project involved any of the following issues (tick box) :	*YES*
RESEARCH ON HUMANS	
• Did the project involve children?	
• Did the project involve patients?	
• Did the project involve persons not able to give consent?	
• Did the project involve adult healthy volunteers?	
• Did the project involve Human genetic material?	
• Did the project involve Human biological samples?	
• Did the project involve Human data collection?	
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	
• Did the project involve Human Foetal Tissue / Cells?	
• Did the project involve Human Embryonic Stem Cells (hESCs)?	
• Did the project on human Embryonic Stem Cells involve cells in culture?	
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	
• Did the project involve tracking the location or observation of people?	
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	
• Were those animals transgenic small laboratory animals?	
• Were those animals transgenic farm animals?	

• Were those animals cloned farm animals?	
• Were those animals non-human primates?	
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	
DUAL USE	
• Research having direct military use	○ Yes ✓ No
• Research having the potential for terrorist abuse	

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	1	1
Work package leaders	1	1
Experienced researchers (i.e. PhD holders)	4	10
PhD Students	2	5
Other		

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	0
Of which, indicate the number of men:	

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project? ○ Yes ✓ No

6. Which of the following actions did you carry out and how effective were they?

	Not at all effective				Very effective
☐ Design and implement an equal opportunity policy	✓	○	○	○	○
☐ Set targets to achieve a gender balance in the workforce	✓	○	○	○	○
☐ Organise conferences and workshops on gender	✓	○	○	○	○
☐ Actions to improve work-life balance	✓	○	○	○	○
○ Other:					

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

○ Yes- please specify

✓ No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

○ Yes- please specify

✓ No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

○ Yes- please specify

✓ No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

○ Main discipline[21]: agriculture (bioeconomy)

○ Associated discipline[21]: environment ○ Associated discipline[21]: competition

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)* ✓ Yes ○ No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

○ No

○ Yes- in determining what research should be performed

○ Yes - in implementing the research

○ Yes, in communicating /disseminating / using the results of the project

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	○ ○	Yes No

12. Did you engage with government / public bodies or policy makers (including international organisations)

- ○ No
- ○ Yes- in framing the research agenda
- ○ Yes - in implementing the research agenda
- ☑ Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

- ☑ Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
- ☑ Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
- ○ No

13b If Yes, in which fields?

Agriculture	☑	Energy		☑	Human rights		
Audiovisual and Media		Enlargement			Information Society	☑	
Budget		Enterprise		☑	Institutional affairs		
Competition	☑	Environment		☑	Internal Market		
Consumers		External Relations			Justice, freedom and security		
Culture		External Trade			Public Health		
Customs		Fisheries and Maritime Affairs		☑	Regional Policy	☑	
Development Economic and Monetary Affairs		Food Safety	☑		Research and Innovation	☑	
		Foreign and Security Policy		☑	Space		
Education, Training, Youth	☑	Fraud			Taxation		
Employment and Social Affairs	☑	Humanitarian aid			Transport		

13c If Yes, at which level?

- ☑ Local / regional levels
- ☑ National level
- ☑ European level
- ○ International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	1
To how many of these is open access[22] provided?	1
How many of these are published in open access journals?	1
How many of these are published in open repositories?	
To how many of these is open access not provided?	
Please check all applicable reasons for not providing open access:	
❑ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other[23]: ……	

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		-
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	-
	Registered design	-
	Other	-
17. How many spin-off companies were created / are planned as a direct result of the project?		-
Indicate the approximate number of additional jobs in these companies:		

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

❑ Increase in employment, or	❑ In small & medium-sized enterprises
❑ Safeguard employment, or	❑ In large companies
❑ Decrease in employment,	☑ None of the above / not relevant to the project
❑ Difficult to estimate / not possible to quantify	

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE – one person working fulltime for a year*) jobs: Difficult to estimate / not possible to quantify	*Indicate figure:* ☑

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

○ Yes ☑ No

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

○ Yes ☑ No

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

☐	Press Release	☐	Coverage in specialist press
☐	Media briefing	☐	Coverage in general (non-specialist) press
☐	TV coverage / report	☐	Coverage in national press
☐	Radio coverage / report	☐	Coverage in international press
☑	Brochures /posters / flyers	☑	Website for the general public / internet
☐	DVD /Film /Multimedia	☑	Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

☐	Language of the coordinator	☑	English
☐	Other language(s)		