Green Lifestyles Alternative Models and Up-scaling Regional Sustainability / GLAMURS

Work Package 2: Knowledge Co-production and Scientific Integration Deliverable 2.1: Report on the opportunities presented by the project to provide a context for knowledge coproduction with stakeholders, policymakers, researchers and experts

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Work Package 2: Knowledge Co-production and Scientific Integration

Deliverable 2.1: Report on the opportunities presented by the project to provide a context for knowledge coproduction with stakeholders, policymakers, researchers and experts

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Preface

This report summarizes the activities the project has done that are either interdisciplinary or involve non-scientists, to see what effect various attributes of transdisciplinary knowledge coproduction add to the outcomes of the research expressed in terms of action, use, impact and spin-off. The task of this report is to evaluate the context the GLAMURS project has created for knowledge coproduction with the various potential audiences of its work. However, it is also interesting to see what knowledge has been coproduced internally to the project as a direct result of the involvement of scientists with many specialisms being involved in it. Our results show that there is a significant issue with the conceptualization of different modes of research, and that it is not necessarily the case that all of the features of transdisciplinary research, as it is currently described, collectively lead to the kinds of outcome that are hailed as being associated with it. However, there are clear benefits to knowledge coproduction as a mode of interaction, no matter who is involved (scientists or not). This lack of vocabulary to articulate both the benefits of transdisciplinary research and the institutions in which it is funded and assessed (particularly those individuals undertaking it), highlights that science itself must change – at least in the sustainability arena – if it is to play any kind of significant role in achieving the dream of living sustainable lifestyles. This observation is supported by our own interactions with our case study participants during the course of the project.

Summary of Main Findings

- Transdisciplinary knowledge coproduction is widely held to be the gold standard for scientific research activities in the sustainability arena.
- The GLAMURS project has undertaken a diverse range of activities aimed at coproducing knowledge with stakeholder audiences.
- Sustainability is something scientists, businesses, initiatives, citizens and policymakers have to learn to do together.
- Achieving the transition will have political, economic and social consequences that predicate the active engagement of citizens, policymakers and businesses in developing and adapting our lifestyles and economy.
- Language seems to be an issue at the heart of the problem both of doing transdisciplinary knowledge coproduction successfully and in terms of articulating its benefits.
- Advancing the transdisciplinary knowledge co-production agenda is inhibited by institutional barriers.
- We need to break down academic institutional barriers to promoting best practice approaches to sustainability research.
- Problem-focused research is not necessarily associated with action or use.

Full Report

1. Introduction

There are various ways in which scientists can share their research with people who are interested in it. Such individuals, besides other scientists, include those responsible for funding the research, people who are studied by it (in the case of social research), and members of organisations and government who might be affected by its findings.

In the traditional model, which could be characterized as *knowledge transfer*, findings by scientists are disseminated by knowledge brokers (journalists, experts, consultants, extension agents) to the various interested parties. The concept of *knowledge exchange* builds on this model by recognising that information may need to pass in two directions between scientists and their stakeholders. However, this model still sees knowledge as a commodity that is passed between participants to fill a gap.

Knowledge coproduction envisions knowledge exchange as a process by which knowledge is created through the interactions of stakeholders and scientists (Hage et al. 2010). This view of knowledge creation is akin to the goals of transdisciplinary research in breaking down barriers between scientific disciplines and between researchers and the non-academic community when addressing complex problems (Lawrence and Després 2004). Nonaka et al.'s (2000) article on knowledge creation in organisations articulates the Japanese concept of *ba* as the shared context essential for knowledge creation to take place, and emphasises that social and/or human-environmental interaction is the means by which knowledge is created (p. 15).

The subject matter of GLAMURS means knowledge coproduction is the most appropriate model. Although highly uncertain, the cost of climate mitigation and adaptation is estimated to be approximately 0.7% of GDP in Europe by 2050 and 1.6% by 2100 (Waisman et al. 2012). Despite these relatively low costs, the reality is that carbon emissions have continued to grow, following trajectories that correspond to worst-case scenarios (Peters et al. 2013). Indeed, over the period 2000-2010, carbon emissions grew at their fastest rate since records began. Members of the public, manufacturers and governments are not, it seems, waiting on the edge of their seats for scientists to tell them how to reduce their carbon emissions. Only by working together can scientists and stakeholders come to know what it is we need to do to transition to sustainable lifestyles and a green economy.

Ironically, although there is widespread recognition that knowledge coproduction is best practice in relevant domains of research (such as those forming the subject of GLAMURS), institutional constraints in funding contracted research limit the degree to which researchers can respond to their conversations with stakeholders. Such barriers are recognised in articles on transdisciplinary research (e.g. Carew and Wickson 2010), but a key issue is the iterative and evolutionary nature of such research (Russell et al. 2008), which can conflict with contractual obligations.

GLAMURS has created various opportunities for knowledge coproduction in the project, some facilitated directly through activities in WP2, but others were organized as parts of activities in the rest of the project. This is encouraging, as scientific integration and knowledge coproduction is work that cannot be done as an exercise *after* the main (disciplinary) work of the project is finished; rather it must be embedded within the work of the project as a whole. When scientists work together across disciplinary boundaries, they already need to be willing to work outside their 'comfort zone'. This situation is

exacerbated when working together with non-academics, who have intuitive, emotional and spiritual ways of knowing as well as reason and logic. It is important for project leaders to create a culture in which there are no 'stupid questions'. This is particularly important in transdisciplinary contexts, where non-academic participants may fear being 'shouted down' if they make an assertion contrary to accepted scientific opinion.

Whether inter- or trans-disciplinary in nature, the success of scientific integration on the research depends on the personalities of the team members, and is sensitive to research project culture. Clearly, integration cannot be something that is simply left to members of the team with nominal responsibility for it. Yet the institutional barriers to inter- and trans-disciplinary working may mean that scientists have to make what they perceive to be personal sacrifices for the sake of the project, even if the resulting knowledge generated is interesting and publishable.

This report documents the efforts GLAMURS has made to undertake inter- and trans-disciplinary knowledge coproduction, through a number of approaches, exercises and methods. Something we are particularly interested in is evaluating them. We do this in two ways. First, in section 2, we draw on relevant literature to develop a framework for evaluating transdisciplinary knowledge coproduction exercises. Second, in section 3, we apply this framework to a number of activities organized by tasks in the GLAMURS project. Critically, we apply the framework both to the activities that were intentionally focused on knowledge coproduction or transdisciplinary interaction, *and* more traditional research activities and knowledge transfer. In evaluating the central question for this report to assess (the contexts GLAMURS has created for knowledge coproduction with stakeholders and policymakers) we are also interested in whether newer styles of activity and stakeholder engagement from the literature on knowledge coproduction on transdisciplinary research really deliver benefits over more traditional activities. Section 4 presents our results, which are then discussed in section 5. Section 6 concludes, but the report also contains a number of appendices in sections 8-12 that provide detail on activities of the project that have not been documented already in any of the other project deliverables.

2. Evaluation of knowledge coproduction

One of the issues with inter- and transdisciplinary knowledge coproduction is the lack of coherent frameworks for evaluating it. Brandt et al.'s (2013) review of transdisciplinary research in sustainability adopted a categorization framework for the case studies they examined that grouped into what they claim to be three components of transdisciplinarity (ibid. p. 3). Definitions of their terms are our interpretations as Brandt et al. do not go into detail. As Brandt et al. (2013) have developed their framework for a specific type of case emphasising citizen/community involvement, their framework has been extended (where needed) with some insights from policy analysis, for example Thissen and Twaalfhoven (2002), who propose a general structure for evaluating activities consisting of (i) inputs (ii) process and methods, (iii) results, (iv) use and impacts. The Thissen and Twaalfhoven has also been used for evaluating transdisciplinary vision and backcasting projects in sustainable food (Quist 2007, Quist et al 2011) and in climate adaptation (Van der Voorn et al 2016).

Below first the items building on Brandt et al. (2013) are listed (but marked in which part of the general structure they fit), followed by additional items that are based on Thissen and Twaalfhoven (2002) or Quist (2007)

1. Process phases (Process or Results)
    a. Problem identification and structuring. Defining and scoping the extent of the problem.
    b. Problem analysis. Analysing the problem and any relevant data; evaluating alternatives.
    c. Integration and application. Applying a proposed solution in a specific context.
2. Knowledge type (Results)
    a. System knowledge. Information about the current state of affairs.
    b. Target knowledge. Information about a desired state of affairs.
    c. Transformation knowledge. Knowledge about how to achieve a desired state of affairs given the current state of affairs.
3. Level of involvement of non-scientists (Process)
    a. Information. Non-scientists are being told scientific findings.
    b. Consultation. Non-scientists and scientists are exchanging information.
    c. Collaboration. Non-scientists and scientists are working together on solving a problem using their collected knowledge and experience.
    d. Empowerment. Non-scientists are empowered to take action.
    e. Non-scientists have full control

To this framework certain other considerations may be added. First, we might contrast the 'mode' of interaction. Although Brandt et al. (2013) have partially categorized this in terms of the level of involvement of non-scientists, it might also apply to interdisciplinary exercises where only scientists are interacting – processes we are interested in evaluating here.

4. Mode of interaction (Process)
    a. Transfer. The relationship is unidirectional, and the actors comprise a donor and a recipient.
    b. Exchange. The relationship is bidirectional, and actors take on roles of donor and recipient.
    c. Coproduction. A bidirectional relationship as in knowledge exchange, but with a view to creating new knowledge, rather than simply exchanging existing knowledge with each other.

A second consideration is what, precisely, is the subject of the interaction. Schreiber et al. (2000, pp. 3-4), introducing their textbook on *Knowledge Engineering and Management* distinguish between *data*, *information* and *knowledge*, providing another dimension of consideration for our framework thus:

5. Subject of the interaction (Process or Results)
    a. Data. Uninterpreted, raw 'signals'. An example might be the current reading on a domestic energy meter.
    b. Information. Data with associated meaning. An example might be a display on an energy monitor, showing how much energy the household has used in the last hour.
    c. Knowledge. Information with purpose (i.e. that enables people to take action) and/or generative capacity (i.e. enabling people to generate new information and knowledge). For example, knowledge would be that households using LED lightbulbs save a certain percentage of electricity when compared with other similar households who otherwise use halogen and/or tungsten lighting technology.

Third, we are interested in understanding who was involved in a particular interaction, to gauge the disciplinarity involved. We adopt Tress et al.'s (2005) classification:

6. Disciplinarity (Process or Results)
    a. Monodisciplinary. The interaction only involved individuals from a single discipline.
    b. Multidisciplinary. The interaction involved individuals from multiple disciplines, but the mode of interaction was 'exchange'.
    c. Interdisciplinary. The interaction involved individuals from multiple disciplines, and the mode of interaction was 'coproduction'.
    d. Transdisciplinary. The interaction involved scientists and non-scientists. This, however, does not distinguish the number of scientific disciplines involved. We do need to distinguish this, but this can be achieved later as we simplify all these elements.

Finally, we are interested in who took the initiative to arrange the interaction. There are various possibilities:

7. Ownership of the interaction
    a. GLAMURS scientists
    b. Other scientists

c. GLAMURS case study initiative participants

d. Other stakeholders

Brandt et al. (2013) also grouped the papers they reviewed into seven categories with respect to the methods used in the case studies (ibid. p. 3):

A. Evaluation and validation (Process/Methods)

B. Modelling

C. Visioning

D. Data collection

E. Description

F. Learning and exchange

G. Visualization and structuring

As well as methods, we would also be interested in recording inputs, process, method, results, outcome and impact. Inputs could include knowledge resources, which is already captured by considering disciplinarity; inputs could also include any details of the setting, which partially relates to item 1 (process phase), but also includes ownership (item 7). Methods or process could well be covered by Brandt et al.'s (2013) categories listed above, though this list may not be comprehensive enough given that we want to look at non-transdisciplinary exercises. The results are any immediate outputs from the interaction. Outcome and/or impact cover longer-term consequences that are reasonably attributable to the interaction. Theoretically, we should expect such consequences when knowledge rather than data and/or information have been the subjects of the interaction. Returning to Schreiber et al. (2000), outcome or impact would occur as a consequence of the actions taken by individuals because of the knowledge they have learned.

There is considerable overlap in the various data we would like to capture, as mentioned above; however, there are also some areas where Brandt et al.'s framework does not really work for us, such as item 1, in which we prefer to capture similar information in a less constrained way. As to overlap, items 2 and 5 are similar in nature, largely because Brandt et al. (2013) were only interested in cases where knowledge rather than data and/or information are the subjects of interaction. Similarly, items 3, 4 and 5 are related. The information and consultation levels of non-scientist involvement correspond to transfer and exchange interaction modes respectively. The collaboration level of non-scientist involvement occurs when there is information coproduction; the empowerment level when there is knowledge coproduction. Brandt et al. (2013) were not concerned with non-transdisciplinary forms of knowledge coproduction. The following suggests a framework that simplifies everything we want to capture:

From Thissen and Twaalfhoven (2002) and/or Quist (2007) the following items have been added to form our framework:

With regard to Inputs:

- Timeline
- Purpose/aim/objective
- Resource (budget/materials/skills)

- Preparatory activities

With regard to the Process, Methods, and Results sections, no items have been added, though actions have been moved to follow-up, use and other impacts. The Results section has also been extended with:

- Use (how have results been used), and
- Impacts.

The framework is summarized in Table 1. It was circulated to the GLAMURS research team involved in various exercises together with instructions on how to complete it. These exercises cover a range of activities. Some were internal to the project, others involved citizens, stakeholders and/or policymakers; some were intended as knowledge coproduction exercises, others weren't; some involved many academic disciplines working together, others didn't. In section 3, each of these interactions is evaluated using the framework by the GLAMURS researchers most closely involved with organizing it; in some cases, the researchers have raised discussion points about their interaction. Seventeen exercises are evaluated in total. In section 4, the results are summarized. We are interested in evaluating how GLAMURS has created contexts for transdisciplinary knowledge coproduction, but also how essential the various features of knowledge coproduction – interdisciplinarity, involvement of non-scientists, and co-creation of information that leads to action are to various kinds of impact and outcome.

Table 1. Framework for describing and assessing contexts of the project for transdisciplinary knowledge coproduction; Green shaded rows are used as simple summaries of whether what occurred was transdisciplinary, coproduction, and whether what was transferred, exchanged or generated was indeed knowledge.

Item	Type / Options	Description	Connection with other framework(s)
INPUTS			
Timeline	Free text	What is the timeline of the interaction process?	
Location	Date range and spatial location if relevant	Where and when the interaction took place	
Ownership	One of: 1. GLAMURS scientists 2. Other scientists 3. GLAMURS stakeholders 4. Other stakeholders	Who initiated the interaction?	
Purpose	Free text	What was the aim/objective/purpose of the interaction (process/meeting)	
Preparation activities	Free text	What were preparatory activities taken by organisers, in particular Glamurs organisers?	Policy Analysis
Resources	Free text	What budgets, special skills, supporting material were mobilised/used for the interaction event?	Policy Analysis
Scientific Expertise	Free text list	Which scientific disciplines were involved in the interaction?	
Monodisciplinary?	Boolean	Do you consider the scientific expertise essentially to be from a single discipline?	
Non-scientists Involved?	Zero or more of: 1. Civil Society & Citizens, 2. Government, 3. Business, 4. Third Sector	Were non-scientists involved in the interaction?	Brandt 3
PROCESS AND METHODS			
Non-scientific Expertise	Free text list, distinguish at least between govt, civil society, business	What knowledge or expertise from non-scientists involved?	

Item	Type / Options	Description	Connection with other framework(s)
Intended Interaction Mode	One of: 1. Transfer 2. Exchange 3. Coproduction	What was the intended mode of interaction?	Brandt 3a, 3b, 3c&d
Problem Focus?	Boolean	Was the interaction focused on a particular problem?	
Problem	Free text	What was the problem?	
Methods	Free text list	What methods were used to facilitate the interaction?	
Brandt Method Categories	Zero or more of: 1. Evaluation and validation 2. Modelling 3. Visioning & design 4. Data collection 5. Description 6. Learning and exchange 7. Visualization and structuring	Which, if any of Brandt et al.'s categories of methods cover the methods described above?	Brandt
RESULTS			
New Knowledge	Free text	Describe any new knowledge (if any) generated as a result of the interaction.	Schreiber
Subjects of Interaction	One of: 1. Data 2. Information 3. Knowledge	What was transferred, exchanged or coproduced? In the case of 'knowledge', we would expect 'Actions' or 'New Knowledge' to be completed.	Brandt 2, 3c, 3d. Arguably, transformation knowledge is information with a purpose; system and target 'knowledge', being less actionable, would be better understood as 'information' using Schreiber et al.'s definition. Schreiber
Immediate results	Free text	Describe any other short term results of the interaction, including reflections and evaluations by those involved	

Item	Type / Options	Description	Connection with other framework(s)
Actual Interaction Mode	One of: 1. Transfer 2. Exchange 3. Coproduction	What do you think was the actual mode of interaction?	
FOLLOW-UP ACTIONS, USE AND OTHER IMPACTS			
Actions	Free text	What actions (if any) were identified as a result of the interaction? Who had to do them?	Schreiber
Use	Free text	How were the results used and where and by whom?	
Impact	Free text	What was the longer-term impact of the interaction, the use and the actions?	
Spin-off	Free text	Were there any other impacts or spin-off from the interaction process/event?	

3. Evaluating GLAMURS interactions

Using the framework in section 2, we evaluate various exercises where researchers in GLAMURS with various disciplinary backgrounds have interacted with each other, and where the GLAMURS research team have interacted with scientists and non-scientists outside the project. Not all of these were intentionally about creating or obtaining knowledge (rather than data or information), nor were they necessarily aimed at coproduction. Our interest here is in using the framework to evaluate how the knowledge coproduction exercises differed in outcomes or methods from other exercises.

3.1. Meetings between psychologists and economists

The project arranged workshops for psychologists, economists and other modellers to meet and discuss how to formalize psychological theories in the representation of human decision-making. Though not originally planned in the project, this exercise was important in facilitating dialogue and mutual understanding. Minutes of the meeting in Bath are included as an appendix in section 8.

Psychology and economics integration		
In	Timeline	July 2014, March 2015
	Location	Bath, A Coruña
	Ownership	GLAMURS Scientists
	Purpose	To create a space for dialogue between psychologists and economists and agent-based modellers in the project. On the one hand psychologists from A Coruña and Roma Tre to present psychology theories that are useful for extending economic analysis, and that can have a specific relevance for pro-environmental behaviours. On the other hand, economists and computer scientists to communicate analytical structures and modelling frameworks for economic decision making and social behaviours.
	Preparation activities	Reading and sharing papers
	Resources	Meeting room, projectors
	Scientific expertise	Psychology, Economics, Artificial Intelligence, Agent-Based Modelling
	Monodisciplinary?	No
	Non-scientists involved?	No
Proc	Non-scientific expertise	N/A
	Intended interaction mode	Coproduction
	Problem focus?	Yes
	Problem	How to represent psychological theories formally in various kinds of model. In particular, for the economic modelling tasks, two objectives are identified: first, to extend individual utility function with psychology terms, namely descriptive social norms and psychological well-being. Second, to endogenize bounded rationality and salience of different terms in decision-

		making through cognitive theories of dual-process account.
	Methods	Presentations, Discussion (Q & A)
	Brandt method categories	Modelling (2), Learning and exchange (6)
Res	New knowledge	See Deliverables 6.1, 6.2 and 6.3.
	Subjects of interaction	Knowledge
	Immediate results	A number of policy-relevant findings regarding the interplay of individual decision making and collective behaviour. In particular, consumption policies aimed at reducing negative externalities from pollution may seem to obtain an effect at individual level, but the opposite effect at the population level, as a result of crowding-out green behaviours when decisions are mediated by a lifestyle choice.
	Actual interaction mode	Coproduction
Out	Actions	Finalising analytical models, finishing scientific papers, designing and writing interdisciplinary co-authored papers.
	Use	N/A
	Impact	N/A
	Spin-off	N/A

Discussion points

Successful integration of the disciplines needs new basic research to develop cross-disciplinary scientific theory and new research methods. The question of how to include psychology in economics, for example, is a purely theoretical one, involving the appropriate discussions among scientists with relevant interests. Though seemingly abstract in nature, it is also an important matter to resolve if economic models are to be successfully refined such that they make credible economic findings based on psychologically plausible assumptions about the nature of human decision-making. Such work need not only involve scientists from the disciplines attempting to integrate their theories. In the case of psychology and economics, for example, the artificial intelligence community have invested effort in formalising models of behaviour from psychology.

Problem-focused research, typically the context for transdisciplinary work, does not always provide the opportunities to reflect on experiences, draw general conclusions, or make advances in the science of transdisciplinary research practice. In general, as multiple disciplines are brought together to address societal problems, space will be needed for those disciplines to think critically about how best to integrate their ideas and adjust their methods so they can work together more effectively.

3.2. Theoretical integration

Work Package 3 of the project was aimed largely at theoretical integration in the GLAMURS project. The interaction activities discussed here overlap with those in section 3.1 somewhat. The latter are more specifically focused on the interactions between microeconomists and psychologists and exercises aimed at practical and specific integration, whilst the work here is more abstract and formally theoretical. For more information on this aspect of the work of the project, see Deliverables 3.1 (Report on the meta-analysis results on the determinants of lifestyles and lifestyle change) and 3.2 (Report on the relationships

among psychological, economic and political/policy factors determining lifestyle change and transitions to alternative consumption-production systems in a green economy).

Theoretical integration		
In	Timeline	January 2014-December 2016
	Location	GLAMURS consortium meetings and smaller scale meetings in Bath, A Coruña and Brussels)
	Ownership	GLAMURS Scientists
	Purpose	First, to mutually exchange theoretical insights among experts from different disciplinary; experts from one discipline selected and presented major both mainstream and more innovative theories to experts of other disciplines, suing an easy-to-understand language and clarifying possible ambiguities in terminologies or differences between the meaning of a concept within a discipline and common sense meanings of the same concept (e.g., attitudes or social norms in psychological vs. common sense terms). Second (more difficult but possible) to mutually incorporate concepts from one discipline into another, so to broaden and deepen the current understanding of a phenomenon (e.g., incorporating social influence within micro-economic or agent-based models)
	Preparation activities	Exchange of papers, presentations during meetings
	Resources	Meeting room, projectors
	Scientific expertise	Psychology; social sciences; political science; computer science; ontology; economics
	Monodisciplinary?	No
	Non-scientists involved?	No
Proc	Non-scientific expertise	N/A
	Intended interaction mode	Coproduction
	Problem focus?	Yes
	Problem	How to enlarge theories and models used for describing the process of formation and change of sustainable lifestyle beyond the narrow borders of single discipline (e.g, psychology), in order to be able to understand knowledge-action gaps that still prevent massive lifestyle change among citizens at large and inform institutional actors with robust theory-driven and evidence-based knowledge
	Methods	Exchange of ideas, scientific literature, working papers and oral presentations during meetings
	Brandt method categories	Description (5), Learning and exchange (6)
Res	New knowledge	Deliverables D3.1 – D3.2 – D3.3 – D3.4
	Subjects of interaction	Knowledge
	Immediate results	A broader definition of sustainable lifestyles, new theoretical models for understanding sustainable lifestyle formation and change, insights for

		including psychological concepts into micro-economic macro-economic and agent-based simulation of societal transitions towards sustainable lifestyles and green economic systems, and for incorporating behavioural data and consumer-based information within carbon footprinting calculations
	Actual interaction mode	Coproduction
Out	Actions	Writing working papers and policy-oriented documents, drafting new theoretical models, planning and drafting interdisciplinary co-authored papers
	Use	N/A
	Impact	N/A
	Spin-off	N/A

3.3. Checking models with other team members

At the Bath Consortium meeting in late 2015, we discussed the relationship between the modelling work and empirical social research, coming to the conclusion that we should examine the extent to which various modelling efforts in the project are or are not addressing points deemed by the empirical social researchers to be important. This exercise was referred to as the 'health check' by GLAMURS project participants, and the Appendix in section 6.3 provides a more detailed summary. It comprised two questionnaires, one sent to everyone in the project, eliciting items that the respondents thought the models should address. The second questionnaire was sent to those involved in modelling, asking them to evaluate each of their models against each item elicited from the first questionnaire. The results of the questionnaires were then discussed in a workshop held at the Delft consortium meeting.

Modelling Health Check		
In	Timeline	February-April 2016
	Location	Delft (workshop)
	Ownership	GLAMURS scientists
	Purpose	To evaluate the extent to which models prepared by micro- and macroeconomists and agent-based modellers were addressing concerns of priority to other researchers in GLAMURS.
	Preparation activities	Two questionnaires were prepared and trialled; the workshop was designed
	Resources	Questionnaires, implemented on LimeSurvey; workshop venue.
	Scientific expertise	Psychology, Economics, Artificial Intelligence, Agent-Based Modelling
	Monodisciplinary?	No
	Non-scientists involved?	No
Proc	Non-scientific expertise	N/A
	Intended interaction mode	Coproduction
	Problem focus?	Yes
	Problem	Perception that the models were not addressing concerns of the non-modelling researchers.

	Methods	Questionnaire survey, workshop
	Brandt method categories	Data collection (4), Learning and exchange (6)
Res	New knowledge	It was unclear how the results of the backcasting would be studied in the models; it was also unclear where the models would be looking at upscaling.
	Subjects of interaction	Knowledge
	Immediate results	Discussions held about how to model initiatives.
	Actual interaction mode	Coproduction
Out	Actions	Various actions emerged from the minutes of the Delft consortium meeting in which the results of the health check exercise were discussed.
	Use	Modellers took the results forward to examine how they could better relate their models to the work in the rest of the project.
	Impact	Design for how to model initiatives prepared.
	Spin-off	Considering which backcasting scenario clusters models could address, which was discussed at the Leipzig consortium meeting.

3.4. Constructing an ontology integrating terminology used in the project

Ontologies are formal, explicit representations of shared conceptualizations (Gruber 1993), and one popular language used to write them is the Web Ontology Language (OWL; Horrocks et al. 2003, Cuenca-Grau et al. 2008). In the GLAMURS project, we have used OWL ontologies to represent various aspects of the projects work, with a view to enabling automated reasoning about the relationships among terms used in specialist disciplines. Creating these ontologies required a number of exercises to be conducted within the project team to find terms that needed defining, and agree ways in which they could be related. You can read more about this work in D2.2 (Report on ontology generation and data and knowledge integration).

Ontology construction		
In	Timeline	January 2014 to December 2016
	Location	A Coruña, Rome, Trondheim, Bath, Leipzig
	Ownership	GLAMURS scientists
	Purpose	To develop a formal framework allowing terminology in various disciplines to be related to each other.
	Preparation activities	Refinement of earlier workshop methods to elicit ontologies (Gotts and Polhill 2012; Polhill et al. 2010) to fit into a one-hour workshop at the A Coruña kick-off meeting. Development of an 'ontology checklist' for participants to complete at the Bath consortium meeting. Refinement of the checklist into an on-line terminology questionnaire. Construction of a central 'common-sense' ontology.

		Initial working document to collect terms in a glossary.
	Resources	Workshop resources include various coloured cards on which people could write processes, entities and attributes, for the A Coruña meeting; cards containing concepts to be defined for the Bath meeting; worksheets for people to complete on vocabulary at the Leipzig meeting. Technical resources include the Al Fresco content management system, Protégé, Eclipse, Lime Survey for the on-line ontology questionnaire, Git for version control. Skills include programming, system design, data modelling.
	Scientific expertise	Ontologies, Knowledge Engineering, Knowledge Elicitation
	Monodisciplinary?	Yes
	Non-scientists involved?	No
Proc	Non-scientific expertise	N/A
	Intended interaction mode	Coproduction
	Problem focus?	No
	Problem	N/A
	Methods	Workshops, Questionnaire, Glossary, Knowledge Engineering, Text Mining.
	Brandt method categories	Modelling (2), Data collection (4), Description (5), Learning and Exchange (6), Visualization and Structuring (7).
Res	New knowledge	We have been able to detect that various terms are semantically related to each other on the basis of assertions made about integration. We have generated new knowledge on the formal representation of semantic interoperability among ontologies. We have also developed methodologies for creating ontologies from questionnaire survey data. We have also developed a method for structuring knowledge by relating specialist terminology to common-sense terms. We have been able to show that specialist vocabulary can be automatically detected by looking for high-frequency, low-familiarity (using WordNet) terms.
	Subjects of interaction	Knowledge
	Immediate results	An OWL ontology integrating formalizations of Actor-Network Theory and Practice Theory; Text mining results showing frequency of various words used during the ontology elicitation workshop in A Coruña, and any immediate linkages between them derived from the WordNet (Miller 1995) database. A glossary document containing definitions of various disciplinary terminology used (or potentially used) by project participants. OWL ontologies representing common-sense and specialist vocabularies, and various data collected or used by the project.
	Actual interaction mode	Coproduction
Out	Actions	One of the most important lessons learned from this exercise is the need

		for a knowledge engineer to construct an ontology.
	Use	The ontologies can be used to develop various metrics reflecting on the project. For example, we can look at the relative frequency with which terms in the common-sense vocabulary have been applied in the project, which will highlight where less work has been done.
	Impact	The development of a formal language for integration: the available OWL axioms are insufficient to capture some of the important meanings that allow us to relate terms.
	Spin-off	There are potential future projects (were suitable funding available) to develop the tools needed to support scientific integration in other inter- and transdisciplinary research.

Discussion Points

This work made various efforts to engage the project team in the construction of OWL ontologies. One of the main lessons learned is just how hard it is for specialists in ontological languages to explain to non-specialists the basic assertions that these languages allow, and to differentiate between Classes, Relationships, Attributes and Processes. In the end, we addressed this by asking questions in the vocabulary questionnaire on Lime Survey, though even this approach still needs work to make it less daunting for people to complete. These experiences serve only to emphasize the assertion of Sowa (2000, p. 452) that knowledge engineering (converting natural language into formal logic) is a specialism, and there is a need for a dedicated knowledge engineer to construct the ontology. No matter how hard we tried, there were no short cuts that got round this problem!

The construction of the ontologies was included in the integration Work Package because it took a literal, technical interpretation of the term 'integration'. It was intended as an exercise that would run throughout the project that all the team would engage with. We can see in the minutes of the Delft consortium meeting where the health check was discussed (see p. 102) that there was a call for something like this to be done to enable modellers and field researchers to talk to each other. One of the problems with committing ourselves to OWL ontologies was the difficulties of visualizing the ontologies and in articulating the benefits that would accrue from reasoning over the formalization. In part, this is because such benefits could not be realized until the ontologies were finished, with the consequence that individuals had to engage with a rather technical exercise that would not be delivering benefits to their careers in terms of research outputs. (Bearing in mind especially that in some disciplines, only certain journals are 'recognized' as being legitimate destinations for published research for the purposes of career advancement.)

Another lesson learned was that this specialist work needed to be done throughout the project, rather than, as has been the case here, concentrated effort being applied in the final year. (Though this is not to say that there was no activity on the ontology in the first two years – which arguably were spent learning how to do this.) The main point, however, is that scientific integration requires dedicated staff time to achieve successfully; a matter about which we were naïve when applying for funds, through not recognizing the degree of specialist skills required.

The ICT tools to facilitate integration in inter- and transdisciplinary projects are still lacking. In particular, there are major issues with metadata, which are well recognized in on-line content management systems and virtual research environments, that users hate completing metadata (Doctorow 2001; Edwards et al. 2014). Ideally as much metadata as possible would be collected automatically. Naivety about file formats

among non-specialists using their preferred tools for creating content means that extracting vocabulary automatically, for example, can be hampered by not being able to access the writing without proprietary software. (Indeed, owners of proprietary file formats often do not provide the tools that are needed.) Use of open and standard content formats (such as HTML, or Open Document) should be strongly encouraged as part of facilitating automated services for metadata collection and text mining for terminology. As well as needing knowledge engineering to support scientific integration, inter- and transdisciplinary project team members in specialist domains do also need to recognize that they will have to devote time to this effort themselves. Reviewers of proposals claiming to do inter- and transdisciplinary work should be suspicious if insufficient budget is allowed for these supporting activities.

One particularly interesting consequence of this work has been the discovery that formal languages are need to define terms allowing vocabularies to be related to each other. We have found in this case that most relevant assertions can be achieved with a surprisingly small set of terms. See Deliverable 2.2 for more information on this.

3.5. Pressure cooker

"Pressure cooker" cross-project symposium on "Theories of change in sustainability transitions"		
In	Timeline	September 2015
	Location	The workshop was carried out in the Department of Psychology, at the University of A Coruña
	Ownership	Organized by the People-Environment Research Group and the coordination team of GLAMURS, with contributions from nine different European projects.
	Purpose	The symposium aimed to bring together theoretical approaches and empirical results from different European projects focusing on the role of different types of agents and agency in sustainability transitions and transformative social innovation. It also aimed at debating the interplay between theories of change, processes of agency and societal transformation outcomes. All projects had as a commonality the fact that they studied a variety of initiatives and networks across Europe and beyond and look at processes of change and the role of these and other agents in bringing it about. They used different scientific theories to tackle these issues and interact with a variety of theories of change that the initiatives themselves held.
	Preparation activities	The agenda was designed in such a way as to achieve interaction between the different projects and respond to the addressed questions. The theme of the workshop and agenda had to be organized in advance, the different suitable projects had to be identified and invited to submit papers and attend and the practical elements of hosting such a meeting had to be arranged.
	Resources	Research staff time at University of A Coruña was employed to organize the meeting. Some monetary resources were employed for the practical organization of the symposium. Researchers from other projects employed their own research time and monetary resources to be able to attend the

		meeting.
	Scientific expertise	Researchers from a diversity of disciplines attended: psychologists, economists, transition studies experts, political scientists, sociologists, geographers, agent-based modellers, ecologists and environmental studies experts.
	Monodisciplinary?	No
	Non-scientists involved?	No
Proc	Non-scientific expertise	N/A
	Intended interaction mode	Exchange
	Problem focus?	Yes
	Problem	The following questions were addressed in the symposium: • What theories of change do initiatives hold and how do they influence their action and experience? • What do different pathways of transition to sustainable societies reveal about mechanisms of large-scale societal change and what is the role of different types of actors in these processes? • How do these theories of change play out in processes of collective agency and empowerment? • What is the meaning of individual and collective agency and their relationship to empowerment in these processes? • If agency is a relational process, what factors need to be in place to promote relationships that lead to empowerment and a feeling of collective agency?
	Methods	Short presentations, together with discussant interventions/critical input and discussion sessions among members of the different projects.
	Brandt method categories	Evaluation and validation (1), Description (5), Learning and exchange (6)
Res	New knowledge	New insights were generated related to different ways of understanding agency, the role of different actors in processes of societal transformation towards sustainability, and the role of theories of change in the ways in which agency is manifested.
	Subjects of interaction	Knowledge
	Immediate results	Insights from the pressure cooker symposium on agency have been reportedly used by researchers of different projects in their conceptualizations of agency. A report of the results of the symposium has been drafted and there are plans for the publication of a special issue on the topic.
	Actual interaction mode	Exchange
Out	Actions	N/A
	Use	The contents of the symposium will be used for the preparation of a report on agency and theories of change in sustainability transitions; and potentially for scientific dissemination – in the form of a special issue.
	Impact	Through dissemination via both scientific media, results might impact approaches to empowerment of actors in societal transformations towards sustainability.

	Spin-off	N/A

3.6. Meetings between researchers and the European Policymakers

The GLAMURS project has included three workshops in Brussels with European stakeholders and policymakers with a view to engaging them in the project's work. Consortium meetings were used to reflect on these, and any implications for how we conduct our research. The appendix in section 7.4 contains a short report on the articulation of the results of the first workshop for the purposes of adjusting our planned work.

Workshops with European policymakers		
In	Timeline	November 2014, November 2015, November 2016
	Location	Brussels
	Ownership	GLAMURS Scientists
	Purpose	To disseminate GLAMURS research findings to key Europe-level stakeholders and policymakers, and to seek feedback enabling us to adapt our research to ensure its policy relevance.
	Preparation activities	Each of the workshops had to be designed to best achieve the appropriate interactions. Agendas had to be prepared, location and timing organized, individuals identified who might attend and invitations sent as widely as possible to relevant stakeholders.
	Resources	Flipcharts, Post-it notes and other standard workshop materials. Money to pay the expenses of guest speakers. Catering. Research staff time was also dedicated to the organization of the workshops, from several GLAMURS teams.
	Scientific expertise	All disciplines in the GLAMURS project were represented at each workshop.
	Monodisciplinary?	No
	Non-scientists involved?	Yes
Proc	Non-scientific expertise	Policymaking, Sustainability
	Intended interaction mode	Coproduction
	Problem focus?	No
	Problem	N/A
	Methods	Workshop exercises; Presentation, discussant and Q&A.
	Brandt method categories	Evaluation and validation (1); Learning and exchange (6)
Res	New knowledge	Policymakers have a requirement for concrete answers with quantification – they need to be able to say to politicians such things as 'If you do X, then Y will improve by Z%'. Providing regional profiles of sustainability transitions was deemed useful for the project, as regions have different cultural, social and economic characteristics as well as strengths and weaknesses. The interaction with policy-makers made researchers achieve a clearer understanding of how to present research results in ways that allow them to be taken into account. It also provided a clearer picture of how policy-makers use research results for the goals they set for.
	Subjects of	Knowledge

	interaction	
	Immediate results	Minutes of the workshops
	Actual interaction mode	Coproduction
Out	Actions	Discussed at consortium meetings.
	Use	The results were used to shape certain aspects of the research process. For each issue, the Consortium decided how to address it, and to what extent it was possible to address, in the project.
	Impact	The TiPaC agent-based model included oversampling of urban over rural residential occupancy as a direct result of discussions at the first workshop.
	Spin-off	The case study exchange (see section 3.7) was probably the most significant spin-off from these workshops.

Discussion points

A significant institutional barrier to be broken is in policymaking culture itself. There are perceptions that scientific evidence is only used when expedient in political debate, and even then there is a preference for 'hard facts' and 'concrete evidence' (typically in the form of numbers). Focusing only on research that delivers this kind of information ignores a significant area of scientific endeavour, and leads to a distorted perception of what science is saying. Related to this is approaching disciplinary experts to obtain evidence to support policymaking. The people regarded highly by the scientific community in a specific field may not necessarily be best placed to give relevant advice where problems cut across disciplines and affect everyday life.

Transdisciplinary research and knowledge co-production cannot be exercises in which policymakers exclude themselves from dialogue. This creates the impression that scientists are being used to report findings to policy-makers who then use results to the extent they find useful (or not). Suspicion of government, particularly as a force preventing sustainable initiatives achieving their objectives, was a discourse we observed in the project; less through activities targeted specifically at preventing the initiatives working, more through activities undertaken by governments aimed at supporting multinational corporations and lifestyles predicated on conspicuous consumption. If transdisciplinary knowledge co-production is to be achieved regarding sustainable living, policymakers will need to play an engaged role, and be as ready to work outside their comfort zones in such contexts as everyone else.

3.7. The case study exchange

The case study exchange was arranged in response to the first Brussels workshop with European stakeholders. The dissemination team (SERI) used some of their budget to pay for as many of the GLAMURS initiatives as were available to gather together with members of the GLAMURS research team, with a view to coproducing knowledge on sustainable living, and enabling the initiatives to learn from and share with each other. The appendix in section 7.2 contains a summary of the meeting.

Case study exchange		
In	Timeline	17-20 June 2015
	Location	West University of Timisoara, Village Museum Timisoara, Stanciova ecovillage
	Ownership	GLAMURS scientists, GLAMURS case study initiatives

	Purpose	To promote mutual learning among case study participants and GLAMURS scientists.
	Preparation activities	Agenda, locations, session design, activities, engaging with participants, organizing travel
	Resources	An expenditure of some €24k?? was required to cover the costs of the workshop (I don't know, you should ask Moritz)
	Scientific expertise	Workshop design, activity design, knowledge coproduction
	Monodisciplinary?	Yes
	Non-scientists involved?	Yes: Civil Society & Citizens; Third Sector
Proc	Non-scientific expertise	Sustainable living
	Intended interaction mode	Coproduction
	Problem focus?	No
	Problem	N/A
	Methods	Workshops; Open space; Graphic recording
	Brandt method categories	Learning and exchange (6)
Res	New knowledge	A great deal was learned, especially about the relationships between scientists and people participating in the initiatives studied by GLAMURS.
	Subjects of interaction	Knowledge
	Immediate results	Report on the case study exchange; Graphic recordings of the workshop sessions
	Actual interaction mode	Coproduction
Out	Actions	Continued facilitation of interaction through social media (Facebook and Twitter).
	Use	An article in IAPS Bulletin (Polhill et al. 2015) described some of the findings on relationships between scientists and the people they study.
	Impact	Social media have been used by the Initiatives to continue the co-learning process (? Data from Moritz) Some participants have gone on to start their own initiatives (e.g. a Repair Café in Cluj-Napoca, Romania)
	Spin-off	Contributions to a policy brief on knowledge coproduction were also derived from the case study exchange.

Discussion Points

Several issues emerged about the relationship between scientists and the initiative participants, which the meeting was instrumental in breaking down. It is somewhat ironic that the more intuitive, emotional and spiritual ways of knowing of initiative participants are often regarded with caution, if not outright contempt by scientists who stereotypically are supposed to have more logical, rational ways of knowing. No scientific argument would be based on visions from sky spirits, or dreams that a theory is wrong. And yet the initiative participants are the ones living more sustainably, while the scientists are typically not doing so. How can we possibly have reached a situation as a society where it is somehow not seen as rational to live more sustainably?

Suspicion of scientists in general is somewhat exacerbated by the fact that they publish in specialist journals that are not accessible to the general public – either in terms of the freedom to do so without financial outlay, or in terms of the language used to write the articles. In terms of helping people live more sustainably, articles in academic journals have at best an indirect effect on our everyday lives, and even then over relatively long time horizons. Suspicion of psychologists in particular derives from their treatment of the people they study as subjects – there is a sense in which sustainable living initiative participants are somehow suffering from an 'interesting' *disorder* in comparison with mainstream society. Indeed, it is their very 'differentness' that not only (in some cases) forms an important part of their identity but also makes them interesting subjects scientifically.

3.8. Meeting other sustainability initiatives

Task 2.5 of Work Package 2 of the GLAMURS project was an attempt to broaden the potential transdisciplinary impact of the project by encouraging case study teams to visit meetings or events organized by sustainable living initiatives in their area *that were not already one of the initiatives being studied by GLAMURS*. This was intended to be a short, reflective exercise offering the case study teams an opportunity to check whether there are any particularities of the case study initiatives that meant GLAMURS might be missing important considerations in determining how we transition to more sustainable lifestyles in Europe. The exercise was undertaken by case study teams in Scotland, The Netherlands, Austria, Italy, Romania and Spain. Case study teams reported back at consortium meetings, and their observations and reflections on implications for GLAMURS research formed the subject of our deliberations. Various implications for GLAMURS were observed:

- The importance of networks in upscaling sustainable initiatives.
- In upscaling initiatives, greater attention has to be paid to the 'business' side.
- The importance of providing people with sustainable alternatives to their everyday choices, and meeting places for initiatives to engage with mainstream communities.

Meeting other initiatives		
In	Timeline	Summer 2014 to Summer 2015
	Location	Aberdeenshire, Timis, Delft, Galicia, Rome, Austria
	Ownership	The initiatives visited
	Purpose	GLAMURS: To look for further opportunities to expand the relevance of GLAMURS research; the initiatives: typically, to promote outreach and awareness of their work, though this depended on the initiative and event.
	Preparation activities	GLAMURS: Finding events to attend over the year.
	Resources	GLAMURS: Travel and subsistence expenses associated with attending the events.
	Scientific expertise	Environmental Psychology
	Monodisciplinary?	Yes
	Non-scientists involved?	Yes
Proc	Non-scientific expertise	Sustainable living, promoting sustainable lifestyles.
	Intended interaction	Exchange

	mode	
	Problem focus?	No
	Problem	N/A
	Methods	GLAMURS: Critical reflection
	Brandt method categories	Learning and exchange (6)
Res	New knowledge	Networks and visibility are important in the successful upscaling of initiatives.
	Subjects of interaction	Knowledge
	Immediate results	One of the initiatives attended in Galicia requested contact with the People-Environment Research Group at UDC to share information on tools to spread pro-environmental attitudes, and ways of reaching more people.
	Actual interaction mode	Exchange
Out	Actions	Discuss reflections on these events at consortium meetings
	Use	The agent-based model that drew on Callon's theory of translation (Callon 1984) was built to explore the role of networks in the successful establishment of initiatives.
	Impact	N/A
	Spin-off	N/A

3.9. Interviews

The GLAMURS project included a number of interviews in each of the case study initiatives. Though a traditional scientific method for acquiring information to be processed by a specialist, interviews are nevertheless an important point of interaction of the GLAMURS project with those interviewed. We include an assessment of the interviews using our framework mainly with a view of comparing this interaction with others having a more specifically coproduction emphasis. Details of the interview findings may be found in Deliverables 5.1 (Report on sustainable lifestyle initiatives in 7 case studies) and 5.3-5.9 (individual case study reports).

Qualitative interviews (T5.1)		
In	Timeline	• Planning started in March 2014, development of research questions and interview guidelines, pretesting of interview guides, refining guidelines, completed by December 2014 • In parallel: case study teams establish contact with study initiatives • Interviews conducted in spring 2015, with some Adobe connect calls within the team to exchange experiences • Exploratory analysis in preparation of/at Trondheim workshop (May 2015) • Collecting ideas for analysis and developing coding framework, including test coding and drafting of guidance (May-July 2015) • Coding and summary writing, discussion at Bath workshop and refining of summaries (August-December 2015)
	Location	Interviews conducted in seven countries, in one or two study initiatives per country
	Ownership	GLAMURS scientists
	Purpose	To empirically address T3.3, T5.1 and T6.6.

		Aims of T5.1: Explore qualitatively the determinants and effects of membership in the initiatives as well as their diffusion potential The aim of this activity is to understand why people start initiatives or are members of those, what the effects are on their lifestyles, and ultimately, on their wellbeing. Together with T5.2, this task intended to gather data on: i) determinants of the adoption of sustainable lifestyles and alternative consumption-production systems; ii) obstacles and prospects for their diffusion to larger societal scales; iii) changes on their lifestyles; iv) impacts on the levels of wellbeing, and v) environmental impacts of membership in initiatives. In this activity, we addressed (i),(iii), (iv), and potentially (v) (but using qualitative data only).
	Preparation activities	See above
	Resources	Input from all seven case study teams
	Scientific expertise	Psychology, Sociology, public administration
	Monodisciplinary?	No
	Non-scientists involved?	Yes
Proc	Non-scientific expertise	Everything that our interview participants told us
	Intended interaction mode	Transfer
	Problem focus?	No
	Problem	Our main research questions were: 1. What motivates people to become a member of an initiative (or found one themselves), and what are the obstacles? 2. What are the changes in lifestyles in the initiatives, and what are the effects of these changes on levels of wellbeing and on environmental behaviour? 3. How do people experience intrapersonal conflicts over sustainable behaviour (i.e. what is it exactly that is conflicting – values, norms, beliefs, emotions, habits etc.)? 4. How do people deal with such intrapersonal conflicts when they emerge (coping strategies)? And what are the implications of intrapersonal conflicts for actual behaviour? 5. In people's views, which governance mechanisms would help them to address intrapersonal conflicts over sustainable behaviour? What are governance mechanisms that people consider useful for themselves, and which ones do they consider as most effective at a societal level? How do initiatives help to address intrapersonal conflicts? 6. What factors influence views on the appropriateness of governance mechanisms?
	Methods	Semi-structured interviews.
	Brandt method	Data collection (4)

	categories	
Res	New knowledge	See Deliverable 5.1. Also, procedural knowledge on how to organise collaborative research across so many teams.
	Subjects of interaction	Information
	Immediate results	N/A
	Actual interaction mode	Transfer
Out	Actions	Lots of work emerging from interviews: transcriptions, exploratory analysis, identification of suitable coding categories, testing and refining the coding framework, coding, summary writing, cross-case analysis
	Use	Write-up (in various formats, including briefing sheets etc), discussion and revision etc.
	Impact	N/A
	Spin-off	N/A

3.10. Backcasting workshops

In the empirical work packages of the GLAMURS project (WP4 & WP5) two series of stakeholder backcasting workshops for sustainable lifestyles and a green economy have been organised. Task 4.3 (T4.3) guides the first series of workshops consisting of participatory backcasting scenarios workshops in all seven regions studies in the GLAMURS project, and Task 5.3 (T5.3) is meant for backcasting pathways and implementation workshops. These two series of workshops are connected in an integrated backcasting methodology that has been developed for application in the GLAMURS project, but has broader relevance for sustainability transitions at the level of regions and cities that want to include consumer lifestyle as well as economic aspects. The aim of the two tasks is to develop backcasting scenarios for sustainable lifestyles and a green economy at the regional level, and to develop backcasting pathways and implementation agendas contributing to bring about future sustainable lifestyles and a green economy for all case study regions. Main results from T4.3 can be found in D4.3 (Quist and Leising 2016a), while main results from T5.3 can be found in Quist and Leising 2016b). Main inputs for developing the methodology can be found in Quist (2013, 2016)

In the DOW, T4.3 has been described as follows. To conduct exploratory backcasting scenario workshops for future sustainable lifestyles for all case study regions in order to achieve sustainability targets at the level of lifestyles. This task will provide the necessary input for the assessments of alternative future scenarios in WP6 for modelling and WP7 for environmental analysis, consisting of combinations of changes in technology, lifestyles and economic structure. While the assessment of long-term trends will be done in part through expert estimations and modelling approaches, the desired lifestyle change in a sustainable direction for different societal groups will be determined and further specified within the backcasting workshops in the regions, which would be supported by data on environmental impact of different lifestyle options obtained in WP7. Activities for T4.3 include:

- Develop backcasting scenario workshop methodology in alignment with T5.3.
- Organise and conduct backcasting workshops in the seven regions under study involving a range of relevant stakeholders for developing normative backcasting scenarios based on sustainability targets at the level of lifestyles and identifying technological, lifestyle, behavioural, and institutional changes required for realizing the scenarios.

- Analyse the results of the backcasting scenarios and feed them into WP6 and WP7, followed by a cross-case comparison of results and process.

T5.3 has been described as follows in the DoW. It comprises conducting backcasting pathways and implementation workshops for future integrated sustainable lifestyles for each case study region. The backcasting pathways and implementation workshops conducted in each of the case study regions will build on the results from the qualitative and the quantitative analyses in WP 4 and 5 and will involve relevant stakeholders in each region. The workshops will focus on how to diffuse, mainstream and integrate sustainable practices and lifestyles through developing transition pathways and implementation agendas and how these can contribute to the backcasting scenarios developed in T4.3. The task consists of:

1. Developing backcasting pathways and implementation workshop methods for the lifestyle niches as a follow up of Task 4.3;
2. Conducting backcasting pathways and implementation workshops in each of the case study regions, and
3. Report and summarise results of the workshops and make a cross-case evaluation.

In this input for D2.1 a knowledge co-production perspectives is taken on the two series of backcasting workshops using the framework described earlier in this document. In D4.3 the following has been mentioned on stakeholder benefits and coproduction aspects of the two series of workshops (Quist and Leising 2015a, p. 22). The two series of workshops are expected to contribute to additional stakeholder benefits and co-production of knowledge in the GLAMURS project through:

- Exchange of experiences and knowledge between initiatives in the case study regions.
- Contributing to region-wide dialogue among relevant stakeholders, in particular stimulating discussion and exchange between bottom-up initiatives, regional authorities and relevant policymakers, as well as other relevant stakeholders in the region.
- contributing to learning among stakeholders and commitment for the outcomes of GLAMURS research at the regional level, including support measures for initiatives in the lifestyle domains studied in a region.
- Contributing to agendas, plans and proposals for diffusing the lifestyle and the topic of the initiative within region, and contributing to creating agency and support for that.
- Exchange of relevant experiences from cases across Europe, e.g. through dissemination at the workshops taking place. This can be done in addition to the stakeholder case study exchange program that is currently being developed within GLAMURS.
- The backcasting workshops should also be seen as instruments for co-production of knowledge, as stakeholders have the opportunity not only to contribute through their knowledge and learn from each other, but also to articulate questions and issues that may need further attention in the case studies or elsewhere in the project.

Backcasting workshops		
In	Timeline	The two series of workshops, totally 15, took place between September 2015 and April 2016.
	Location	In all case study regions in GLAMURS workshops were organised in the following places: Delft (Netherlands), Timisoara (Romania), Aberdeen (Scotland), Halle (Germany), A Coruña (Galicia, Spain), Rome (Italy), Lembach (Austria). In all regions two workshops took place, apart from Aberdeen where one workshop took place, due to using existing visions from an earlier project (MUSIC) as input.
	Ownership	Local GLAMURS case study teams initiated and organised the workshops.
	Purpose	First series of workshops were meant for generating regional visions for sustainable lifestyle visions and a green economy. The second series of workshops aimed at discussing visions, further development of visions and defining pathways towards the visions as well as follow-up activities. More specifically, the goals for the first series of workshops have been formulated as follows: • Generation of future visions for sustainable lifestyles at the regional level and an inventory of issues and potential solutions for the region. • Participation of a wide range of stakeholders to not only inform on the development of visions, but also to realise awareness and learning among stakeholders involved with respect to the future vision and other aspects of transitions to sustainable lifestyles. • Learning and first commitment among participants, as well as exchange of ideas, opinions and extension and broadening of existing networks. • First ideas on goals and targets related to the changes, policies and activities in achieving the visions. Goals for the second series of workshops include: • Assessment and further development of future visions for sustainable lifestyle visions at the regional level and an inventory of issues and potential solutions for the region through backcasting techniques. • Participation of a wide range of stakeholders to not only inform, but build awareness and learning among the stakeholders involved with respect to the future vision, the consequences, the agenda and the views and perspectives of others. • Learning by stakeholders, through defining pathways and a follow-up agenda of activities for various groups of stakeholders in line with the envisioned desirable future. • Specific agendas and proposals for the lifestyle domains under study and diffusion of the associated lifestyles.
	Preparation activities	Each workshop had preparatory activities (for more details see D4.3 and D5.2). For the first series of workshops the following activities were scheduled: 1. Update regional stakeholder analysis 2. Extension regional analysis focusing on sustainable lifestyle and

		consumption aspects 3. Stakeholder mobilisation, for instance through a few stakeholder interviews 4. Test workshop 5. Practical workshop organisation: location & program facilitators script 6. Practical organisation: writing input documents For the second series of workshops the following activities were scheduled: 1. Additional round of Vision specific stakeholder identification, 2. Stakeholder re-engagement 3. Practical workshop organisation and development workshop program 4. Writing input document
	Resources	There were (limited) budgets for location rent, catering, and drinks, but not for hiring external or additional facilitators. There was substantial capacity for doing stakeholder analysis, regional analysis, and system analysis of initiatives with whom collaboration was started (all part of T5.1, see D5.1 Omann et al 2015) and for preparing the workshop and processing workshop results.
	Scientific expertise	In all workshops there was scientific expertise from the local case study teams, complemented with experts on sustainable lifestyles, and sustainability at large.
	Monodisciplinary?	No
	Non-scientists involved?	Yes
Proc	Non-scientific expertise	Each non-scientific participant brought non-scientific expertise in the workshops.
	Intended interaction mode	Coproduction
	Problem focus?	Yes
	Problem	The problem included: (i) what are sustainable lifestyles, what are relevant issues and aspects of sustainable lifestyles, followed by (ii) generating ideas clustered into future alternative visions for sustainable lifestyles in a specific economic context, and (iii) there was in the second series of workshops some work done on implementation through defining long-term pathways and short-term follow-up activities.
	Methods	A range of workshop and facilitation methods has been used in both series of workshops.
	Brandt method categories	Visioning (3), Data collection (4), Description (5), Learning and exchange (6), Visualization and structuring (7)
Res	New knowledge	Yes, 14 visions have been generated depicting future sustainable lifestyles in the context of a green economy and for each vision a transition and implementation pathway was developed. Four clusters of visions emerged are: a cluster of four rural sufficiency visions, a cluster of four urban sufficiency visions, a cluster of four green growth visions, and a "miscellaneous" cluster of two "other" visions.
	Subjects of interaction	Knowledge
	Immediate results	Identified actions for the short-term were included in pathways and

		follow-up agendas
	Actual interaction mode	Coproduction
Out	Actions	Identified actions for the short-term were included in pathways and follow-up agendas
	Use	Results were fed into other research activities in the GLAMURS project, in particular economic modelling, environmental assessment and agent-based modelling. Economic modelling used three main clusters of visions to model macro-economic implications of sustainable lifestyles in both a sufficiency context and a green growth context. The Scottish vision was fed into an agent-based model to assess some of the implications of a decline of the Scottish oil industry. In addition, environmentally benign lifestyle elements were selected from the visions to assess the environmental improvement potential if these would become adopted by all citizens in Europe. Further, visions and pathways were used to define policy relevance and to formulate policy recommendations. For example, the Austrian case study team prepared a 60-page booklet covering the results of the regional case study work, distributed to attendees at the final Donau-Böhmerwald case study meeting on 2 November 2016.
	Impact	In some regions some of the actions were adopted by local stakeholders and implementation has started. For example, in the Austrian case study, a local core team of fifteen people have taken over the initiative with a view to realizing their local vision for 2040 step-by-step. Backcasting workshop results from the Rome case study were presented to the Municipality of Rome North. Links have been established between the Roma Tre team and the Municipality, Roma Resiliente, and the Urban Centre Committee, involving citizens, politicians and institutions in decisions regarding urban transformation and regeneration.
	Spin-off	Broadening the thinking on repairing in the Netherlands by connecting it to sharing, and re-use. The Rome team participated as experts in multidisciplinary workshops organised by the TURaS (Transitioning towards Urban Resilience and Sustainability) FP7 project (grant agreement number 282834). They also participated in workshops of Roma Resiliente (part of the 100 Resilient Cities Programme of the Rockefeller Foundation). In the Donau-Böhmerwald case study, the core team are setting up a follow-up project, applying for funds from the LEADER programme to cover their costs.

3.11. Focus groups

Focus groups		
In	Timeline	The focus groups sessions were carried out between February and May 2015.
	Location	Three focus groups were planned in each case study region of GLAMURS, two with a variety of participants from each region (one urban and one rural) and one with members of the studied sustainability initiatives. Five of the seven regions carried out all focus groups; the exceptions were the regions of Central Germany and the region of Rotterdam-Delft-the Hague

		in the Netherlands: the former only carried the two regional focus groups, as the initiative members did not cooperate in performing this particular activity due to an overload of participation in research projects, including GLAMURS; in the latter case, case study researchers judged the rural focus group not feasible and unnecessary, given that the region is highly urbanized. The focus groups were carried out in the following locations: - Galicia (Spain): Regional urban in A Coruña, Regional rural in Laxe, a small village on the coast of Galicia), and the initiative focus group was again carried in a room at the University of A Coruña; - Banat-Timis (Romania): Regional urban at the West University of Timisoara, Regional rural in the town hall of the small village of Giroc, and the initiative focus group at one of the houses in the ecovillage (being studied); - Donau-Bohmerwald (Austria): regional urban, rural and initiative carried out at locations established by the intermediary organization SPES; - Central Germany: regional urban and rural in a youth centre in the region; - Lazio (Italy): regional urban and rural carried out at the Department of Education of the University of Roma Tre, and the initiative focus group was carried out on the premises of the Coraggio cooperative-the studied initiative; - Rotterdam-Delft-the Hague (the Netherlands): regional urban and initiative focus groups carried out on the campus of Delft University of Technology; and - Scotland (UK): regional urban at Aberdeen city centre, regional rural at Logie Coldstone, and the initiative focus group at Woodhill House – the headquarters of Aberdeenshire Council.
	Ownership	Local GLAMURS case study teams selected the participants and organized the focus groups, based on detailed guidelines from the task lead (UDC), to ensure comparability (see Del.4.1).
	Purpose	In GLAMURS, the focus group method was chosen as a suitable approach for collecting qualitative data from diverse stakeholders in each case study region regarding the conceptualization of lifestyles as patterns of time-use and associated consumption, on the drivers and barriers that affect people's sustainable lifestyle choices, and finally people's motivations for joining sustainability initiatives and the impacts on their lifestyles of said engagement. The purpose in these focus groups is to explore these relationships by tapping into the everyday experience of a group of people, thus providing the basis for further exploration by means of surveys at both regional and case study levels. These dimensions were explored at regional levels (in both rural and urban residential environments) and in particular sustainable lifestyle initiatives. The following objectives were established for the focus groups: ✓ To explore people´s attitudes and feelings about their lifestyle in terms of satisfaction and obstacles for change

		✓ To explore the drivers of time pressure and the relationships between time pressure and activities that are relevant in terms of environmental impact – the six domains of GLAMURS ✓ Exploring the relationship between time pressure and consumption The results of the qualitative exploration done through the focus groups were then used to develop the focus and items for the regional survey.
	Preparation activities	Focus groups had several preparation activities which are described more in detail in Del 4.2. For details of each region and case study initiative focus group preparation, information is also available in the Case study reports (Del5.3 to 5.9). Main preparation activities were: 1) Prepare extended guidelines for the organization of the focus groups, including details on size of the focus groups, identification, selection and contacting of adequate participants, procedure for the development of the activity and questions guide 2) Prepare time-use survey diaries for focus groups participants (See Del 4.1) 3) Carry out focus group pilots/simulations in several regions to test the guidelines and the focus group questions guide and refine final list of questions 4) Identify socio-demographic categories for the selection of participants in the regional focus groups 5) Select and contact potential focus group participants; 6) Organize the practical details of carrying out the focus groups: location, facilitation, programme 7) Organizing a training session for researchers involved in the focus group analysis, in order to learn how to use Atlas.ti (a computer-assisted qualitative analysis software) in the analysis of results. 8) Developing the analysis framework for the various case studies with participation of researchers from each team, in an iterative process 9) Analyzing and writing-up results.
	Resources	Research staff in each region for the selection and recruitment of participants; facilitation was provided by researchers in the project; standard focus group consumables (e.g. paper, time-use surveys, recording devices etc). Research staff for the analysis of results. Money for the organization of a training session in Atlas.ti (a computer-assisted analysis software) to analyze the data, organized at the University of A Coruña).
	Scientific expertise	Each team in charge of the case study region either had previous expertise in organizing focus groups and analyzing results or they developed capacity within the project in various training sessions (beyond the one mentioned above, there were training sessions at Consortium meetings)
	Monodisciplinary?	No
	Non-scientists involved?	Yes

Proc	Non-scientific expertise	Sustainability initiative members have expertise in starting and/or maintaining and developing an initiative; all focus group participants brought knowledge of their lifestyles and attempts to live a sustainable lifestyle (where the case)
	Intended interaction mode	Coproduction
	Problem focus?	Yes
	Problem	What kinds of changes in time-use would be necessary in order to achieve transition to sustainable lifestyles? How do people perceive the relationship between sustainable behaviours and time? Are sustainable behaviours perceived to take longer time? Is time scarcity perceived as an obstacle to sustainable lifestyle choices? What other obstacles people face in living sustainably? How do perceptions of wellbeing relate to (un)sustainable lifestyle choices? What is the role of social norms, social status and social identity in (un)sustainable lifestyle choices? How does time pressure relate to material consumption? Do people consume more or less under time pressure? Do they consume differently? What is the role of time pressure in the experience of hindrances to live more sustainably?
	Methods	Guided discussion
	Brandt method categories	Evaluation and validation (1), Data collection (4), Description (5), Learning and exchange (6)
Res	New knowledge	In-depth knowledge was obtained on the following analysis categories: • Lifestyle satisfaction; • Desired lifestyle changes; • Drivers of sustainable lifestyle choices; • Barriers to sustainable lifestyle choices; • Beliefs of and experiences of time; • Time-use and wellbeing; • Motivations for joining a sustainability initiative; • Impacts of joining a sustainability initiative.
	Subjects of interaction	Knowledge
	Immediate results	Beyond the knowledge exchanged on personal lifestyles and desires for lifestyle change, there was new knowledge created on the barriers and drivers for sustainable lifestyle choices, desired lifestyle change and the relationship between time-use and satisfaction. Also, participants reported to have had several moments in which group discussion and reflection led to new insights about structuring their own time-use and lifestyle choices (e.g.: participants were surprised when realizing that most or all of the lifestyle changes they mentioned did not entail earning more income and did not cost money).
	Actual interaction	Coproduction

	mode	
Out	Actions	N/A
	Use	The results were used in several ways: - To gather new knowledge within GLAMURS on the relationships and trade-offs between time-use, enhancing sustainability of lifestyle choices and wellbeing. - To feed results into other research activities such as the creation of the regional survey
	Impact	We have some indication that self-reflection in the focus groups has led to personal lifestyle changes. Through dissemination via both scientific and popular media, results might impact approaches to interventions to change lifestyles in a sustainable direction.
	Spin-off	N/A

3.12. Questionnaire surveys

Regional survey		
In	Timeline	The survey was conducted between the months of December 2015 and January 2016.
	Location	An online regional survey was carried out in each of the seven case study regions.
	Ownership	The survey was designed by the research team at the University of A Coruña, with extensive collaboration of the NTNU team for the behavioural questions, and with input from researchers at Roma 3, OVGU, Hutton, TUDelft and UVT. Local GLAMURS case study teams have identified and contacted intermediary organizations which distributed the survey link and thus contributed to the recruitment of survey respondents. They were also responsible for the translation of the survey to local languages, sending out reminders to potential participants and making sure data was collected. Ownership of each national dataset belongs to the corresponding case study team.
	Purpose	The survey aimed to explore the psychological factors influencing environmentally-relevant lifestyle choices (both sustainable and unsustainable) in the six domains of interest for GLAMURS, and their relationship to wellbeing. A host of potential factors were measured with the survey (e.g. time affluence, aspirations, identity, social norms etc.), and data on lifestyle choices in the six domains was gathered, together with data on wellbeing. The purpose was also to gather detailed individual data that could be used for more detailed and mixed-data calculations of the environmental footprints of households in different European regions.
	Preparation activities	The survey had several preparation activities which are described more in detail in Del 4.2. For details of each region and case study initiative focus group preparation, information is also available in the Case study reports (Del5.3 to 5.9). Main preparation activities were: 1) Choose the psychological dimensions to include in the survey. 2) Develop a first version of the survey items in consultation with

		members of several research teams (see above – ownership section). 3) Carry out two pilot studies of the survey – in Spain and Germany. 4) Analyze pilot study results and refine final version of the survey items 5) Translate surveys in all regional languages; solve translation problems and adaptation of items to regional contexts. 6) Build online versions of the survey in all regional languages. 7) Contact intermediary organizations for support in the distribution of survey (with the exception of the German region where data gathering was subcontracted to a specialized company). 8) Data gathering 9) Database preparation and data analysis 10) Writing-up results.
	Resources	Some research staff time was available in each region for tasks related to the survey. Monetary resources were used for the online versions of the survey and the gathering of the data in the German case (only). Intermediary organizations voluntarily helped with the distribution of the survey.
	Scientific expertise	Scientific expertise on survey design, sampling, data gathering and analysis was available in the GLAMURS consortium. Mostly psychologists and industrial ecologists were involved in the survey design.
	Monodisciplinary?	No
	Non-scientists involved?	Yes
Proc	Non-scientific expertise	N/A
	Intended interaction mode	Transfer
	Problem focus?	Yes
	Problem	What are the factors that influence actual sustainable lifestyle choices in the six GLAMURS domains? What are the factors that influence the desire to change lifestyles (with specific interest on changes in a sustainable direction)? What is the relationship between sustainable lifestyle choices and wellbeing? How does time affluence/scarcity influence sustainable lifestyle choices and wellbeing? How do attitudes towards sustainability initiatives and the use of their services influence lifestyle choices?
	Methods	Online survey
	Brandt method categories	Evaluation and validation (1); Data collection (2)
Res	New knowledge	Yes, new knowledge was generated on determinants of sustainable lifestyle choices in each region; predominance of willingness/desire to change certain aspects of lifestyles; the relationship between time affluence/scarcity, sustainable lifestyle choices and wellbeing; relationship between sustainable lifestyle choices and wellbeing; the influence of attitudes towards and the use of initiatives 'services on sustainable lifestyle choices; the environmental footprint and potential for behavioural change in each region and for each GLAMURS domain.

	Subjects of interaction	Information
	Immediate results	Information was gathered on individual psychological dimensions and lifestyle choices, which was used to answer the project questions mentioned in the "problem" section.
	Actual interaction mode	Transfer
Out	Actions	N/A
	Use	The results were used in several ways: - To gather new knowledge within GLAMURS on the psychological determinants of actual lifestyle choices and desired changes. - To feed results into other research activities such as the calculation of the environmental footprint in each region.
	Impact	Through dissemination via both scientific and popular media, results might impact approaches to interventions to change lifestyles in a sustainable direction.
	Spin-off	N/A

3.13. Scottish Questionnaire Survey

Questionnaire surveys (Scotland)		
In	Timeline	2015-2016. For the Scottish case, first the regional survey was distributed to a sample of 10,000 people in the region, and almost 1,000 responses were received. Secondly, the case study organisation (Aberdeenshire) council asked their staff to fill in the same questionnaire, so that comparisons could be made between the regional sample and the case study
	Location	All case study regions and case studies used questionnaires. This form will mostly talk about the Scottish case.
	Ownership	GLAMURS scientists, and in the case of the Scottish case study, one question was added to our questionnaire by Aberdeenshire Council, and the data will be provided to them directly.
	Purpose	The purpose of the survey was to gather data from a sample of people in the region (and the cases study) on a number of different measures. The overall purpose is to understand the relationships between the measured constructs – including time-pressure, autonomy, well-being, etc.. A further purpose was to provide data to feed into the agent-based models (TiPaC and DIReC).
	Preparation activities	The questionnaire was prepared to explore some of the key relationships outlined in the earlier position papers prepared as part of WP3. The questionnaire itself was designed to be user-friendly, and possible to fill in either on paper on online. The sample for the regional survey (in Scotland) was designed in consultation with the statistician working on the GLAMURS project. As the Scottish questionnaire was deigned to be machine readable, a considerable amount of work went into designing the workflow to get things operating smoothly.
	Resources	The mailout of the Scottish regional questionnaire was a large undertaking, and required a lot of informal support (i.e. goodwill from fellow scientists) to get all of the 10,000 questionnaires posted.
	Scientific expertise	Psychology, Economics, Agent-Based Modelling

	Monodisciplinary?	No
	Non-scientists involved?	Yes
Proc	Non-scientific expertise	Local government
	Intended interaction mode	Transfer
	Problem focus?	No
	Problem	N/A
	Methods	Questionnaire surveys, project meetings (where the design of the questionnaire and discussion over which constructs to include/exclude) occurred.
	Brandt method categories	Data collection (4), Learning and exchange (6)
Res	New knowledge	In terms of the interaction between the Scottish case study researchers and the case study, the new knowledge created was related to the barriers to uptake of flexible working in the organisation (Aberdeenshire Council). In terms of the agent-based model, the data from the questionnaire on housing preferences was used to help generate parameters for the model
	Subjects of interaction	Information
	Immediate results	Discussions with council about the results; data feeding into the agent-based models
	Actual interaction mode	Exchange
Out	Actions	Discussion between modellers and cases study researchers scheduled for continuing dialogue about use of the data in the models. Meeting with Aberdeenshire council to be organized in the first quarter of 2017.
	Use	This is clear from the answer given to 'actions' (i.e. to inform the model and also to provide feedback to the council
	Impact	N/A
	Spin-off	N/A

3.14. IAPS Symposium

IAPS Symposium in Lund, Sweden		
In	Timeline	30 June 2016
	Location	24th IAPS Conference, Lund University, Sweden
	Ownership	GLAMURS scientists
	Purpose	Scientific dissemination
	Preparation activities	Registering the symposium and presentations; Preparing and circulating presentations
	Resources	Travel, accommodation and conference attendance budget
	Scientific expertise	Psychology (Behavioural, Environmental, Social etc.)

	Monodisciplinary?	Yes
	Non-scientists involved?	No
Proc	Non-scientific expertise	N/A
	Intended interaction mode	Transfer
	Problem focus?	Yes
	Problem	Psychological factors influencing (un)sustainable lifestyle choices
	Methods	Qualitative interviews, Focus groups, Theoretical model design
	Brandt method categories	Visioning & design (3), Data collection (4), Description (5)
Res	New knowledge	Psychological for possible predictors of sustainable behaviour, Time-use factors that impact on sustainable choices, Particularities of researched factors in European sustainable initiatives
	Subjects of interaction	Information
	Immediate results	Presentation abstracts included in post-conference book; Good feedback on symposium; High level of interest from audience in project results and directions for future research on sustainability from a time-use perspective; Networking between researchers in the community
	Actual interaction mode	Transfer
Out	Actions	N/A
	Use	N/A
	Impact	N/A
	Spin-off	N/A

3.15. Published article 1

NTNU: Scientific Article - Ivanova et al (2015) - Environmental Impact Assessment of Household Consumption		
In	Timeline	Published: 18 December 2015
	Location	N/A
	Ownership	GLAMURS scientists
	Purpose	Analysis and Dissemination of environmental footprints of households
	Preparation activities	EE MRIO compilation and analysis
	Resources	Several person months directly on the paper (up to one year), with considerable number of extra person months on refining data, setting up data frames and methods for the analysis. The base database (EXIOBASE 2) is the outcome of several 3 years' FP7 projects.
	Scientific expertise	Industrial Ecology (MRIO modelling)
	Monodisciplinary?	Yes
	Non-scientists involved?	N/A

Proc	Non-scientific expertise	N/A
	Intended interaction mode	Coproduction
	Problem focus?	Yes
	Problem	What are the environmental footprints of households? What consumption categories contribute most to the footprints of households?
	Methods	EE MRIO analysis
	Brandt method categories	Evaluation and validation (1), Modelling (2), Data Collection (4), Description (5), Visualization and Structuring (7)
Res	New knowledge	Information about the role of household in determining country level footprints.
	Subjects of interaction	Information
	Immediate results	Information for scientists and policy-makers
	Actual interaction mode	Transfer
Out	Actions	N/A
	Use	Information for scientists and policy-makers
	Impact	(by December 2016): 3 citations, 268 reads at ResearchGate
	Spin-off	Over 20 public media articles based on the results (BBC, sciencedaily, gemini, …)

3.16. Published article 2

NTNU: Scientific Method and Article – Operational tool for analyzing emission mitigation options using MRIO analysis		
In	Timeline	Ongoing, started March 2015
	Location	N/A
	Ownership	GLAMURS and other scientists
	Purpose	Develop a tool to used modified environmental footprinting to study the effectiveness of consumer actions/policies at a macroeconomic level
	Preparation activities	Coding and Design
	Resources	Several person months on developing the method as well as on a paper draft describing the method (up to more than one year), with considerable number of extra person months on refining data, setting up data frames and methods for the analysis. The development of the method was a knowledge coproduction process across the EU FP7 project GLAMURS and EU FP7 project Carbon-CAP. The base database (EXIOBASE 3) is the outcome of several 3-year FP7 projects.
	Scientific expertise	MRIO modelling, climate policy, industrial ecology
	Monodisciplinary?	No
	Non-scientists involved?	No
Proc	Non-scientific expertise	N/A

	Intended interaction mode	Coproduction
	Problem focus?	Yes
	Problem	How can we use macro-economic EE MRIO analysis to assess lifestyle and policy emission mitigation options including rebound-effects.
	Methods	Novel EE MRIO analysis
	Brandt method categories	Evaluation and validation (1), Modelling (2), Data Collection (4), Description (5), Visualization and Structuring (7)
Res	New knowledge	Assessment of mitigation options. What effects have mitigation policies or specific lifestyle changes (e.g. change in diets, increased used phases for clothing items) on the EU and global footprints.
	Subjects of interaction	Information
	Immediate results	Information for citizens and policy-makers
	Actual interaction mode	Transfer
Out	Actions	N/A
	Use	Information for citizens and policy-makers
	Impact	Paper describing the method is still under review. The method was used for several analyses within GLAMURS deliverables (D7.2, D7.3).
	Spin-off	Paper based on the results and their interpretations currently under review (Wood et al. ES&T).

3.17. NTNU Environmental Footprints Webpage

NTNU: Webpage - www.environmentalfootprints.com/regional		
In	Timeline	Webpage launched November 2015
	Location	N/A
	Ownership	GLAMURS scientists
	Purpose	Dissemination of regionalized EU footprints
	Preparation activities	Coding and Design
	Resources	2 person months (programmer)
	Scientific expertise	Industrial Ecology (MRIO modelling)
	Monodisciplinary?	Yes
	Non-scientists involved?	Yes
Proc	Non-scientific expertise	Programming
	Intended interaction mode	Transfer
	Problem focus?	Yes
	Problem	Land/Water/Carbon/Material footprint for EU regions in NUTS 2 classification
	Methods	MRIO-CES coupling at a regional (NUTS2) scale
	Brandt method categories	Evaluation and validation (1), Modelling (2), Vision and Design (3), Data Collection (4), Description (5), Visualization and structuring (7)
Res	New knowledge	Information about footprints at regional level. Knowledge about how to design an interactive webpage for scientific dissemination.
	Subjects of	Information

	interaction	
	Immediate results	Information for citizens and policy-makers
	Actual interaction mode	Transfer
Out	Actions	N/A
	Use	Information for citizens and policy-makers
	Impact	Over 4000 page views by over 800 users (by December 2016)
	Spin-off	Paper based on the results and their interpretations currently under review.

4. Results

A summary of the activities, with respect to their disciplinarity, mode of interaction, subjects of interaction, methods and outcomes appears in Table 2. There are eight possible combinations of (a) whether the scientists involved in an activity came from just one discipline; (b) whether the activity involved non-scientists; (c) whether the activity was focused around a problem. Of these eight, seven possible combinations are observed in the table – the only combination not being observed is monodisciplinary, no involvement of non-scientists, and no problem focus. The question of whether an activity as a problem focus is debatable – in some cases in the table, it is questionable whether the assertion that the activity was focused around a problem that needs solving (in the sense it is used in the transdisciplinary literature), rather than articulated around some research questions. The possibility of the missing eighth combination of these three disciplinarity attributes being a situation that might reasonably occur should not be ignored. Indeed, it might arguably have occurred in the activities recorded.

The distinction between multi- and inter-disciplinary work was argued earlier around the mode of interaction – coproduction being the mode associated with interdisciplinary work. The question of whether or not the mode of interaction was coproduction means there are sixteen possible combinations. Coproduction was regarded as the actual mode of interaction in eight cases, across which there are instances of mono- and non-mono- disciplinary work, involvement of non-scientists and no such involvement, and a problem focus for the activity and no such focus.

Only four activities were listed as being monodisciplinary. Even for these, there is potential for debate in the sense that some subject areas have an interdisciplinary identity (e.g. industrial ecology). The association of one or multiple disciplines with outcomes is therefore not one that can be meaningfully discussed in the context of GLAMURS. Four activities involved non-scientists and were knowledge coproduction, but only two of these were problem-focused (the backcasting workshops 3.10 and focus groups 3.11); under the strictest sense of transdisciplinary knowledge coproduction, these were the two qualifying activities GLAMURS undertook. If a problem-focus is not seen as essential to transdisciplinary knowledge coproduction, then the meetings in Brussels 3.6 and the case study exchange 3.7 also qualify.

As might be expected in a situation such as this, no data were exchanged – all subjects of interaction are either knowledge or information. Since no-one completing the framework was willing to suggest that no new knowledge was generated by the activity (indeed, it is hard to conceive of a research activity not generating new knowledge), arguably the classification of Schreiber et al. (2000) would suggest that knowledge was always the subject of interaction in the GLAMURS activities listed here. In this context, it is the question of whether the subjects of interaction led to action that might be more relevant. Actions were identified in ten of the activities, and information was less often associated with an action than not (twice as opposed to five times), whilst knowledge was more often associated with an action than not (seven times as opposed to twice).

As Table 3 also shows, actions were strongly associated with a coproduction interaction mode; of seven activities where coproduction was listed as the actual mode of interaction, six led to actions. The one that didn't (the focus groups, 3.11) would still be reasonably described as coproduction, is not really designed as a forum in which actions are identified as a consequence of the interaction, and did have other outcomes. The occurrence of actions for exchange and transfer based interactions is more patchy, with

three of ten such activities having actions recorded. Interestingly, all cases of coproduction are associated with knowledge as the subjects of interaction.

Table 2. Summary of the activities. The Subjects column records K if knowledge was the subject of interaction, I for information. The modes of interaction are T for transfer, E for exchange and C for coproduction. In the Outcomes columns, F means that the outcome is expected in the future, P that it has the potential to happen in the future.

Activity	Time	Disciplinarity			Mode		Methods	Knowledge vs. Information		Outcomes			
		Mono?	Non-Sci?	Problem?	Intended Mode	Actual Mode		Subjects	New Knowl.?	Actions?	Use?	Impact?	Spin-off?
3.1	07/14, 03/15	N	N	Y	C	C	6	K	Y	Y	N	N	N
3.2	01/14-12/16	N	N	Y	C	C	5, 6	K	Y	Y	N	N	N
3.3	02-04/16	N	N	Y	C	C	4, 6	K	Y	Y	Y	Y	Y
3.4	01/14-12/16	Y	N	N	C	C	2, 4, 5, 6, 7	K	Y	Y	Y	Y	P
3.5	09/15	N	N	Y	E	E	1, 5, 6	K	Y	N	F	P	N
3.6	11/14, 11/15, 11/16	N	Y	N	C	C	1, 6	K	Y	Y	Y	Y	Y
3.7	06/15	N	Y	N	C	C	6	K	Y	Y	Y	Y	Y
3.8	06/14-09/15	Y	Y	N	E	E	6	K	Y	Y	Y	N	N
3.9	03-06/15	N	Y	N	T	T	4	I	Y	Y	Y	N	N
3.10	09/15-04/16	N	Y	Y	C	C	3, 4, 5, 6, 7	K	Y	Y	Y	Y	Y
3.11	02-05/15	N	Y	Y	C	C	1, 4, 5, 6	K	Y	N	Y	P	N
3.12	12/15-01/16	N	Y	Y	T	T	1, 2	I	Y	N	Y	P	N
3.13	11/15-01/16	N	Y	N	T	E	4, 6	I	Y	Y	Y	N	N
3.14	06/16	Y	N	Y	T	T	3, 4, 5	I	Y	N	N	N	N
3.15	12/15	Y	N	Y	C	T	1, 2, 4, 5, 7	I	Y	N	Y	Y	Y
3.16	03/15-	N	N	Y	C	T	1, 2, 4, 5, 7	I	Y	N	Y	P	P
3.17	11/15-	Y	Y	Y	T	T	1, 2, 3, 4, 5, 7	I	Y	N	Y	Y	P

Table 3. Association of activity feature with outcome; Bold cases suggest where there would be significance to the numbers were we to use the binomial test.

Activity feature		Action = Y	Use = Y	Impact = Y	Spin-off = Y	**N. cases**	**N. sig**
Non-scientists involved	Yes	6	**9**	4	3	9	8
	No	4	4	3	2	8	7
Problem focus	Yes	4	7	4	3	11	9
	No	**6**	**6**	3	2	6	6
Coproduction (actual)	Yes	**7**	6	5	4	8	7
	No	3	7	2	1	9	8
Knowledge	Yes	**8**	7	5	4	10	8
	No	2	6	2	1	7	7
Number of cases		10	13	7	5		
N. for significance		8	10	7	5		

Pretty much all the activities involved some sort of use, not least within the project itself. Strikingly, all cases where non-scientists were involved entailed the results of the activity being used, whilst roughly half the cases where non-scientists were not involved had results that were used. Rather strangely, all cases where there was no problem focus also resulted in use. The strongest association of meeting attribute with use is the involvement of non-scientists, with nine of thirteen cases involved. Were we interested in p-values, this is not quite enough to be significant at the 0.05 level were we to assume that the probability of the row determining the column is 0.5 as a null hypothesis. Indeed, no results are significant under this criterion.

Only two activities recorded no use. Though the meetings between psychologists and economists (3.1) are recorded as not having any 'use' as such, this again is more a function of the purpose of the meetings in that they did not lead to 'results' (e.g. in the sense of data) that were to be used as such; rather they led to actions for the participants, and changes in thinking and theorization. The other activity with no use recorded is the IAPS symposium (3.14), which is also the only activity to have recorded no outcomes at all; however, such activities are not necessarily held with outcomes (other than the stimulated interest of fellow academics) in mind.

Table 4. Brandt method category against activity feature or outcome. Category 3 is missing because only three activities used it. Highlighted cells have a high enough value to be potentially significant were we to use the binomial test.

Feature or outcome	Brandt method category						N	S
	1	2	4	5	6	7		
Non-scientist	4	2	5	3	6	2	9	8
Problem focus	6	4	7	**8**	5	4	11	9
Coproduction	2	1	4	4	**8**	2	8	7
Knowledge	3	1	4	5	**10**	2	10	8
Actions	1	1	5	3	**9**	2	10	8
Use	6	**5**	**9**	6	8	5	13	10
Impact	3	3	5	4	5	4	7	7
Spin-off	2	1	3	2	4	2	5	5
Number of cases	7	5	10	9	11	5		
Significant number	7	5	8	8	9	5		

As Table 4 shows, learning and exchange (6) is the Brandt method category most likely to be associated with knowledge as the subject of interaction, and with action and the involvement of non-scientists. As might be expected, data collection (4) is strongly associated with use; it would be strange to collect data and then not to use it.

5. Discussion

Our summary table (Table 2) has shown that more combinations of the attributes that constitute the classification of the disciplinarity of a piece of work are possible than traditionally indicated by the monodisciplinary, multidisciplinary, interdisciplinary, transdisciplinary progression suggested by Tress et al.'s (2005) characterization of research modes. Our vocabulary for describing the possible concatenation of circumstances in which scientists and non-scientists are involved in collaborative activities is somewhat inadequate. There is no reason to suppose, for example, that the involvement of non-scientists in research is predicated only on the basis that there is a problem to solve that the non-scientists have a 'stake' in the outcome of. Various citizen science projects, for example, use non-scientists to perform computational tasks to analyse data that cannot currently be automated. The motivation of the case study participants to be involved in GLAMURS was not driven by the idea that they would benefit from it. Speaking to some of them at the Brussels final conference meeting, many simply thought they were helping scientists with their research. In research where stakeholders are involved in the hope that they will benefit from the outcomes of the project, coproduction and a problem focus are clearly essential, but there is no reason to suppose that the problem in question requires multiple scientific disciplines to solve it. That multiple disciplines are needed in sustainability research is a different matter.

Table 5. A more complete picture of research modes than suggested by the monodisciplinary, multidisciplinary, interdisciplinary, transdisciplinary progression.

Mono-disciplinary	Non-scientists	Problem-focus	Co-production	Possible designation or research style
T	F	F	F	'Heroic' monodisciplinary curiosity-driven research ('gentleman' scientist)
T	F	F	T	Monodisciplinary curiosity-driven research in peer-to-peer teams
T	F	T	F	'Heroic' monodisciplinary applied research
T	F	T	T	Monodisciplinary applied research in peer-to-peer teams
T	T	F	F	Monodisciplinary curiosity-driven social science
T	T	F	T	Monodisciplinary citizen science
T	T	T	F	Monodisciplinary applied research (consultancy)
T	T	T	T	Monodisciplinary participatory research
F	F	F	F	Multidisciplinary curiosity-driven research
F	F	F	T	Interdisciplinary curiosity-driven research
F	F	T	F	Multidisciplinary applied research
F	F	T	T	Interdisciplinary applied research
F	T	F	F	Multidisciplinary citizen science
F	T	F	T	Interdisciplinary citizen science
F	T	T	F	Multidisciplinary applied research (consultancy)
F	T	T	T	Transdisciplinary research

Table 3 shows that there is a need for the extended vocabulary. There is only one potentially significant result if outcome is the focus – knowledge as the subject of interaction is significantly associated with action as the outcome – but this is really only a feature of the definition of knowledge (from Schreiber et al. 2000) we have used. It is more surprising that there are any cases where knowledge has not led to action. With regard to the outcomes you are likely to get for exercises with a particular feature, it is interesting to see action and use associated with all cases in which there was *not* a problem-focus to the exercise. This is an extremely interesting result if it is indicative of a general rule, as it would imply that designing research funding calls around policy problems may not be effective in generating action or use of the research – an observation that is certainly contrary to generally-accepted wisdom and prevailing trends in funding science. Use is a notable outcome when non-scientists are involved, but this need not be in a transdisciplinary context. Action is also significant for activities featuring coproduction as the mode of interaction. As noted, the numbers are not high enough for us to be able to assess the difference being monodisciplinary makes from the exercises undertaken by this project. Even so, Table 3 suggests that of the research modes in Table 5, mono- and inter-disciplinary citizen science should be best placed to lead to action and/or use. We do not have significant results for spin-off or impact, but in the latter case, this may in part be due to difficulties in measuring and attributing impact to the research specifically, and because a longer time period after the end of the project may be needed to assess this insofar as it is measurable and attributable. Hence, for impact and spin-off, there is still scope for features of transdisciplinary research to be shown to be more likely to lead to the kind of outcome that is needed from research in the sustainability domain.

There are various stories of impact derived from the interaction of the project with the case study initiatives. Some have been related to the case study exchange itself, such as the example in the framework table in section 3.7 of members of one of the Romanian ecovillages starting a Repair Café in Cluj-Napoca as a direct result of having met with the Dutch Repair Café case study participants at the case study exchange meeting. This simply would not have happened were it not for the GLAMURS project, but also of course ultimately relied on the energy, enthusiasm and entrepreneurial spirit of the case study participants that have made them such inspiring people to study.

However, the project has provided more general opportunities for mutual learning and impact. In Galicia, for example, the involvement in the backcasting workshops of a participant from a different Galician university (not Universidade da Coruña) has led to him repeatedly inviting people from one of the initiatives he met there to his own activities. In another Galician example, the leader of Zocamiñoca food cooperative has approach the UDC research team to collaborate on launching a social platform pressing governments to start work on transitioning to more sustainable lifestyles. They are now in the process of planning a public start-up meeting of this platform to which regional stakeholders and sustainability initiatives would be invited, that will involve a presentation of GLAMURS research work.

Galicia is not the only case study where there are longer-term implications of the interactions between researchers and case study initiatives. In Aberdeen, we are organizing a workshop with leading council officials to discuss the results of the project (especially the survey and agent-based modelling work) and to identify further opportunities for the councils to contribute to more sustainable lifestyles in north-east Scotland.

Returning briefly to the case study exchange, the discussion between researchers and case study participants at that meeting covered the 'publish or perish' pressure on academics. Good though the above stories of impact from GLAMURS are, there remain obstacles to advancing knowledge co-

production on living more sustainably that suggest even more could have been made of the opportunity provided by GLAMURS. Transitioning to sustainable lifestyles is widely recognized as being an inherently inter- and transdisciplinary problem, but for individual academics, it is recognized that established disciplines are easier to work in if you want to advance your career. This is for several reasons:

- methods have been refined over decades and even centuries of endeavour and are trusted by a peer-review community;
- if the agenda of transdisciplinary research is not controlled by scientists, there is the risk that the results will not be publishable, either because they do not constitute an advance in scientific knowledge, or because they have not rigorously followed scientific methods;
- there is a potentially larger audience for your research; and
- it is easier to publish in high-ranking journals.

In various subjects, and in certain countries, there is a specific set of journals that is recognized by the community involved in assessing performance. Publications in other journals simply do not 'count'. Significant institutional changes are going to be needed in academic institutions across Europe if science is going to contribute successfully to the most pressing problem of the contemporary age. Scientists wanting to work in sustainability need to be encouraged to work at the creative boundaries between disciplines, to work in teams rather than as lone 'heroes', and to break down the walls of the ivory tower. There need to be recognition and rewards for taking these risks, both in terms of job security and in terms of academic prestige.

Transdisciplinary research projects are also, to an extent, hamstrung by traditional methods of research contracting, in which a planned series of research activities is undertaken resulting in a number of specific deliverables. This allows little of the flexibility needed to allow non-academic project participants to influence research methods and directions. Transdisciplinary knowledge co-production ideally involves iterative discussion and co-learning across disciplinary boundaries and through the walls of the ivory tower. This kind of work does not fit neatly into traditional project planning and funding paradigms because the results and outcomes are difficult to define in advance.

GLAMURS has done much to engage with its case study participants and enrich their experience and knowledge through various activities, even though many of the case study participants were working with the researchers as a favour, to help with the science rather than realize any benefits for themselves. There was, however, one further plea from the case study initiative participants in the final meeting in Brussels. They are looking to work with scientists that have emotional intelligence and authenticity, and there is a demand for science that reflects that. The most radical interpretation of that is a fundamental change in the relationship between scientists and citizens. Science has told us, in intimate detail, all the various ways in which our way of life is impacting on the ecosphere; though it can comment on proposed solutions, quantifying their expected impact, the conception and implementation of the solutions will be down to individuals, scientists and citizens – human beings, making choices. Many scientists researching the impact our society is having on the planet do not take steps in their personal lives to reduce it; this is the issue with authenticity – if we, who know so much, aren't doing anything, why should anyone else? In the arena of developing ways of living more sustainably and transitioning to greener economies, a model of scientists as god-like objective observers and oracles, whose wisdom is not for ordinary mortals to question, will not work.

6. Conclusion

There is now a reasonably well-established literature on experiences with transdisciplinary research projects and knowledge co-production. However, as yet there have been few attempts to draw methods together and develop a 'community of practice'. To some extent, transdisciplinary research is something we still need to learn how to do. It is not always clear whether a project really has been successfully 'transdisciplinary' per se. There are no generally accepted rules for how to go about transdisciplinary research in such a way that people will recognize it as being so. As such, 'transdisciplinarity' risks being something people merely say they are doing, rather than taking seriously.

Frameworks, such as those by Brandt et al. (2013), on which we have drawn, go some way to addressing these concerns. Showing the benefits of transdisciplinary knowledge coproduction, however, requires these frameworks to be applied in other contexts, so that the contrasts in outcomes can be evaluated. This report has proposed an extension of the framework of Brandt et al. (2013) by drawing on other areas of the literature, and applied it to a number of exercises in the GLAMURS project. The results have highlighted how inadequate our vocabulary is for describing various modes of scientific research; and the framework itself has revealed the full multidimensionality of these modes, which we have been able to label and characterize in the discussion above.

Our results have not conclusively shown that all of the attributes of transdisciplinary knowledge coproduction necessarily lead to the kinds of outcome used to argue for it. In particular, there is evidence to suggest that a problem focus to the research is not necessarily helpful, at least in terms of action and use. We do not have enough data to assess whether multiple or single scientific disciplines involved has any effect, but we can show that knowledge coproduction is significantly associated with action, and involvement of non-scientists (in any capacity) is significantly associated with use (albeit that that use may be solely within the scientific domain).

Much of the integrative work in this project has touched on vocabulary. Indeed, the discussion of this report has also done so in a 'meta' sense to the other activities. Where there is a vocabulary issue and a power imbalance, it is tempting to look for a Lyotardian (1988) *différend*, which may be generally articulated around cases where the less empowered are unable to do justice to themselves using the language of the dominant. We have described in our discussion how the incentives for academics and the research funding process itself work against integrative, transdisciplinary research. If such research really is essential to transitioning to sustainable living, then the dominance of these incentives and processes also need to change. Indeed, they could be seen as being part of the global conspiracy to hamper the kinds of transformative societal change needed to achieve sustainable communities.

Regardless of our observations in GLAMURS, if requirements for transdisciplinary research increase through the nature of research funding available, researchers in various disciplines will be seeking to discover how to participate successfully in it. This would suggest that we need to be able to articulate better what it means, and how it may be assessed. However, there may also need to be an acceptance that there will always exist specific contexts for various such exercises that are not amenable to generic methods. If true, this would be difficult for the more discipline-oriented scientists.

Appendices

These appendices contain more detail on the various knowledge coproduction exercises that have been undertaken in the project, where it is available. Texts are based on reports circulated in the project team.

7. Appendix: Minutes from psychology and economics meeting

Purpose of the Meeting: Discussion and focus on the links between psychology and economics, conceptual issues and integration concerning Work package 3 and Work package 6.

Date of Meeting: 17th-18th July 2014 (*Thursday 17th* 14:00-17:15 / *Friday 18th* 09:30-16:15)

7.1. WP3, Task 3.6i - Performing a meta-analysis on the factors influencing the adoption of sustainable lifestyles

Christian Gross/Lucy O'Shea - ***"Survey of psychological factors to be considered within the microeconomic framework"*** (Session 1, Thursday 17th July)

- Talk based on Christian's paper to provide an overview for approaching a sustainable lifestyle.

- It was decided not to do the meta-analysis because it had already been carried out in the literature.

- Determinants of environmentally relevant behaviour such as drivers (socio-technical context *including infrastructure*, individual determinants and socio-demographic context). They summarised the extent to which lifestyles have become more unsustainable. They liked the 'additive' model of sustainable behaviour outlined in Position Paper 1, but given that behaviours interact with each other, it is more complicated than that. They wish to explore dynamics and long-term developments in behaviours rather than behaviours one by one, bearing in mind a linear regression model – behaviour as a function of socio-technical + individual + socio-demographic variables.

- Guidelines focusing on relevance for sustainability research (environmental significance, dependence on influencing factors, dynamics among influencing factors and behavioural spillovers).

- Description of internal aspects to consider in each guideline. Guideline 1 in paper: Behaviour must be environmentally significant, dealing with self-control and motivation as limited. Giuseppe said this is consistent with theory on self-regulation (Ego-depletion theory: either habits or the system facilitate you doing something, or psychic effort/energy is required to do it. In the latter case, the resource of psychic energy is limited across the basket of behaviours performed). At this point Gary thought that this could involve the uncomfortable consequence that having more options for things to do means less self-control in each one, and so this could be understood as meaning that computation is limited. Guideline 2: concerns interaction among factors; context is important – i.e. certain factors only come into play if other factors are within given ranges. Guideline 3: concerns dynamics among influencing factors; one factor changes another by behaviour and intervention; habit discontinuity occurs when the environment changes; motivational crowding-out is when interventions adversely affect the significance of intrinsic motivations; the direct rebound effect – reduced energy expenditure due to energy-efficient devices leads to greater demand for other non-environmental aspects. Guideline 4: concerns behavioural spillover, a change in the behaviour in question might lead to a change in another behaviour, and hence, spillover (self-licensing, the foot-in-the-door effect, self-serving bias, the re-spending effect).

- Recommendations for environmental research focus on: environmentally significant behaviours, optimising the possibility of more behavioural spillovers, modelling upstream processes that might enable sustainability transitions, considering the dynamic nature of behavioural phenomena even more, and considering long-term co-evolutionary processes between technology, norms and individual behaviour.

7.2. WP6, Task 6.3 - Developing micro-economic models of individual behaviour governing lifestyle choice, the replication of lifestyle choice within the population and the identification of superior models in describing the most significant internal and external drivers in influencing the choice of lifestyle

Michael Finus, Shasi Nandeibam, Lucy O'Shea, Paolo Zeppini - ***"The microeconomic framework"*** (Session 2, Thursday 17th July)

- There were four versions of the model - Individual Behaviour, Population Behaviour, Behaviours on Networks and Environmental Policy. This is not an incremental model design - the individual model could not be "plugged in" to the population model - but the population model might gain from insights into the individual model. The general discussion was started by Gary about the term "versions" of the model, possibly inducing a parallel model in relation to the Individual Behaviour Model. In response to Gary's question, Paolo commented on the idea that Population Behaviour is the main field, and that the next stage implies interaction with other networks, when talking about the Individual Behaviour model.

- Shasi, Adina, Giuseppe and Gary opened the discussion on environmental policy, more specifically about preferences and the idea that preferences can be modelled and changed; the salience concept; the debate about what the term preference means and if it is possible to change individuals' preferences; simply changing the framework is more effective than, for instance, education, so this sentence introduces the idea of manipulating the framework. The individual model has a single representative agent with dispositional and situational factors - preferences and norms respectively. The aim is to obtain a complex model of behaviour to extract several features of decision-making.

- The Population Model is dynamic, with social interactions, a well-mixed population - people interact with a mean field, not with individual agents - and distributions of decisions. The setting is evolutionary (utility as fitness - so the behavioural options are like genes) and the use of heuristics instead of full rationality. A simpler behaviour model is used, e.g. a binary choice.

- Concerning analysis variables, Gary asked for Paolo's comments on the fact that working hours can be a continuous variable, and continuous variables, like time to be checked, are easier in the field of mathematics.

- The Network Model introduces interactions on a network and the Environmental Policy introduces interventions – tax, subsidies, infrastructure, information and education and nudges. A discussion was opened about what nudges are and how they can be modelled. Michael mentioned that nudges make people more irrational; Shasi then pointed out that nudges change preferences – parameters, not functions - which classically - like values in psychology, interestingly enough - do not change.

- Ricardo and Giuseppe commented on Paolo´s remarks and pointed out the need to keep in mind the concept of multiple identities, so that there is a connection with heterogeneous preferences and multiple identities in psychology.

- Christian raised the point about t_0 and how to start the model.

- Providing information about Discrete Choice Modelling, Continuous Choice, and speaking about Multinomial Hybrid Choice, Michael asked what Paolo meant by the term "social influence" and "learning". Paolo explained that he considered "social influence" as simply looking at what society is doing, while "learning" is a more sophisticated concept than influence.

- Examples were given of Individual behaviour (consumption of a single item in two varieties, and the pressure of a social norm) and Population Behaviour (Feedback into one agent's decision, exerting a positive or negative influence).

- A discussion was opened about imitation, individual learning, social learning and social influence. Giuseppe remarked that "imitation" is the basic way of describing norms, and simply being exposed leads to changing preferences. Ricardo introduced the idea that Social Learning provides an explanation for the capacity of human beings to anticipate before a choice is made. It involves a cognitive process, and so imitation is a part of social learning. Adina and Gary commented on Paolo's intervention, pointing out the existence of two different categories - learning and imitation – and Gary said that they are using four different ways to represent learning.

- Giuseppe asked about the possibility of introducing the term in an uncertain way (introduced previously in relation to exogenous uncertainty in situational terms, like product performance, availability or dedicated infrastructure) in relation to environmental damage, and Paolo confirmed that it is possible.

7.3. Summary & further questions on Sessions 1 & 2 (Session 3, Thursday 17th July)

- General issues to keep in mind on Session 1 as pointed out by Giuseppe:

- The idea of categories/segments
- We need to consider segmentation approaches
- Pricing as an economic variable, translation to policy and institutional reforms must be triggered
- Self-regulation issues, linked to time pressure and identities
- Summative framework (individual + population)
- Preferences and factors
- Categories – behavioural domains/segments. There is a need to consider segmentation approaches. Segmentation is also useful in order to gain simplicity and may be needed in simulation for this purpose, but a great part of human action is driven by habit (discrete/continuous choices studied in this project do not involve formal or rational choice).
- Explanatory variables in economics, according to his understanding of the message he received. He read implicitly and explicitly in the section on pricing that in the translation into policy we need to explore more than pricing policies. He particularly liked the part about institutional

reforms and transformation: institutional reforms might instigate the change in motives we are looking for.

- From the psychological field, mention was made of the self-regulation issues discussed previously, but one interesting point is that this is linked to the time pressure issue – which could be linked to the energy capacity discussion. The dual process model fits into this well, together with identity or cognitive dissonance (also mentioned in Christian's report).
- Link to health and well-being.
- Guidelines in conjunction with the simulation of policy tracks. He believes that guidelines are very important; from LOCAW, one of the final aims of the simulation exercise is to simulate policy tracks, to answer the question about whether there are robust policies. The recommendation could be empirically tested through the case studies, but also fed back through the simulation exercise.
- The environmental impact of any single category of behaviour is also significant.

- On this point Ricardo suggested that Gary focus on the option/possibility of using algebraic language in order to analyse hypotheses.

- General issues to keep in mind on Session 2 as pointed out by Adina:

- Adina thought that some of the points could be placed in Friday's discussion session.
- We are not talking about additions of behaviours, but about lifestyles and dynamics of interest. We want to look at trade-offs and dynamics among the factors Christian mentioned. We would have an attractive result from this – not looking at behaviours individually, but at lifestyles as collections of interacting behaviours, and so exploring these within the model would be positive.
- Relation of the model to the data to be collected. Models can be seen as prototypes. But one of the questions that emerged was what the relationship of the model to the data is. How is it to be validated? At this point, Shasi mentioned that in economics, theorists develop blue-sky models - people ask what data is available and see if there are general models already in existence that can be tweaked to fit them. Shasi also thinks the second approach is more fruitful.
- Modelling dispositional and situational factors are not clear. So the question is if dispositional factors would not change - e.g. values or attitudes in psychology literature. Shasi answered that they could not change.
- Modelling change: tipping points. Even at an individual level, there might be points at which behaviour becomes multipliable. Pro-environmental behaviours spread from one behaviour to another: the individual tipping point, as it were. It would be interesting to explore this further.
- In the idea of time-use and time-pressure there is a double dimension, and Lucy said that it is possible to model this. In reply to Michael Finus she pointed out that there is a wide definition of preferences in different contexts, as explained by Adina previously. Time use and time pressure is central to GLAMURS and it appears at certain points in the model. We make explicit decisions about time use because things are important to us. Time is also a dimension in any activity – it might not be a factor in the decision-making process, but it does affect what other things you can do. Lucy said we can model this.

- Ricardo suggested the possibility of preparing a glossary to include the most important and common terms and definitions in order to differentiate what a term means in the field of economics from what it means in psychology. A list of 20/30 terms could be included in this glossary. Ricardo also suggested uploading all presentations into Dropbox.

7.4. WP3, Task 3.1i - Developing general conceptual frameworks linking existing models and theories about lifestyle formation and change across transition, psychology, economics, political and policy sciences

Adina Dumitru / Giuseppe Carrus - ***"Psychological models explaining lifestyle preferences"*** (Session 4, Friday 18th July)

- A summary of the psychological issues was given. Giuseppe commented on the idea that we should consider all factors, not only the context, although this is one of the most important, concerning Lucy and Michael's question on the importance of context and the other variables that moderate behaviour. On this point "moderate" means that it can be amplified or modified. Questions to be addressed, similar to Christian's on his Thursday session presentation: How can psychological models lead our investigations on sustainable lifestyles? What personal factors play a role in making sustainable lifestyle choices? What situational factors influence preferences? How do factors interact with each other? Is there a relationship between psychological factors and time use in promoting sustainable lifestyle preferences?

- They still miss a shared and clear-cut definition of what a lifestyle is – and hence what a sustainable lifestyle is … Factors to be considered in lifestyle definition include personal and situational or contextual factors and collective interests (including social norms). A key question is whether environmental behaviours are one-dimensional (bringing clusters of environmental behaviours back to the same trait or preference or orientations), or if we are forced to treat single behaviours separately, defined by specific cultural, personal and contextual variables (Bratt, 1999).

- Personal and contextual factors interact – external factors act as moderators of the individual factors on the adoption of sustainable lifestyles. Lucy asked whether the contextual moderating the personal somehow meant that personal factors were more important. Giuseppe answered that it depended. Lucy wondered whether the personal moderated the contextual, but Giuseppe said neither is dominant over the other. Michael suggested the verb "transforms" instead of "moderates". Giuseppe said it could be "reduces", "amplifies" (and also any other adjectives that come under the general heading of "changes"). Moderation – sticking with this term for now – is mediated through group membership, social norms and social identity. Personal factors vary in the degree to which they can be changed during the course of one's life.

- Shasi commented on the point that social factors should be more visible whilst personal factors are less visible - that some personal factors are more difficult to see, less visible - and so it is very difficult to test. There is also a policy implication to focus on, which sparked my "collective individual science" rant about the so-called "social" sciences, which habitually explore heterogeneity among individuals in some detail, but have relatively few methods for obtaining empirical evidence on interactions. Shasi remarked that if personal factors are more difficult to influence than social factors, then policy should focus on the latter. Giuseppe agreed this was an interesting point; a study by FGM was cited in which if you ask people

indirectly you get different results from when you ask them directly about the ethics of something (when they say it is wrong).

- Giuseppe listed psychological theories for sustainable lifestyles. Social Influence, Social Identity and the Self-Categorisation Theory, Group Identity Processes and Cooperation, Dual Process Models (rationality versus heuristics), Automaticity and Implicit Social Cognition (implicit attitudes, identity and self-esteem), Ego-Depletion and Self-Regulation models of Social Behaviour, the Prospect Theory – Intertemporal Choice Paradigm (people are sensitive to the way problems with uncertainty are framed, e.g. a focus on prevention or a focus on promotion). The thought occurs that when modelling "non-rational" behaviour, we should be developing algorithms that mirror the ways people make irrational or non-optimal decisions – i.e. developing some sort of "logic" or "rules" for such choices.)

- Sjak asked what the most influential theory in relation to social influence is from all the theoretical review introduced by Giuseppe. Sjak wondered what the hierarchy of theories is, and what 'fashionable' means. In what might have been an ironic gesture, Giuseppe ordered the theories *in his perceived importance* for GLAMURS in descending order as follows: Dual Process Models first, then Social Influence and Social Norms, Social Identity and the Self-Categorisation Theory, Ego-Depletion and Social Behaviour, the Prospect Theory and Norm Activation. Hence Giuseppe explained that there is not only one theory to keep in mind and that we should take into account the contributions from the different theories presented (Social Influence, Social Identity, the Dual Process Model, Ego-depletion, the Prospect Theory and Norm Activation).

- In relation to the previous point brought up by Giuseppe, Gary asked about the possibility of working across different theories. Giuseppe and Adina confirmed that this is possible. Gary asked about incompatibilities and other relationships among the theories. Giuseppe and Adina answered that there are no such incompatibilities among the theories Giuseppe listed. In fact, and much more interestingly, he started to say that, for example, the Norm Activation Theory would apply in certain "boxes" of Kahnemann's Dual Process Theory. Gary introduced the concept of Decision Trees in LOCAW to be considered in this way, but he pointed out that this would be a very useful exercise more generally – identifying how the theories of decision-making interact and especially where one theory applies in specific contexts outlined by another. This would be one way of putting together a theoretical model of decision-making. Gary also asked about the possibility of drawing up a map that includes these theories, in order to obtain a more visual presentation.

- Shasi asked about the possibility of classifying the most current theories from among those explained by Giuseppe into groups.

- Adina said that time and space are properties and limits of everyday life. We want to "zoom in" on the individual located, in time and space: space as infrastructure and context in which behaviour is triggered. The literature in automaticity suggests behaviour is triggered by things in the environment that we are not aware of. The decision-making focus is neither wholly conscious nor wholly deliberative.

- As far as lifestyle definitions in GLAMURS are concerned, Adina noted that they are "patterns of time use that take place in given locations and have associated consumption patterns". Purposefulness is not explicitly mentioned in this definition – but we perform behaviours to fulfil needs: basic, and more importantly for sustainability, social needs (affiliation, status, identity, expression, meaning-making, time structuring and stimulation). We also need to consider that lifestyles are embedded within cultural

practices. Adina remarked that in GLAMURS we want to look at lifestyle continuity and change – either individually-driven (self-determined, spontaneous or necessity-driven) or context-driven.

- Adina pointed out that a normative agenda behind this is that sustainable lifestyles are a counter-culture to the narrative of "progress", together with a context of increasing dissatisfaction and meaninglessness in western lifestyles.

- Adina indicated that individuals are transiting through time and space trying to fulfil needs. We want to look at occasional decisions (e.g. buying a house) and more frequent/everyday decisions. Segmentation efforts suggest that people with similar lifestyles tend to cluster spatially, and become more similar afterwards (the Schelling model is relevant here). Gary asked if people with similar lifestyles are clustering in the same space, and Adina answered in the affirmative. It is also possible that people who live together have the same lifestyle (partly because of e.g. similar income levels, local infrastructure, etc.). One thing to be considered is what people consider when choosing where to live. What role do pro-environmental decisions play? At medium and high levels of income, what are the options for reduced consumption? Changing the quality of consumption? Or even redistribution of income?

- Patricia pointed out that in travel literature it is very common to model commuting choice and the choice of where to live together.

- Looking at a more local life is also of interest, as suggested by Adina, and hence what the determinants of wishing to lead a more local life are (meeting material needs locally as well as spending leisure and vacation time locally). Christian asked Adina for examples of car use in relation to local life slide.

- Concerning time and space, it was mentioned that Ellegard and Palm have collected time-diaries to identify where energy is used in the home. It was found that people chose less energy intensive activities over time, but it is not clear from the research what the determinants for this were.

- Regarding work/life balance, Adina pointed out that the relationship between working time, productivity and leisure choices has effects on consumption and environmental impact. The less time I have, the more things I have to help me save time (Knight et al. 2012). Bauman suggested a de-localised, unbound elite, temporarily insulated from the effects of climate change, contrasted with a growing community who cannot move so readily and are bound to place. On the other hand, wealthy people who enjoy more leisure time might lead high consumption lifestyles. Shasi explained the importance of considering that most people are not employed (unpaid), and that this is a problem. We would like to look at how these trade-offs are worked out within the individual.

- Adina remarked on the importance of considering aspects such as unhappiness and the lack of well-being in lifestyles, longer working hours, more depression, feelings of social alienation and poor health. Low impact activities are assumed to be more time consuming.

- Adina remarked that Ego-depletion, as a result of time pressure, has resulted in poorer environmental decision-making.

- A discussion was opened on the meaning of the concepts introduced, like lifestyles, activities, consumption, social categories and time.

- In regard to Adina's presentation, Lucy stated that she felt more and more that the questions would become difficult to address – that they would require several models. She wondered whether space could, for example, be inferred from consumption patterns. Lucy also wondered whether lifestyles could be aggregations. She also asked if we could use a sustainability 'index' from 0 to 1.

- Concerning Giuseppe´s presentation, Lucy asked if within categories we can say that the personal is stronger than the contextual, or if there is literature to say, for example, that within age, identity is stronger than gender.

- Lucy remarked that from an economic point of view, we have to narrow it down. It can be complex at the individual stage, but needs simplifying at the population stage. We could see from Paolo's presentation on Thursday that they were trying to take psychological concepts on board in the models proposed.

- Sunčica noted that data will be needed for all these concepts and questions that Adina discussed. Adina said that data will be gathered in this project; beyond that we will have to use existing data, but in some cases this is scarce.

7.5. WP6, Task 6.5 - Computer simulations of micro- and macro-models using agent-based modelling

Gary Polhill - ***"Agent-based modelling in GLAMURS"*** (Session 5, Friday 18th July)

- Gary spoke about the work in progress on Agent Based Model building, concerning the work/leisure balance (currently focusing thereon), transport (currently focusing thereon), the status and use of homes, energy use in homes, consumption of material goods and food.

- Gary provided information about the entities to keep in mind, both agents and space.

- He then introduced decision-making, related to how people decide to get to their workplace, and if they are unhappy or stressed. Michael asked Gary about the meaning of decision-making in relation to entities, and Gary explained that it is the exploration of options for decisions. Paolo asked Gary about the number of parameters needed, and Gary confirmed that we need at least 2 parameters for "rational decisions", and at least 1 parameter for "unhappy". Giuseppe introduced the idea of binomial parameters (low/high). Paolo recalled that positive and negative feedback, discussed in previous sessions, is related to feeling unhappy. Giuseppe asked a question about whether it is necessary to have one stress parameter for individuals and another for population. Gary confirmed that it is necessary to include how individuals' behaviour changes if they are stressed.

- Gary remarked how useful the decision-trees learned from questionnaire data were for creating the algorithms used in the LOCAW project.

- Gary also introduced the other aspects of the case studies that are household-specific, such as food choice, energy use, energy performance of homes and the consumption of material goods, mentioning that an explicit representation of households in the model would enable appropriate extensions.

- He also brought in the following questions as discussion points: On which data/theory could we base the model? (Link with case study data? Should we model adoption and evolution of practices in a more abstract way? How are the driving variables of behaviour affected by other behaviours?) How are choices concerning infrastructure affected? How can we build and grow initiatives? (Endogenously?) and How does this fit in with macro- / micro-economic models?

- Shasi spoke about the consistency of data, and asked how we can confirm that the data collected is consistent, as what people say they do is different from what they actually do. Hence Shasi said that

rationality plays a critical role. One interesting thing that came out was a definition of rationality from Sashi; the decision is consistent with preferences.

- Paolo said that we face the same dynamics but from different points, and Gary confirmed that the most important thing is to establish a starting point of connection.

- Gary will prepare a document outlining as far as possible the data needs of the ABM, which can be met from external sources, and which we would ideally obtain from within the project, also taking a quick look at relevant ABM literature to see what has already been done. Other modelling groups will do similar work. Psychologists should have an opportunity to comment on suggested external datasets in case there are reasons why we should not use them here (e.g. they are not transferable from the original sample to here).

7.6. WP6, Task - Macro-economic modelling

Sjak Smulders - ***"Sustainable lifestyles: Insights from Growth Theory"*** (Session 6, Friday 18th July)

- Sjak introduced perspectives on sustainable lifestyles from the Growth Theory. Growth seems to be unsustainable, and so if we talk about sustainable lifestyles, growth needs to be included. Macro-economics can contribute to general equilibrium and dynamics (in the context of real growth). There is a significant overlap with Bath – micro-economics can be input for macro (aggregated), but the micro-economic model is mainly about consumption, and the macro-economic model needs to take the production side into consideration. Even though it is not the primary interest of the project, it cannot be left out. However, they did not show any interest in aggregating and adding production. The effect of growth on lifestyles, however, would be interesting, and would create a feedback loop from lifestyles to growth and vice versa. Sjak proposed a "division of work" between Bath and Tilburg, in which Bath looks at an evolutionary approach with detailed links to psychology, while Tilburg looks at identity choice, habits and peer pressure, linked to growth and resource economics. Michael indicated that the interesting part Sjak talked about was how lifestyles impact growth; he also anticipated future slides on growth, which is not necessarily unsustainable, and decrease is not necessarily sustainable.

- Sjak commented on the effects of the general equilibrium on the macro scale, such as the waterbed effect. Small changes can affect others, not just through norms and technology but through changes in prices. There is a link from lifestyles to growth. If lifestyles and behaviour change, this creates a new market to which firms have to respond. This leads to changes in investment and growth patterns.

- Sjak mentioned their proposed guidelines from Tilburg:

- Everything is interdependent. What happens to consumers has an effect on producers and vice versa.
- There is no free lunch, but there are many externalities. It is difficult and costly to change things, but that does not mean you cannot make major improvements. In economic terms, there are "imperfections" or "externalities". There is a missing market for some things because the externalities cannot easily be internalised by using a policy.
- The model needs to be parsimonious and disciplined. We cannot just extend utility functions or arbitrarily impose heuristics, trying to define a function that, with as few variables as possible (inputs to the utility function), effectively generates the same behaviour as would be modelled

with heuristics such as satisficing – to them, this provides a single, underlying, "grand unified" theory of how decisions are made. Sjak explained that they are willing to sacrifice accuracy for simplicity. Adina said that in psychology they have tried and given up looking for a grand theory of everything. Sjak said we do not want to explain everything, but just the behaviours we are interested in. Shasi said that we are looking in terms of the precise/quantitative (in the field of economics), but it is not completely possible, so he said that in economics they are looking for robustness in qualitative results, increasing/decreasing, rather than quantitative. Sjak said they like to tell stories using just the vocabulary of marginal costs and marginal benefits. Sashi, however, pointed out that ranking is not enough in the policy world, because you do need to provide comparability across individuals. Sjak disagreed. Gary believes there is an interesting question around which algorithms you are constraining yourself to by using a Cobbs-Douglas utility function - for example, which algorithms can you fit a Cobbs-Douglas function to and effectively get the same, or very similar, outcomes?

- Start from a well-defined question.
- Build models that are based on accepted principles, with variables that can be observed, that generate stylised facts, and from which non-trivial further implications can be derived.

- Gary said that he did not agree with anything related to the proposed guidelines in the way that Sjak presented them, such as the assertion that "you cannot just extend utility functions or arbitrarily impose heuristics". Lucy pointed out that variables are the key to making the choice, saying that economists would not just discard irrelevant variables, but would also look for a minimal set of variables they could use – which sounds a lot like feature selection. On this point, Gary considered, as per his thoughts on this in LOCAW, that if a variable could be influenced by other dynamics, and if it is selected "out", there is no opportunity for the model to capture it.

- A general discussion was opened on the role of growth in sustainable lifestyles in the terms of the previous topics. Giuseppe asked about the weight thereof, including consumers' resistance to change in the model.

- Sjak explained what a growth model looks like (Textbook macro growth), pointing out that:

- Producers invest in production capacity and produce goods (sometimes also ideas or new technologies they can use to produce new goods). So you need a production or production possibility function and you need an innovation function (what innovations are possible).
- Consumers save and consume material and immaterial things. What are important are the most resource-intensive goods. Savings are invested in producers. So there are two interactions between consumers and producers, although they are effectively the same because what is not spent is invested.
- Variables are a parameter to be considered. Utility function u(c), production f(k); Variables - Consumption c and Capital stock k; Parameters - discount rate, capital productivity, productivity growth.
- Consumers care about consumption. Result: Convergence to a balanced growth path. This only happens if there is sufficient interest in savings. Technical change is necessary for this to happen. The main extension is to introduce endogenous technology (New variables: R&D and productivity level).

- Green growth model. Utility function u(c, n), production f(r, k). The variables are Consumption and Capital Stock as before. People care about environmental quality n and resources r. Parameters now include discount rate, capital productivity, productivity growth as before, plus environmental preferences.
- Consumers care about consumption but also about the environment. Firms pollute and dematerialisation is possible (substitution). The results are that growth drag proceeds from pollution reduction, and pollution tends to grow, while sustainability requires policy. The extension to be explored would be that environmental quality affects production - presumably positively - which means environmental policy can be pro-growth - assuming policymakers are only interested in GDP. The Environmental Kuznets Curve can be used as a theory on which to base the assumption and to direct technical change in ways that lead to better environmental outcome.
- Steady-state economics. If pollution is required to be constant, do you always get zero growth (not in these models)? You can do this by having more capital installed, or using lower energy inputs and still produce the same amount (e.g. shifting production among sectors).
- There are also models with network effects. Essentially there are many ways in which the model can be extended. In the end it all fits in with the paradigm in which consumers have to decide how much to save and how much to spend. For GLAMURS, a parsimonious model would use Social Interaction (peer effects and habits) and Ego-Depletion ("liquidity shock" in growth and finance literature). You also need consumers to participate in groups. There is also the need to think about the production side, however, and therefore technology change.
- Several questions for which models such as these can be used.
    - Interaction between consumers and firms – lock in, fixed cost, hard to start up a sustainable economy; the international dimension – the competitiveness argument not to be green.
    - How quickly can green practices diffuse – it takes time for companies to respond to changing demand, and the lifetime of equipment (capital turnover) is relevant here.
    - Structural change – the rise and fall of sectors. This can be measured – collect data about how fast solar panels are diffused in the economy. How can it be matched with models?
    - From environmental pressure to policy and lifestyle. Stress creates changes in lifestyle (not exactly phrased in these terms in De Zeeuw and Van de Ploeg's paper, but it is still relevant and worthy of consideration).
    - Directed technical change. Environmental pressure and policy encourages the development of clean technology. Increasing time pressure creates incentives for firms to create goods that save time, but these are energy intensive. Why is there an incentive to develop short-lived products?
- Growth theory is a method, not an ideology (as Sjak sees it). Degrowth and growth theories can be readily compatible. Examples: Roseta-Palma et al. (2010) – over-consumption and under-provision of leisure - and Acemoglu et al. (2012) - shrinking sectors are not strange in multi-sector

growth models. Also, typically balanced growth is only possible with constant resources in the very long run, though there are exceptions.

- The ensuing questions covered, under Michael's direction, possible extensions to the model proposed by non-economists. Sjak seemed reasonably disposed to exploring most of them (or they are already being looked at by other authors); this includes the case in which people do not know how to value the environment because they do not know what it does for them until it stops happening.

- In relation to examples of growth models, Ricardo remarked that there are studies that show that people do not change environmental behaviour if they are paid. At this point, Giuseppe introduced the stress variable as an addition to Ricardo's contribution. Paolo suggested that due to technical advances, we now pollute much more than previously. Lucy pointed out that consumers/consumption are the key in this project in relation to these growth models.

- Giuseppe asked Sjak several different questions, such as how much innovation we need, what the risk is if intervention is not sufficient, time-use, time-balance and personal time-balance.

7.7. Summary & Further Questions on Sessions 4, 5 & 6 (Session 7, Friday 18th July)

- As a list of important aspects to be considered once the individual contributions during the sessions were finished:

- Gary recalled the importance of data needs from different disciplines (Economics, Psychology, Sociology…). At this point Adina remarked that every partner should state how long they would need to run the tasks delivered in each consortium meeting.
- Shasi and Lucy recalled that theories are the most important aspect, together with the key dimensions. Lucy sought affirmation that consumption could be the resulting variable of interest, which would mean that all activities are consumption activities.
- Ricardo remarked that we need to make a decision about the theories that are going to support the project; how we are going to integrate all the dimensions into a common framework, taking into account multiple regression analyses, as a way to obtain cohesion among theories in relation to time-use data analysis.
- Adina recalled the idea of developing a comprehensive glossary to facilitate a common understanding.
- Concerning lifestyle dimensionality, there was agreement at this workshop that we would take Adina's definition (to be taken from Adina's slides once uploaded to Dropbox – with the placing of the words consumption and time switched) and define all activities as consumption, i.e. consumption of material goods, leisure, transport etc, e.g. $c=\{c_1, c_2, c_3 \ldots\}$. The micro-modellers require a clear indication of how many c's from the psychologists they should include within the curly brackets.
- Giuseppe mentioned that we need a more advanced position on paper 3 in the short term. He proposed a paper to provide information about the most psychological theories, and the above-mentioned glossary. Hence he proposed that each partner identify the key concepts in order to

obtain a third stage with a final glossary (ontology). At this point, Ricardo said that he will coordinate the drawing up of the glossary. After the Rome meeting, more concepts and terms could be included in the glossary.

- Concerning time-use and data analysis. The Oxford data-use check in relation to consumption activities was mentioned by Lucy. It was agreed to send presentations about work leisure from UBAH to Giuseppe and Adina, and it was also agreed to send variable top proxy greener lifestyles from UBAH to Giuseppe and Adina. Lucy remarked that we might wish to distinguish between qualitative and quantitative data; from a modeller's point of view qualitative data may be more relevant as we may wish to identify a variable/parameter and in the case parameter, values assign values based on the magnitude of their importance as evidenced in databases.
- Next week Giuseppe will send a draft including possible topics for the sessions for the Rome meeting, clarifying information about the format of the meeting in Rome and considering an outside audience (both academic and non-academic) for a session (possibly keynote + panel/roundtable scheduled for the evening) and possibly have parallel sessions and break-out sessions for the main body of work to be done.
- As Lucy gathered about interactions between micro, ABM and macro, Gary would like to see tangible links made if possible. Gary can drive this process with Sjak and Paolo.
- Ricardo asked what economists' preferences are for gathering data. The preferences are two options to make a choice - binomial categories.
- Lucy mentioned the importance of further ad hoc meetings, but fully reported within the work of the project, to be scheduled in the future.
- General review by Michael about the expected meeting results introduced by Ricardo early in the meeting session start on Thursday 17th July. In the end the following were reached:
    - *Establish the stepping stones for our preference model and further work steps in developing a theory of lifestyle change.*
    - *Establish the ways in which we will work with the empirical data, and what the relationships are between the modelling and the empirical work.*
    - *Gain insight into macro-economic modelling and the building of scenarios for a green economy, including policy scenarios.*
    - *Debate the connections between economic modelling and agent-based modelling and their respective relevance for advancing theory and policy recommendations for transforming European economic systems.*
    -

7.8. Summary of tasks and actions

OUTSTANDING TASKS	RESPONSIBILITY
Draw up a glossary of terminology. Groups propose key concepts. To be drawn up by each group (for the Bath group Lucy will take responsibility and aim to supply a first draft by 7th August). Once	Coordinated by Ricardo (UDC). Drawn up by all partners with

each group (Macro, Psychologists [WP3], ABM and Micro) have supplied their own lists, each group can respond by requesting explanations of common terms.	individual contributions from different disciplines.
Send presentations about work leisure from UBAH to Giuseppe and Adina, and it was also agreed to send variable top proxy greener lifestyles from UBAH to Giuseppe and Adina.	UBAH
Next week Giuseppe will send a draft including possible topics for the sessions for the Rome meeting, clarifying information about the format of the meeting in Rome, and considering an outside audience (both academic and non-academic) for a session (possibly keynote + panel/roundtable scheduled for the evening) and possibly have parallel sessions and break-out sessions for the main body of work to be done.	UNIROMA3
Gary, Jiaqi and Patricia to prepare a document outlining as far as possible the ABM's data needs, which can be met from external sources, and which we would ideally obtain from within the project, also taking a quick look at relevant ABM literature to see what has already been done.	JHI
Prepare a new reduced wish list to identify key dimensions of lifestyles to be explored, identifying theories that will be used by psychologists, and ordering the variables according to their significance for economists' interest.	UDC UNIROMA3
Related to time-use data/analysis, we hope to be in a position to identify a timeline for data acquisition & construction of database (Deadline: October, Rome meeting). To this end, both groups (modellers and empirical analysts) need to inform the other of their data needs.	UDC UBAH
Related to lifestyle dimensionality, provide a clear indication to micro-modellers of how many "c"s from the psychologists should be included within the c={c1,c2,c3…} (concern defining all activities as consumption, i.e. consumption of material goods, leisure, transport etc, e.g. c={c1,c2,c3…}).	UDC
In relation to time-use data/analysis, and to identify meaningful sources of data, Adina will draw up some research questions and then Sunčica can have a look at the databases (HETUS; ATHUS; MTUS) and tell her what is/is not feasible. Adina will inform UBAH of the relevant "c"s and Sunčica will find out if the time intensities of these different activities (c={c1,c2,c3…}) can be extracted from the databases. This information is for the modellers.	UDC UBAH

Concerning interaction between micro, ABM and macro, Gary would like to see tangible links made, if possible, driving this process with Sjak and Paolo.	JHI UBAH TSC

7.9. Workshop content summary

After a session introduction to recall the purposes of the workshop and the expected results once the meeting is finished, we focused our attention on the kick-start of the close collaborative work, defining specific aspects of the modelling, and also connecting empirical research and projection into the future. The workshop sessions then started. From sessions related to *WP3 (Task 3.6i - Performing a meta-analysis on the factors influencing sustainable lifestyle adoption)* and *WP6 (Task 6.3 - Develop micro-economic models of individual behaviour governing lifestyle choice, the replication of lifestyle choice within the population, and the identification of superior models in describing the most significant internal and external drivers in influencing lifestyle choice)*, we found that we ought to keep in mind issues regarding the need for segmentation approaches; pricing as an economic variable, translation to policy and institutional reforms should be triggered; also self-regulation issues, linked to time pressure, and identities. We are not talking about additions of behaviours, but about lifestyles. We would have an attractive result from this – not looking at behaviours individually, but lifestyles as collections of interacting behaviours, and so exploring these within the model would be positive. Regarding the relationship of the model to the data to be collected, models can be seen as prototypes. Pro-environmental behaviours spread from one behaviour to another: the individual tipping point, as it were. It would be interesting to explore this further. Time use and time pressure are central to GLAMURS and they appear at certain points in the model. Time is a dimension of any activity as well – it might not be a factor in the decision-making process, but it does affect what other things you can do. From the sessions related to *WP3 (Task 3.1i - Developing general conceptual frameworks linking existing models and theories about lifestyle formation and change across transition, psychology, economics, political and policy sciences)*, *WP6 (Task 6.5 - Computer simulations of micro- and macro-models using agent-based modelling)* and *WP6 (Task Macro-economic modelling)*, we considered that consumption could be the resulting variable of interest, which would mean that all activities are consumption activities. Concerning lifestyle dimensionality, there was agreement that we would define all activities as consumption, i.e. consumption of material goods, leisure, transport, etc. We need to make a decision about the theories that are going to support the project, how we are going to integrate all the dimensions into a common framework, taking into account multiple regression analysis, as a way to obtain cohesion among theories in relation to time-use data analysis. On data analysis, we might wish to distinguish between qualitative and quantitative data; from a modeller's point of view, qualitative data may be more relevant as we may wish to identify a parameter, and in the case parameter, values assign values based on the magnitude of their importance as evidenced in databases. Finally, there was a general review about the workshop results reached, emphasising the following aims reached: 1) Establish the stepping stones for our preference model and further work steps in developing a theory of lifestyle change, 2) Establish the ways in which we will work with the empirical data, and what the relationships between the modelling and the empirical work are, 3) Gain insight into macro-economic modelling and the building of scenarios for a green economy, including policy scenarios, and 4) Debate the connections between economic modelling and agent-based modelling and their respective

relevance for advancing theory and policy recommendations for transforming European economic systems.

8. Appendix: Initial Ontology Workshop Report

8.1. Introduction

In GLAMURS, OWL ontologies were used to develop vocabularies describing the terms we are using in the research, and to provide a basis for integrating data collected or used by the project. Both adopt a very literal, formal approach to the concept of integration. The initial ontology was developed from a workshop held at the kick-off meeting in late January 2014 involving participants in the GLAMURS project. This appendix describes that workshop – a full account of the ontology development itself is available in an accompanying deliverable (D2.2: Report on the ontology generation and data and knowledge integration).

OWL ontologies (Horrocks et al. 2003; Cuenca Grau et al. 2008) offer a formalism for representing vocabularies based on description logic. Their main application is in the semantic integration literature, where problems focus on integrating information from heterogeneous databases. OWL ontologies have four ontological entities: classes, data properties (which will be referred to henceforth as attributes), object properties (which will be referred to henceforth as relationships) and individuals. For those familiar with relational database modelling, (named) classes would typically be tables, attributes would be columns in tables, individuals would be rows in tables, and relationships would be relational tables. OWL does not have formal terms to describe processes, which are important in a project covering transitions to sustainable lifestyles and the green economy. However, OWL ontologies have been used to describe such things as the means by which artefacts come to exist (provenance – see Moreau et al. (2011); Belhajjame et al. (2013)). Processes can therefore be represented as a special kind of class, which is assumed to be part of the vocabulary.

8.2. Method

The workshop was designed chiefly to elicit processes and classes. Participants were organised around three tables in groups of between 6 and 8 individuals. In the first step, participants worked alone, and were asked to write on up to ten cards (sized to one quarter of the area of a standard index card, and pre-labelled with a unique participant identification number) each their answers to the following question, which was given verbally by the facilitators and projected onto an overhead screen:

"What do you think are the important processes that could facilitate transitions to sustainable lifestyles and a green economy in Europe?"

The word 'processes' was emphasised to indicate that this was the information required on the cards, and were given pens with thick nibs to encourage them to be succinct on the cards. Where participants queried the meaning of the word 'processes', they were told to base their response on what the word meant to them. Participants were given five minutes to complete this task.

In the next step, still working alone, participants were asked:

"For each process you have listed, please write down what things are likely to be affected by this process."

Again, the word 'thing' was emphasised. Participants were given about ten minutes for this task, with the limit of ten cards per process.

In the final stage, participants worked in their groups, and asked to:

"Sort the cards into groups so that the things in each group are similar in a way that seems natural to you."

The cards to be sorted consisted only of the 'thing' cards written by members of the group in the second step of the workshop. The card-sorting exercise made use of large tables so that participants had plenty of space to explore their categorisations. Groups were asked to record the 'category heading' on a new index card and place it above their sort. A photographic record of the card sorts was taken throughout the workshop to aid transcription and to ensure that the structure of the data was correctly recorded.

Time constraints meant that the following optional steps to gain further information were omitted:

- Asking the groups if they could find alternative ways of sorting their cards.
- Asking the groups to sort the cards of another team to compare categorisations.
- For each 'thing' card, asking participants what it is about the entity named on the card that is changed, with a view to eliciting attributes.
- For each 'process' card, asking participants who would be responsible for making the process happen, in order to elicit the important actors in the transition process.

After the workshop, the cards were transcribed into a spreadsheet, each card being assigned an identifier, and associated with an anonymised participant identifier, or group identifier in the case of the category cards.

8.3. Theoretical underpinning

Experience with earlier cases of this workshop has shown that it tends to come up with 'fragments' of an ontology. These 'fragments' may contain some hierarchies of classes, but the classes tend not to be related to each other. As well as using WordNet to try and uncover some of the ontological relationships, we attempted to draw on social theory to see if these could provide any ontological purchase. Specifically, in this case, we borrowed terms from actor-network theory (Latour 2005) and practice theory (Shove et al., 2012), and explored the degree to which the nouns on the cards had some relationship with the following concepts:

- actor,
- network,
- practice,
- meaning,
- materials,
- competence.

According to Shove et al., 'meaning', 'materials' and 'competence' are the 'elements' of practices that remain comparatively constant through time, whilst practices evolve around them. The actor-network comprises evolving networks of human and non-human entities that persist through regularly performed relations that may be material or semiotic (or both). Practice theory, in providing specific links among materials, meanings and (by implication) actors could potentially be subsumed into actor network theory

(i.e. as a special case with respect to practices) – the evolution of practices being seen as a network over time.

With respect to a particular narrative (in this case, processes of transition to sustainable lifestyles and green economies), Latour discriminates between mediators, which are 'transformers' in the network and intermediaries, which pass things on without changing them or themselves. 'Black boxing' is a process by which networks can be described as actors themselves. In this context, for example, we might describe 'the economy' as an actor if, from a narrative perspective, it makes sense to do so.

The following concepts were also used in this exercise:

- the economy, which could be seen as a kind of network,
- process, which is seen as a broader-scale story of change and transition (and there may well be a better term we can borrow from existing theory for this),
- space, which is important for spatially embedding the concepts (and could reasonably be grounded in geography), which could be seen as a kind of material when it is a resource needed to perform a practice, or as a network when it is used to refer to people in a particular named space. However, since networks are spatially mediated, and, in the form of infrastructure, are clearly physical materials, there needn't be a disjunction here.
- time, which could also be seen as a resource.

A rough sketch of a theoretical underpinning ontology is shown in Figure 1. The most potentially controversial aspect of the ontology is the class hierarchy, and in particular making materials a subclass of actor. The latter is a consequence of following actor-network theory, which is not an uncontroversial theory in sociology. Materials can be seen as kinds of actor, however, with respect to a particular narrative (e.g. "the wind blew the house down," "the car wouldn't start"), and in computer models there may be little algorithmic distinction between human and non-human entities. Indeed, there are models that represent parcels of land as agents that 'choose' whether to be forest, agriculture or urban, for example. It is not the place of GLAMURS to resolve such a fundamental controversy, however, and if the word 'actor' is a cause for concern, it may be better to consider the use of another term that acts as a container for things that are important parts of a narrative.

Meanings are represented as reified relationships. In computer science, when there is a need to describe a relationship that may have attributes, and sometimes when there is a many-many relationship (which can make querying a challenge), it is customary to make that relationship a class. This is termed 'reification'. One of the weaknesses with practice theory is that it does not provide a means for saying whom the practice has a meaning to. Using a reified relationship, it is possible to say that the practice has a meaning ('hasMeaning', specialisation of 'relationFrom') to a particular actor ('meaningTo', specialisation of 'relationFrom').

Another potentially controversial subclass is asserting that practices are networks (and hence, justified by 'black boxing') actors. However, discussing the agency of practices is not without precedent – Reckwitz (2002), for example, describes humans as 'carriers' of practices, which gives the impression that they are intermediaries (in the language of ANT). Hence, 'hasMaterials' and 'materialOf' are specialisations of 'relationFrom' and 'relationTo'.

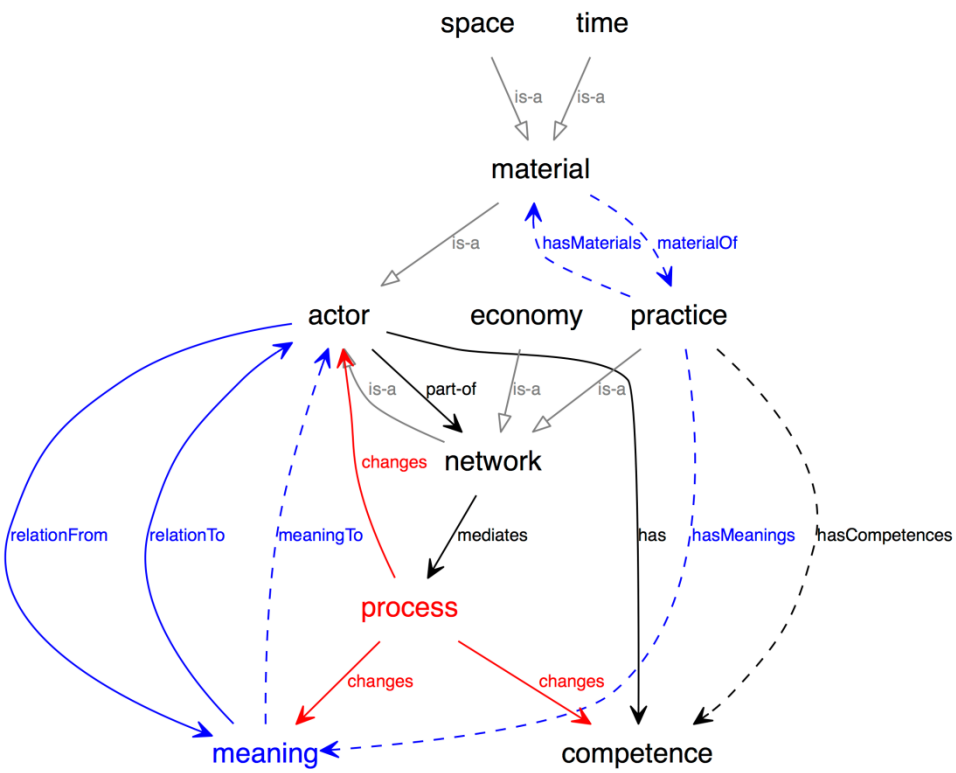

Figure 1. Ontology sketch based on theory. Nodes are classes (words in the larger font), lines are relationships. Grey lines show 'is-a' or subclass relations. Blue lines and text indicate reified relationships; dashed lines indicate specialised relationships. Red is used to highlight processes.

One way to test this ontology sketch is to take a random process card, the things affected by it, and the categories they belong to, and to see how they fit with the sketch.

Process	Dissemination of information about alternative technologies, products, consumption patterns, etc. (best practice examples, etc.)	**Category**
Thing	Innovation	Innovation
Thing	Emissions	Reduction of Emissions

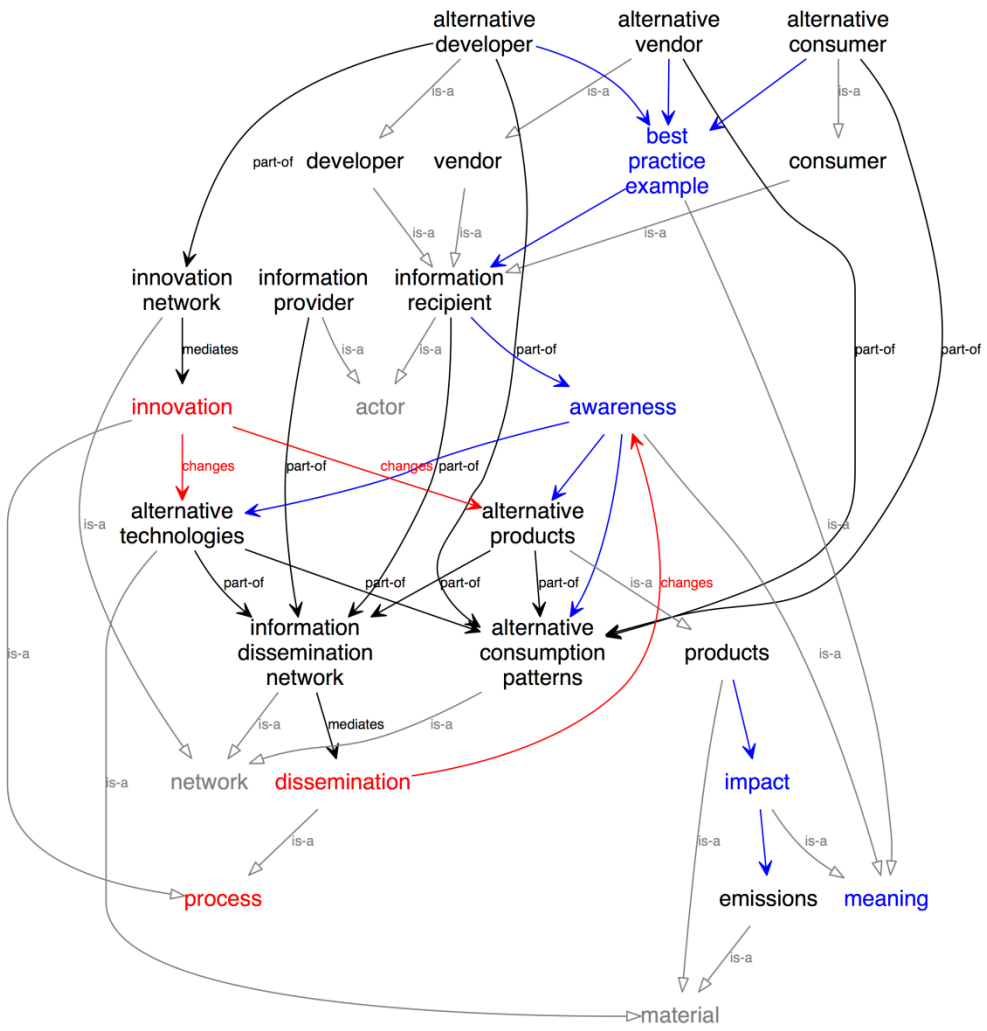

Figure 2. Ontology sketch use case for one of the process cards.

Here, the process is 'dissemination'. An unnamed network is involved in the dissemination, and the recipients and providers of the information are unnamed actors. The process changes the recipients by giving them information, which should be seen as a competence in the everyday practice of decision-making; however, alternative technologies and products are arguably materials, and the upshot of the dissemination is that the recipients are made aware of them, which would be represented using a specialisation of 'meaning'. Alternative consumption patterns are networks of alternative producers and consumers selling and buying alternative products, and the information dissemination process also makes the recipient aware of these. Recipients could be consumers, vendors or developers of products, and innovation is a process involving networks of developers and materials to create new materials. Presumably by increasing the members of that network through making more developers aware of alternative products and technologies, there will be greater innovation in the field. If we assume that by 'alternative', the workshop participant meant 'low-emission', then increased consumption of alternative products will lead to lower emissions. Emissions are materials associated with (the use and/or consumption of) products. Figure 2 shows how this would fit with the ontology sketch above.

8.4. Results

The workshop produced 179 'process' cards, 378 'thing' cards, and 53 'category' cards. Broadly speaking (i.e. with a few exceptions), the processes can be divided into the following categories:

- Education/Communication/Promotion. These all involve giving people, governments and organisations knowledge and information they can use to conduct their everyday practices more pro-environmentally, or raising consciousness and awareness about environmental issues and solutions. Example cards:

  Environmental education programmes

  Spread knowledge and information

  Make attractive visions of sustainable lifestyles

- Regulation/Taxation/Incentivisation. These involve changing regulatory frameworks at national and international levels that facilitate or stipulate pro-environmental behaviour and prohibit or discourage environmentally unsustainable behaviour. Example cards:

  Effective climate policy

  Policy that supports sustainable initiatives – taxes on unsustainable ones

- Reprioritisation/Indicators/Drivers. These involve changing the way we measure success at individual or societal levels, changing emphasis on drivers of behaviour. Example cards:

  More time for self and family

  An international shift in discourse from GDP to new forms of quality of life indices (e.g. HDI)

  Food crises ("mad cow disease", H5N1) changing attitudes

- Innovation/Infrastructure/Greening. These involve making available technology and infrastructure that makes it easier for us to live in a more sustainable way either by changing what we do (i.e. greener behaviours are, or seem more feasible), or by changing the materials with which everyday practices are performed such that their environmental impact is reduced.

  Technology innovation

  Building towns that work without private cars

  Using more electric vehicles

- Lifestyle change/Normalisation. These pertain to individuals choosing to change the way they live and greener lifestyles being seen as more normal. The latter could be seen as relevant to the 'promotion' sense, in that several cards refer to role models.

Buying quality instead of quantity

Media attention, public discourse

Figure 3. Word cloud of verbs used in the 'process' cards. The size of each word reflects its relative frequency.

The verbs on the 'process' cards should reinforce these broad categorisations, and to some extent they do. Figure 2 shows a word cloud[1] of these verbs, and the prominence of 'promote' certainly reflects the prominence of the education/communication/promotion category. Similarly 'support' typically refers to political (financial) support (e.g. Support the production of hybrid cars), though it is also used in other contexts (e.g. normalisation: Community support for alternative ways of spending time; though as a noun here). However, other verbs are more general; for example, 'change' could refer to changes in regulation, lifestyle, or indicators, and 'reduce' is a more specific form of 'change'. One of the issues with parts of speech analysis is the flexibility of natural language expression, which allows ideas to be conveyed using different parts of speech. For example, the cards Educating to sustainability and Install education for sustainable development essentially convey the same idea, but the former uses a verb to convey the idea of education, the latter a noun. The nouns used in 'process' cards are shown in Figure 3, and many of these apply to the above categories more specifically, e.g. 'tax', 'innovation', 'infrastructure'.

[1] http://www.wordle.net/

Figure 4. Word cloud of nouns used in 'process' cards.

Several 'thing' cards contained not only information on what would be affected by the process, but also how those things would be changed (e.g. **More public political involvement**), which often entailed the use of a verb (e.g. **Change societal logic and structure**). Nevertheless, 'process' cards used more verbs by proportion of words (see Figure 4) than 'thing' cards, and more in absolute terms (144 verbs on 'process' cards, vs. 107 on 'thing' cards). There was also a reduced vocabulary of verbs on the 'thing' cards, with 52 unique verbs (average re-use 2.06 times) instead of 85 (average re-use 1.69), with the verbs focusing typically on describing the effect the process would have – e.g. 'change', 'reduce', 'improve', 'decrease' (Figure 5). Adjectives were also used for this purpose; in particular the prominence of 'less' and 'better' in Figure 6 among other adjectives associated with describing pro-environmental-ness ('green', 'organic', 'sustainable', 'solar') shows how often participants described the effect the process would have on the entities they entered on the 'thing' card.

It was for this reason that we undertook the exercise of focusing on the nouns and placing them into categories suggested by the 'borrowed' theoretical terms described above. There are 470 unique nouns on all the cards, and during the exercise we found the need to add two further categories to those listed above:

- environmental outcome – this could be seen as meanings (pollution) or as materials (emissions).
- choices – this could be seen as a network of materials / practices and actors making decisions, but this would mean choices are actors. This does seem uncomfortable, but a choice could be seen as an actor in a narrative sense (e.g. 'the choice to travel by car led to delays caused by congestion').

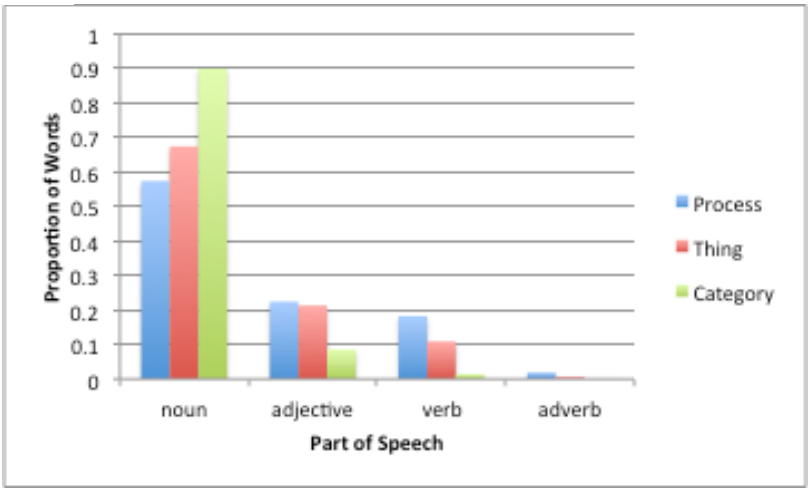

Figure 5. Comparison of frequency of main parts of speech used on different kinds of card.

Figure 6. Word cloud of verbs used on 'thing' cards.

Figure 7. Word cloud of adjectives used on 'thing' cards.

We further found that the concept of materials needed to move beyond the sense of physicality that word conveys. (To some extent, it already had above through asserting that time is a material, but it is at least studied by physicists.) 'Resources' seemed a more general term and a more comfortable fit for 'time' as a resource that is needed to perform a practice.

The more significant modification was that there were a large number of words that ended up in the 'meaning' category, suggesting both that it needed breaking down a bit, and the concept generalised. We grouped the nouns allocated initially into the 'meaning' category under the following subheadings: economic interaction, culture, identity, indicator, norms and salience, and generalised the concept to 'interaction'. (Meanings could be seen as interactions between groups of people and other actors (including resources).

Actors are grouped into Resources, Networks and IntentionalActors. The IntentionalActor class was introduced to deal with any discomfort arising from calling Resources Actors, with the distinction allowing us to conceive of Actors as 'things that have a role to play in the story of transitions to sustainable lifestyles and green economies'. IntentionalActors are further subdivided into Collectives and Individuals, with Collectives also being a kind of Network. This entails a theoretical ontological commitment that has been the subject of debate in the literature, but one that is convenient from a modelling perspective and is in any case often implied in narratives: "The British government decided to opt out of the European Working Time Directive".

These changes are reflected in the class hierarchy of the created OWL ontology shown in Figure 8. 'Thing' is the top level class in OWL, which all classes must be a subclass of. The class hierarchy shows which classes are subclasses of which other classes. To say that one class is a subclass of another is to assert that any member of that class is a member of the other (e.g. all cars are vehicles). In an OWL ontology, this means that all axioms of the superclass apply to the subclass. There are potentially contentious assertions in the hierarchy as it stands, some of which derive from borrowing terms from theories that, although they have provided a basis on which to bring the concepts on the original index cards together, have also been reshaped by the process of 'tagging' concepts with the words written on those cards. It may be the case that some of these assertions can be dealt with simply by changing the class name. It must be remembered that the name of the class is simply a mnemonic for us as humans to read the structure of what is a computational artefact. 'Actor' is a case in point. Other issues may require restructuring of the ontology. Making Practices subclasses of Networks is convenient in that the 'elements' of the Practice can be recorded as specialisations of the 'parts' of a Network: the Interactions (meanings) and Resources (materials) they use, as well as the Actors performing them and the Competence they have. However, so doing has left the Competence class not really embedded within the Actor or Interaction hierarchy.

The assignment of words to classes, where they are associated with it, but do not necessarily indicate creating a class, is achieved by 'tagging' the classes with the words they are associated as an annotation – combining the formality of the OWL ontology with the more informal concept of a 'folksonomy'. The attached annex records the tags associated with each class (where appropriate), which may suggest further subclasses, but may also describe concepts to be associated in a different way, or simply act as associated words that help describe what the concept represents.

Figure 8. Class hierarchy in the OWL ontology

WordNet analysis proved useful in assisting with tagging words and understanding the senses with which they were used. This resource provides further scope for analysis at a future date. However, initial results using WordNet show how fragments of ontologies occur through the hierarchy of hypernyms and hyponyms, and meronyms and holonyms, as well as networks of synonyms. These ontology fragments were the outcome of previous workshops conducted in other projects, and it is interesting that (partially) replacing the manual task of building an ontology from the index cards directly with the application of semantic relationships in WordNet has still resulted in disconnected fragments (though arguably with more links), two of which are shown in Figure 9. Drawing (however loosely) on theory has, in this case at least, assisted in creating an ontology that is less fragmented.

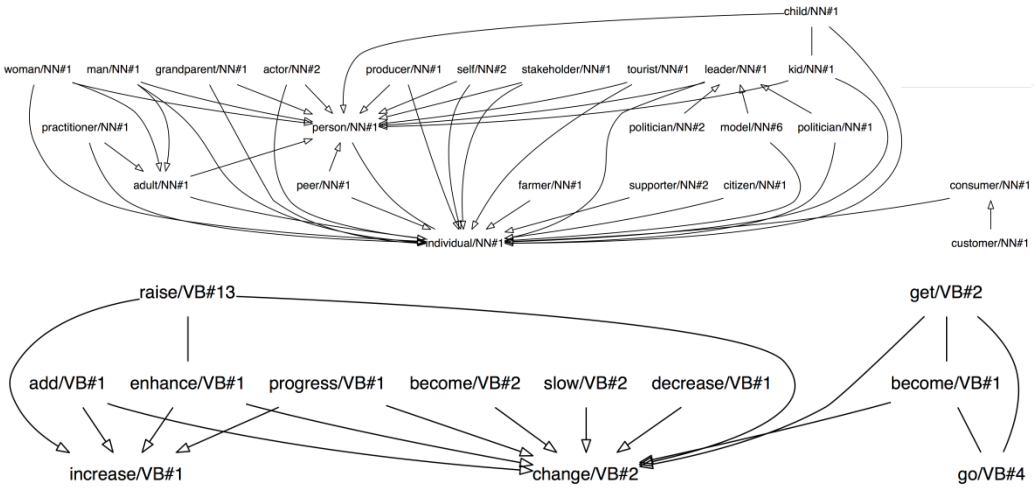

Figure 9. Two selected fragments from the preliminary WordNet analysis. Synonyms are indicated with a line with no arrowhead, hypernyms with an arrow.

9. Appendix: Case Study Exchange Report

9.1. Day 1, 17 June.

Location: *University of Timisoara (UVT) – Amphitheatre A01, (ground floor of main UVT building)*

Facilitation of the evening: *Irina Macsinga and Vlad Pandur (UVT, Romania)*

The GLAMURS Case Study Exchange (CSE) meeting was co-organized and hosted by GLAMURS partners SERI and UVT. The first day started with an official opening introduction and a brief presentation of the ecovillage movement and the status quo of sustainable initiatives in Romania. Finally, an interactive session sought to examaine participants' intentions for attending and their expectations of the meeting.

Official welcome

In her opening speech Irina Macsinga pointed out the event as a valuable opportunity for co-producing knowledge, solutions and recommendations regarding the transition to sustainability, as well as exchanging best practices for supporting and developing alternative lifestyles. Afterwards the Vice-Rector of UVT, Dr. Bunoiu described how well the GLAMURS project fits in with UVT's interest to be actively engaged in transdisciplinary initiatives and projects on sustainability, with multi-level stake-holders.

The official opening concluded with a speech from the Coordinator of GLAMURS Prof. Ricardo Garcia Mira from The University of A Coruña in Spain. He explains that scientists and the academia in general are very interested in transdisciplinary approaches, where different professionals, local and regional authorities, sustainability pioneers and citizens are collaborating and making mutual learning feasible. Accordingly the aim of this meeting is to discuss the motivations and constraints of sustainability initiatives and stakeholders. Similarly, the project's essential goal is to produce tangible solutions and recommendations that must reach the European citizen, in line with the expectations and directives stated by the European Commission.

The Ecovillage Movement in Romania

Claudian Dobos – activist, networker and facilitator, as well as a founding member of international spiritual intentional community Aurora (found in Hunedoara County, Romania) and Terra Livre Movement – informed about the Romanian ecovillage movement and grassroots initiatives that focus on sustainable lifestyles. Although there is a transformation gradually expanding in Romania and a potential for the emergence of a new, strongly sustainability-orientated culture, it is still a pioneering domain. At the moment you cannot truly speak of a consistent, united movement.

Claudian compares this with the status of similar movements in other parts of Europe and explains how the sustainability movement is heavily affected by various cultural and socioeconomic legacies from Romania's previous era as a communist Eastern European state. Claudian also stresses the need for stakeholders to co-create a stronger concern for and pursuit of sustainability within society, in order to motivate people to get out of their comfort zone and engage them in bringing about change.

Participants' responses and expectations

An iterative element in the participants' responses was a good feeling when discovering so many diverse individuals that share a common concern for sustainability and a similar passion for supporting an

alternative way of life. This feeling of kinship during the meeting participants provided good grounds for a knowledge co-production and mutual learning endeavour. The participants' expectations regarding the CSE meeting and the activities in the following days showed a generally optimistic attitude, a lively curiosity for meeting other stakeholders and discovering their work, strengthening already existing movements and support networks, pursuing opportunities in the Danube region and emergence possibilities in trans-sectoral contexts.

9.2. Day 2, 18 June – Opening themes and discussion

Location: *West University Central Library, Timișoara – Conference Room*

Facilitation of the day: *Mirijam Mock (UFZ, Germany) and Peter Jungmeier (SPES Zukunfts-akademie, Austria)*

The second day's session was intended to introduce the main discussion topics of the CSE meeting and to create a setting were participants' diversity, personal interests and experiences could be harnessed in order to help them engage with the topics in a creative, interactive and participative manner. Participants worked in groups and co-produced solutions pertaining to the needs for enacting a transition to sustainability, the needs of stakeholders and scientists for a more fruitful and comfortable cooperation, as well as the implications of time and space use for achieving a more sustainable lifestyle.

Interactive Presentation of the Initiatives

Ines Thronicker, member of the GLAMURS German research team (UFZ) facilitated the next session, which focused on introducing the various case study initiatives present at the CSE meeting. Therefore, a scarf with several objects on it (e.g. an apple, a roll of toilet paper, a hat, etc.) was placed in the middle of the room. Members from the case study initiatives were invited to pick up an object which they considered to be representative for their particular initiative and explain their choice to the group. By this, all the attending initiatives were presented by one or more of their attending members, once again highlighting the high degree of diversity between participants and initiatives, but also the numerous shared beliefs, values, goals, and a significant potential for cooperation.

Afterwards, Mira Löwenzahn (German Case Study) proposed a brief creative activity to conclude the session. First, the participants reflected on the topics discussed and then they picked up any item on the scarf they felt inspired by. They placed, arranged, rearranged, stacked and unfolded the items on a nearby sheet of paper on the floor in order to build a symbolic collage/three-dimensional painting. This collage constituted the first piece of content actively co-created by the meeting's participants, both researchers and stakeholders, setting the stage for upcoming interactive sessions later in the day and the rest of the CSE meeting.

Figure 10. The symbolic collage / 3D painting of the initiative participants

Plenary Session on Needs in Sustainability Transitions

In advance of the plenary session Adrian Popa, who graphically recorded the sessions in real time, presented his drawings. He explained how he integrated all the discussions and the presentations of the initiatives, interpreting them as parts of a bigger picture not separately, but as collective work and as the product of common effort. Even the initiatives might seem different, the key to all of them, in his opinion, is that they have common intentions and goals and share the willingness to provide support to each other.

Figure 11. Graphic recording by Adrian Popa, "Interactive Presentation of the Initiatives" session

Vlad Pandur (UVT) and Andrei Iuroaia (part of Romanian intentional community Aurora and initiator of the Communities Convergence initiative), were the facilitators of the plenary session, which was designed in a World Café format: a certain given topic is discussed for several rounds in small groups of members from different initiatives. The participants got a blank flipchart sheet and markers to draw the main points of their discussions to the topic **"What do we need to promote sustainable lifestyle and**

economical models in Europe?" Each round of discussion focused on one of three specific subtopics related to transition needs:

The first round of discussion was centred on ***learning, knowledge and education*** needed for transition to sustainability. Participants' responses to this topic referred to: schools and learning from the environment; money and the influence of the initiative on the learning process; the role of institutions on education; redirection of taxes, actions for spreading the knowledge; practice by example; a new model and the importance of having a model to follow; love-centred model, new way of gathering knowledge; individual vs. collective government.

The second round focused on ***material resources, human resources or policy support*** needed for transition. The participants' discussions made reference to: various examples of needs on the topic, plans to meet these needs; cooperation; meeting points; network support; competition role, senate representatives; decision making; taking responsibility.

The final round of the session was focused on the ***social relationships and networks*** needed for transition to sustainability. The participants provided responses linked to: leadership and trust; empathy, relationships based on love, cooperation and collaboration; architecture techniques; natural medicine; differences in knowledge between the countryside and urban areas; creating trust by meeting in circles; every question being a valid question; communicating and freely expressing opinions; love, enjoying wellbeing and openness; celebrating relationships; relationship between different generations and open sharing of knowledge throughout society; empathy, embracing each other, connecting with others, welcoming mistakes, patience, gratitude.

Figure 12. Plenary session on needs in sustainability transitions

Harvesting from the morning session

Up next, Mirijam facilitated the harvesting session of the previous plenary session. Each *table captain* presented the drawings they had overseen over the course of the three rounds, and summarised the main points discussed by their teams. In following are the most important points and ideas of Peter's (SPES), Maik Wuttig's (sociologist), Mirijam's (UFZ) and Adela Fofiu's (Aurora) groups:

1. **Education** – should emerge from inside to outside of the box; we should get new insights from our system. We need to find new ways of gathering knowledge – through collective learning. Curiosity is needed.

The idea of best practice is to show the individual how to do things; it is important to give examples.

- Cooperation between practitioners, scientists, education facilitates strong connections;
- It is important to spread the knowledge starting with the children;

Get out of the box, use your intuition, your body knows better. It is important to have knowledge on how to establish resources. Change starts with you yourself.

We need to start educating the younger generations, but in order to do that we need to educate ourselves first. Self-helping, empowerment is important;

2. **Resources** – the most needed resource is trust, which is a prior necessity. If we work together in this attitude of trust, we can cooperate, help each other, and find good leaders. The attitude of trust is your decision.

More attention is needed from politicians and scientists. Personal resources are important as well – we have to use our own abilities in the best possible way. Technology is important, too.

We don't need as many external resources; we should use the resources that we already have. Time resources are also needed.

We need people who can charmingly tell the sustainability story;

3. **Relationships** – we should have legal frameworks which allow freedom of expression. We shouldn't be afraid to communicate; every question is valid. This forms relationships in different ways. Relationships must be based on heartfelt, supportive and appreciative ways. We must try to cooperate instead of competing – this is how we can develop strategies in sustainable life styles.

All started by joint projects, by working together, and, especially, by celebrating. We must learn from others' mistakes. The connection with the mainstream facilitates the sharing of ideas and knowledge.

Bridges are needed between different social actors, between the academic, politics and practical. We are here to put the bridges in practice.

We need to connect with politics. We need spaces where we can meet without the internet. We need trust among each other and we need to trust in our destiny – it is worth to invest. We need cooperation, networks between us, between the politicians and common individuals.

There are many similarities, such as: changing the thinking patterns and education, cooperation- which is an important point on the meeting's agenda- as well as trust and self-help.

The ideas produced by the separate groups were also collected by Adrian and integrated into a single graphical representation. Following from the participant's emphasis on trust as an essential requirement, Adrian represented it as the tree's "trunk", forming a central need underlying all others, and from which multiple clusters branch out, representing domains such as academia, economics, the ex-change and dissemination of best practices, European and regional-level governance, as well as the co-creation of knowledge and solutions in cooperative networks.

Figure 13. Graphic recording by Adrian Popa: "Needs in sustainability transitions"

What do stakeholders need from scientists and vice versa?

In a new session the participants were split in groups of 4-5, made up of either scientists or stakeholders/non-scientists. The activity followed the principles of World-Café. At first the participants should answer two important questions regarding the collaboration between scientists and stakeholders:

1. Which experiences have you had with the other group so far and why was it difficult sometimes?

2. Keeping in mind the difficulties you have found, what could help to improve the cooperation between scientists and stakeholders?

In a very receptive and open atmosphere, numerous points and issues were quickly provided by the participants, with contributions from both scientists and stakeholders:

- scientists are too theoretical;
- scientists put too much trust in old systems; less money for scientists;
- finding the right scientists is difficult; scientists treat humans as case studies; scientists think with their brain, not with their hearts; scientists become frustrated or have to face external pressures if they don't publish ("Publish or perish!");
- the main difficulties are the lack of knowledge and cooperation as well as access to information; also reduced accessibility and patience;
- science must serve the community, not the ego of the scientist;
- access to research is marginalized;
- people are suspicious towards scientists, they want models;
- stakeholders would hire the scientists if they cooperated;
- scientists should integrate subjectivity into science;

- how to go from theory to practice; lack of stakeholders' experience in understanding the language of scientists; stakeholders have no patience and they are greedy;
- scientists think they have the monopoly on the truth; there is a gap between science and common people; lack of money and of accessibility;
- scientists are pressured by society, so there is a great need for having this conversation.

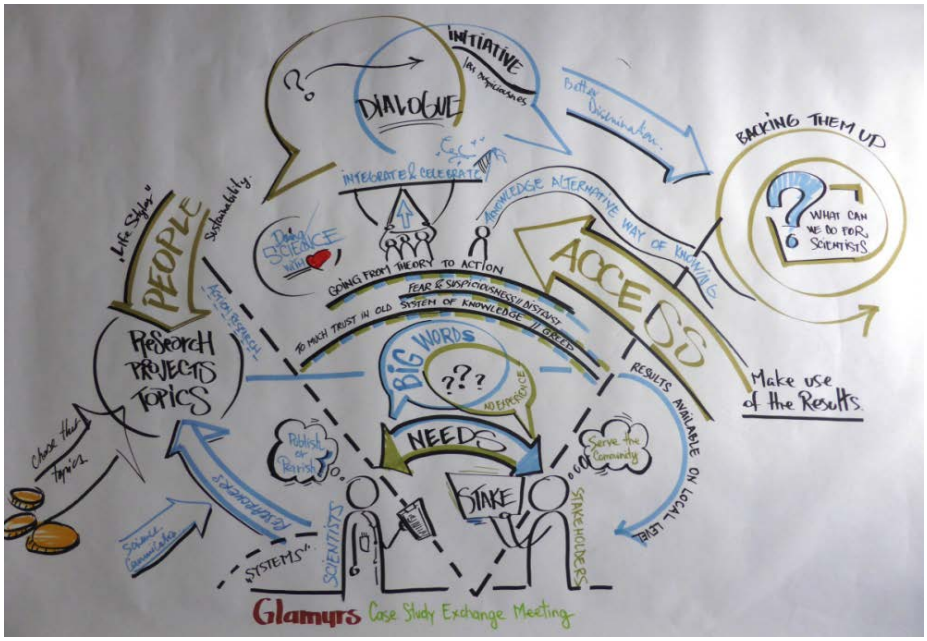

Figure 14. Graphic recording by Adrian Popa: "What do stakeholders need from scientists and vice versa?" session

Time and Space Session

The next plenary session was focused on Time and Space and their implications in transitioning to a more sustainable lifestyle. The session was facilitated by Claudian and his wife Filipa Simões, also a member of Aurora Community.

The session began with participants engaging in a relaxation exercise. They walked around the room and connected with each other. After that, the participants formed groups of 4-5 again and answered the following questions:

1. ***What are the challenges for the transition to a more sustainable lifestyle, taking into account time and space?*** (Additional questions: what is time and space for you? If you look at your life now, what is time and space? What are my challenges? Why don't I live a more sustainable lifestyle?)

2. ***What are the solutions to the challenges you have identified?***

After several participants had shared their responses with the group and had identified their respective challenges, the participants wrote down the solutions to these challenges on small post-its. Building on this, they tried to imagine themselves living a sustainable lifestyle and to draw the image they've formed in their minds. Some of the responses the participants wrote down on the notes referred to:

- creating a closer connection to nature; treating the world like a garden and applying principles of gardening in other areas of life;
- taking breaks; taking more time for listening, reflection and meditation;
- opening up public space for sustainability initiatives;
- supporting gift economy;
- recognizing one's own responsibility; self-efficacy;
- enhancing social acceptance of "slower" lifestyles; learning to occasionally remove yourself from day-to-day concerns and time pressure;
- conscious decision making and setting priorities;
- accepting failures, coming to terms with failure;
- getting some distance from "mainstream" systems;
- appreciating and embracing the different qualities of time;
- investing in education and publicity/dissemination.

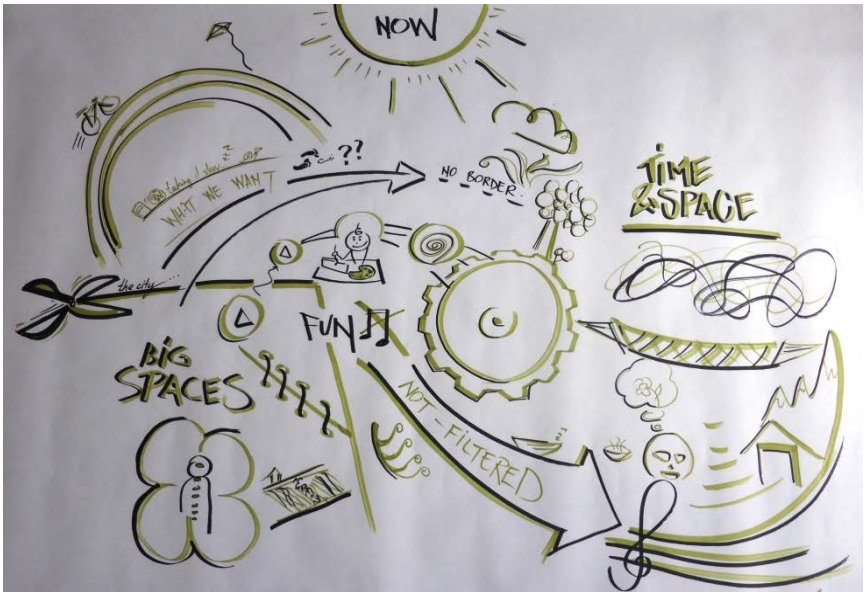

Figure 15. Graphic recording by Adrian Popa: "Time and Space" session

9.3. Day 3, 19 June - Practice Day

Location: *Stanciova, traditional Romanian village in Timiș County*

Facilitation of the day: *members of intentional community in Stanciova, Peter Jungmeier (SPES Zukunfts-akademie, Austria) and Mirijam Mock (UFZ, Germany)*

The third day of the exchange meeting was designed to build on participants' openness and increased comfort with working together to co-create ideas, visions and solutions, which were facilitated over the first days, and to further develop this participative group dynamic while focusing on tangible, practical outcomes.

This was achieved in two ways: first, by holding the day's sessions at the ecovillage initiative in the village of Stanciova, where participants were provided with the opportunity to experience the tangible realities of an alternative lifestyle within an intentional sustainable community first-hand. Second, most of the day's sessions were designed to facilitate participants' propensity for taking initiative, harnessing their collective intelligence, and spontaneously self-organizing in order to tackle significant challenges and to co-create practical solutions.

Welcome & Tour of village and surroundings from hosts at Stanciova

After the participants were welcomed by the day's hosts from the Stanciova ecovillage group, they started the opening session at the schoolhouse in Stanciova, which was facilitated by Teodora Borghoff, a long-time member of the intentional community initiative and current resident of the village. She introduced an icebreaker exercise called "The Human Orchestra", where the participants expressed their desire for a nicer, more sustainable life by producing a sound of their choosing. Next, Teodora gradually assisted the participants with turning the random cacophony of noises into a coherent, pleasant song, making an analogy to how the disparate views and goals of different people can end up as a unified, cohesive and lively initiative, paralleling the history of their own initiative.

Following Teodora's opening, the CSE participants were invited to join the guides on a tour through the village and the surrounding area. The participants had the opportunity to learn about the village and its inhabitants, their typical way of life, the history and socioeconomic characteristics of the region, the local fauna and plant life, and even enjoyed brief interactions with some villagers.

Figure 16. Participants visiting Stanciova village and surroundings

Open Space sessions

Afterwards, the participants reconvened at the schoolhouse for the remaining sessions in the day's schedule. As a contrast to the previous sessions, Peter and Mirijam started an Open Space session, explaining that there would be no established program for the next couple of hours. They opened up the space for anything the participants wanted to know or wished to speak about, and they asked people to write down the sessions they thought of on a flipchart. This Open Space schedule co-created by the participants included the following sessions:

- Meditation – hosted by Sara Albagli;
- Danube alliance, emerging opportunities for collaboration – hosted by Andrei and Claudian;

- The value of Slow in a Fast World – hosted by Adela;
- Filmed interviews with the participants – hosted by Kilian Immervoll, who took the video footage of the whole exchange meeting,
- Dissemination of information; information about the Brussels' workshop in November – hosted by Ricardo;
- Yoga class – hosted by Filipa;
- Introduction to Sociocracy – hosted by Andrei;
- Discussing and organizing the trip to Aurora – hosted by Vlad;
- Terra Livre, Earth Guardians – hosted by Claudian;
- walk& talk in the Stanciova forests, lesson about local plants – hosted by Mihaela Stamate.

After concluding their sessions, each host was asked to fill out a one-page feedback form as well, where they wrote down the participants who attended the session, the topic of the session, 3 main results of the session, and next steps. The forms were then collected by CSE co-organizers from SERI. The visit to Stanciova was concluded with participants and hosts forming a large circle in the school's backyard, sharing impressions and thanks, and reprising the group song from the opening session in the morning, before heading back to Timișoara.

9.4. Day 4, 20 June – Reflection Day

Location: *Timisoara Village Museum*

Facilitation of the day: *Peter Jungmeier (SPES Zukunftsakademie, Austria)*

The closing day of the Meeting was held at the Village Museum in Timișoara. It was intended to provide the participants with an opportunity not only to reflect on their experiences from the previous days, on the connection they've built with each other, but also to draw some conclusions, formulate some plans and set the stage for future meetings and collaborations.

First Reflection Session

The reflection session started and participants shared the ideas they produced when discussing the second question (***"Keeping in mind the difficulties you have found, what could help to improve the cooperation between scientists and stakeholders?"***) posed during a session held on the second day of the exchange meeting. The proposed solutions, presented by the teams' spokes-persons (Ambra, Alberto, Maik, Bogdan, Andrei), were as follows:

- Better communication between Scientists and Stakeholders;
- Development of a common language which can be understood by everyone;
- Cooperation and partnership to initiate crowd funding;
- Suspiciousness about academic aims;
- Providing theoretical basis for improving lifestyles;

- Listening/asking for initiative's needs; redirecting funds directly to the initiatives; making scientific results available for the people in the region;
- Stakeholder's demands and research on sustainability;
- Accepting alternative way of knowing; respect, openness
- Free technological knowledge, free access to knowledge; Connecting knowledge; knowledge, expertise, support;
- Researching with the heart and sharing; an inner science;
- Private or unknown researches should be raised up, their results must be honoured;
- Dialogue and practice, cooperation between science and practice;
- Scientists need partners from the society to get a better view on reality;
- People and the general public should decide on the research projects and hire scientists;
- Meet more often, prepare event meetings;
- The need for regular public disclosure – openness to on-going researches to decide their usefulness;
- Make results more transparent, so that the public can intervene
- We want to integrate, not separate;
- The aims of science must serve the people, not the system;

Figure 17. The reflection sessions

Second Reflection Session

Continuing from where the previous session ended, the 2nd reflection session proceeded with Peter inviting participants to form 3 groups, with a group-leader each, and to answer 2 questions:

- ***What has become really important to me in the last days?***
- ***Which are the next realistic steps after leaving?***

The first group, led by Andrei, shared several impressions that repeatedly stated their satisfaction from attending the exchange meeting, despite initial doubts or reluctance. They also stated joy for having their expectations exceeded, for having built genuine connections with different people in a diverse setting and acknowledgement of their shared beliefs, desires, and goals, which allowed them to work together in a meaningful and productive way. Ideas from the second group, led by Peter, revolved around the idea of exchanging and interacting with even more initiatives as well as the general feeling of joy and happiness felt by the initiative members who attended the meeting. The third group, led by Claudian, expressed their feeling of satisfaction with having done some good work over the course of the meeting, and also shared their ideas:

- More motivation; more knowledge; more gatherings; more cooperation between regions;
- The will to promote a simpler life;
- To have a deeper connection with what is happening in Europe;
- To see ecovillages emerging in Austria;
- To cooperate with scientists more often;
- To make a GLAMURS Facebook group;
- To realise how other things are more important in other countries;
- As a scientist, somebody wants to be more open and discover;
- There should be a newsletter to communicate little steps;
- To have another meeting like this one;
- To draw more attention to these initiatives;
- To meet people who are persisting in practicing sustainability;
- We need to consider the scientists' work much more;
- We think of a network along the Danube;
- Research and regional development go together;
- To learn more about tolerance and open-mindedness;
- It is useful to hear good ideas from other initiatives;
- To discuss serious subjects in a playful, joyful way;
- To enjoy the contacts and the knowledge, the co-creation of things;
- The design of the sessions allowed exchange and feedback;

Figure 18. Graphic recording of the reflection session by Adrian Popa

Check-out and official closing

For the check-out activity, Maik proposed an interesting individual feedback game. He shared Mongolian giant sunflower seeds with the rest of the group. Reasoning that one flower can inspire a lot of people he encouraged participants to plant these seeds. But, the main idea of this game is that participants were supposed to take a seed and give it to someone from the group with whom they had formed a special connection over the last few days and use this opportunity to give that person an individual feedback.

Concluding, Irina and Vlad expressed their gratitude and thanks to all the participants, stakeholders, scientists, and volunteers alike and highlighted appreciation for their exemplary contributions and active participation.

10. Appendix: Modelling Health Check Report

10.1. Introduction

The GLAMURS Health Check ran during the first quarter of 2016, and comprised two questionnaires. The first, aimed at the whole GLAMURS team, elicited a list of 29 different items that those submitting them hoped the modellers would respond to. The second, aimed at anyone in GLAMURS (not just in WP6 or WP7) who thought they had built (or were in the process of building) a model, required respondents to say, for each item in the check list, whether (and if so how) their model addressed the item.

The main table summarizing the first questionnaire is Table 1, which lists the item short name, together with an ID that supposedly (but probably does not quite (except in the case of Voluntary simplicity lifestyle) links items together that are related. The name of the submitter is included, and then a series of Boolean columns state, in order:

- Whether the submitter thinks modellers can just use their common-sense understandings of terms when reading what the submitter wrote explaining the item.
- Whether the submitter thinks all models in GLAMURS should address the item (rather than one or two).
- Whether the submitter is aware of an external dataset (i.e. one not collected as part of the GLAMURS project) that modellers could use with the item.
- Whether the submitter believes data on the item is being collected in one or more of the regional or initiative surveys.
- Whether the submitter believes data on the item will be gathered as part of the backcasting.
- Whether the submitter believes the item is policy-relevant, and if so (green highlight) whether there are policy documents modellers could access to read more about this.

The modellers' responses are summarized in Table 2, which may be seen as the main result of the health check exercise. The models described in that table are:

- WP7 – footprints (NTNU)
- TiPaC v8 (Hutton)
- DIReC v0 (Hutton – not finished at the time the health check was conducted)
- Co-ops v0 (Hutton – not finished at the time the health check was conducted)
- Vogelwijk_Mobilization_v1 (Delft)
- Good-Life model (Tillburg)
- Consumption Discrete Choice (Bath)
- Governance for sustainability (Bath)
- Private norms, social norms, income and environmental behaviour (Bath)
- Time Energy Use (Tillburg).

Although Table 2 effectively summarizes the results of the health check, there are further considerations that should assist deliberations about the degree to which models have already addressed, or (if they have not) should address the items. In the former case, it is important to understand the ways in which models might address an item (and relevant questions to ask). In the latter case, the reason the submitter believes the item to be important is relevant (as is the availability of data, though this is already summarized in Table 1 and will not be detailed further here – the GLAMURS Health Check Survey Results report contains more information on which regions and initiatives have survey or backcasting data on which items).

10.2. Means by which models address items

The original questionnaire included a number of options for modellers to express how their model addressed the item, not all of which were used. The following lists the various means that were used (including a few that were covered as 'other'), giving more detail on the corresponding column in Table 3. Hopefully this will then give non-modellers ideas for questions they can ask of modellers in assessing whether or not the model has addressed the item.

- *Input/Output/Internal variable/Attribute*: Typically, though not necessarily, such variables are represented as numbers, or possibly vectors of numbers. As a non-modeller, how do you feel about a concept being represented as a number? Further, the use of a number to represent something involves consideration of measurement theory – for example, is the number a nominal, an ordinal, or a cardinal? This consideration imposes constraints on the arithmetic and comparison operators that can meaningfully be applied.

- *Parameter*: Similar considerations as per variable. Here, there is the additional knowledge that the parameter acts to adjust the behaviour of a function – the way it produces output for a given input.

- *Function Now*: This suggests an inference or derivation: the way the item is modelled is as the capability to make an inference about the value one variable should have from those of others. Note that this does not mean that the item is necessarily the input or output variables concerned; rather that the item is itself the means by which that inference is made. The question is then whether the rules of that function constitute a reasonable representation of the inference that would be made in the real world.

- *Function Future*: This suggests the representation of the item as a process or a means by which a change of some sort occurs. As per *Function Now*, it is not necessarily the case that the item is represented by the domains or ranges of this function (the variables), rather that the item is represented as the function itself: the means by which variables in one time period are computed from (possibly other) variables in an earlier time period. The question is whether the function is a reasonable representation of the causal relationships among these variables in the real world.

- *Class*: The item is represented as a set or group of entities. It is not the individual members of that set, necessarily; rather the abstract grouping itself. Where classes have attributes (which are, essentially, variables), the fact that those attributes are attributes of the class may be relevant. Since this seems rather circular, consider 'age' as an attribute. There are some things that it is relevant to describe as having an 'age', and a class can be used as a conceptual grouping of those

things. So, the question would be whether the item can be understood as some kind of abstract grouping of things.

- *Relationship*: The item is represented as a matrix that connects entities by ties. Typically, that matrix has a 1 where the relationship exists between a pair of entities, and a 0 where it doesn't. However, it could also have a number between 0 and 1 representing a strength of tie, for example.
- *Patch*: The item is represented as a geographical region. The relevant question would be whether there is a spatial component to a conceptualisation of the item.
- *Equilibrium*: The item is represented as a point (or set of points) in some kind of abstract space (a group of variables) at which the rules defining dynamics (i.e. functions) do not lead to any net change. This concept combines variables, functions and, to some extent (through grouping of variables as the dimensions defining the space) classes.
- *Derivative*: A derivative is the gradient of a function. Just as for *Equilibrium* we are combining some earlier concepts. The item is to be understood as the shape of the way in which one set of variables (the range of the function) changes in response to a unit change in another set (the domain of the function). Hence, we are combining ideas relating to *Variables*, groupings of variables (which could be seen as a *Class*), and *Functions* (describing inferences or dynamics).
- *Scenario variable*: A scenario variable is a special kind of *Input Variable* that conceptually represents a part of a 'what-if' case for running the model. It would typically be associated with a specific case study or a backcasting vision or pathway.
- *Emergent outcome*: An emergent outcome is a special kind of *Output Variable* (or group thereof) that expresses some macro-level phenomenon that has occurred as a consequence of the rules determining the behaviour of micro-level entities.
- *Constraint*: A constraint is a rule determining limitations on decision-making, typically expressed as an inequality, but possibly also an equation. It defines a relationship among variables that must hold for a decision to be 'valid'.

10.3. Reasons why items were seen as important for modellers to address

The original questionnaire provided free text for submitters to explain why they thought it was important for models to address their item. Broadly speaking, these reasons can be categorized as per the list below, which form the column headings of Table 4 indicating the reasons given for each item.

- *Project commitment*. Basically, we said we'd do it, so we should.
- *Related to other concepts*. The item is related to other potentially important concepts in explaining why people engage in sustainable living.
- *Relates GLAMURS to other work*. Modelling the item would allow us to relate work in GLAMURS to other work on sustainability.
- *Integrates work in GLAMURS*. Modelling the item would integrate work in different areas of the GLAMURS project.

- *Critical evaluation of GLAMURS / visions*. It would enable us to evaluate the hypotheses underpinning GLAMURS and / or the backcasting visions more critically.
- *Interesting to policymakers*. It should be interesting to policymakers (often on the grounds that it might explain why people engage in sustainable lifestyles – see later).
- *Everyday behaviour*. It is an everyday behaviour and so has a potentially significant effect on the sustainability of lifestyles.
- *Characteristic of initiatives*. The item has been found or is hypothesized to be a characteristic of people engaged in one of the GLAMURS initiatives.
- *More sustainable*. The item is a more sustainable practice, or a part of living more sustainably.
- *Motivation / might lead to more sustainability*. The item has been found or is hypothesized to be a motivation for why people try to live more sustainably, or is otherwise something that might lead to people living more sustainably, even if of itself, it isn't necessarily sustainable as such (or would not relevantly be measured as sustainable – e.g. if it is a mental state rather than a practice or behaviour).
- *New view of sustainability*. The item provides a new, radical, broader or more encompassing or comprehensive perspective on what sustainability is, constitutes or is measured by.
- *Explains obstacles or unintended consequences*. Modelling the item would allow us to assess an unintended consequences of, or obstacles to the more widespread adoption of (supposedly) sustainable lifestyles, practices or behaviours.

10.4. Tables

Table 6. Summary of items on the health check list, with short name, person completing them, and various Yes/No (and N/S = Not Sure for Common-sense) answers. Colours are used to highlight important points (yellow), the non-availability of data (orange), and the provision of policy documents (green).

ID	Item short name	Name	Common-sense?	All models?	External data?	Survey?	Backcasting?	Policy-relevant?
1	To eat	Angelo	No	No	No	Yes	No	Yes
2	Capabilities	Julia	N/S	Yes	No	No	Yes	Yes
3	Social attachment	Maxie	Yes	Yes	No	Yes	No	Yes
4	Autonomy	Karen	Yes	Yes	No	Yes	Yes	Yes
5	Connectedness to Nature	Karen	Yes	Yes	No	Yes	Yes	Yes
6	Self experience	Maxie	Yes	Yes	No	Yes	No	Yes
7	Voluntary simplicity lifestyle	Karen	Yes	No	No	Yes	Yes	Yes
8	Social responsibility	Maxie	Yes	No	No	Yes	No	Yes
9	Authenticity	Karen	Yes	No	No	Yes	No	Yes
10	Self esteem	Maxie	Yes	No	No	Yes	No	Yes
11	Purpose in life	Karen	Yes	No	No	Yes	No	Yes
12	Group identification	Karen	Yes	Yes	No	Yes	Yes	Yes
13	Social influence	Maxie	Yes	No	No	Yes	No	Yes
14	(Participative and collective) efficacy	Karen	Yes	No	No	Yes	Yes	Yes
15	Professional balance	Maxie	Yes	No	No	Yes	No	Yes
16	Commitment	Karen	Yes	No	No	Yes	No	Yes
17	Political responsibility	Maxie	Yes	No	No	Yes	No	Yes
7	Voluntary simplicity lifestyle	Irina	Yes	Yes	No	Yes	Yes	Yes
18	Indirect effects of an environmental or sustainable mindset	Konstantin	Yes	No	No	No	No	Yes
19	Resource use	Fritz	Yes	Yes	Yes	No	No	Yes
20	Visions	Ines O	N/S	No	No	No	Yes	Yes
21	Sustainable initiatives	Moritz	Yes	No	No	Yes	Yes	Yes
22	Public transport	Ricardo	N/S	Yes	Yes	Yes	Yes	Yes
23	Pathway	Jaco	Yes	No	No	No	Yes	Yes
20	Visons: macroeconomic aspects	Jaco	Yes	No	No	No	Yes	Yes
24	Behavioural assumptions	Wouter	Yes	No	No	Yes	Yes	Yes
25	Adopting sustainable routines	Wouter	Yes	No	No	Yes	No	Yes
26	Mobilization for bottom-up initiatives	Wouter	Yes	No	No	Yes	No	Yes
27	Implications of a degrowth society: from macro to micro effects	Gibran	N/S	No	No	Yes	Yes	Yes
28	The rebound of having more sustainable lifestyle	Diana	Yes	No	No	Yes	No	Yes

Table 7. Summary of responses for each item/model combination. In the cells, N/A means no answer was given for the item, No means the modeller asserted the model could not address the item, Yes means the modeller asserted the model already addresses the item, and a number indicates that the modeller said they could address the item in the given number of person-days. Cells are colour-coded according to answer. Items with text highlighted in yellow are not currently addressed (by models in WP6).

Item	Footprints	TiPaC	DIReC	Co-ops	Vogelwijk	Good Life	Time Energy Use	Consumption	Governance	Norms
To eat	Yes	No	No	No	No	No	No	Yes	N/A	N/A
Capabilities	No	Yes	Yes	N/A	60	N/A	N/A	N/A	N/A	Yes
Social attachment	No	20	Yes	Yes	Yes	Yes	No	N/A	N/A	N/A
Autonomy	No	Yes	Yes	Yes	No	No	No	N/A	N/A	N/A
Connectedness to Nature	No	No	No	15	30	Yes	No	5	N/A	N/A
Self experience	No	10	No	No	No	No	No	N/A	N/A	N/A
Voluntary simplicity lifestyle	Yes	No	Yes	No	No	Yes	Yes	No	N/A	N/A
Social responsibility	No	No	50	No	No	10	No	Yes	Yes	Yes
Authenticity	N/A	No	No	0	60	No	No	N/A	N/A	N/A
Self esteem	N/A	No	No	No	30	No	No	Yes	N/A	N/A
Purpose in life	N/A	No	Yes	No	No	No	No	N/A	N/A	N/A
Group identification	N/A	30	Yes	Yes	Yes	10	No	Yes	N/A	N/A
Social influence	4	10	Yes	Yes	60	8	No	Yes	Yes	N/A
Participative and collective efficacy	N/A	No	No	Yes	90	No	No	N/A	N/A	N/A
Professional balance	No	30	Yes	No	No	No	No	5	N/A	N/A
Commitment	No	No	Yes	Yes	Yes	No	No	N/A	N/A	N/A
Political responsibility	No	Yes	No	40	No	No	No	No	Yes	NA
Indirect effects of an environmental or sustainable mindset	N/A	N/A	N/A	N/A	Yes	Yes	Yes	N/A	N/A	N/A
Resource use	Yes	Yes	Yes	30	No	Yes	Yes	20	Yes	Yes
Visions	N/A	30	50	30	N/A	N/A	N/A	N/A	N/A	N/A
Sustainable initiatives	Yes	10	No	N/A	N/A	N/A	No	30	N/A	N/A
Public transport	Yes	40	Yes	No	No	No	No	30	N/A	N/A
Pathway	No	No	No	Yes	N/A	Yes	Yes	N/A	N/A	N/A
Visions: macroeconomic aspects	4	N/A	N/A	N/A	No	Yes	No	N/A	N/A	N/A
Behavioural assumptions	No	Yes	40	No	60	Yes	No	Yes	Yes	Yes
Adopting sustainable routines	No	50	Yes	No	60	No	Yes	Yes	N/A	N/A
Mobilization for bottom-up initiatives	No	60	Yes	No	90	10	No	40	N/A	N/A
Implications of a degrowth society	N/A	No	Yes	No	N/A	Yes	No	50	N/A	N/A
The rebound of having more sustainable lifestyle	Yes	40	No	Yes	No	Yes	Yes	Yes	N/A	N/A

Table 8. Means of implementation of each item on the checklist indicated in Table 2 has having been addressed

Item	Input Variable	Output Variable	Internal Variable	Parameter	Function Now	Function Future	Class	Attribute	Relationship	Patch	Equilibrium	Derivative	Other	Diversity
To eat	1	1	1								1	1		5
Capabilities	3			1	2	2								5
Social attachment		1		1	1	1		1	2	1				8
Autonomy					3	3	2							4
Connectedness to Nature		1		1										2
Voluntary simplicity lifestyle	1	1		1	1			1			1			6
Social responsibility			1	1	2						1	1	Constraint	6
Self esteem				1										1
Purpose in life					1	1								3
Group identification			2	1	1	1		1	1		1			7
Social influence	1	1	1	2	3	2			2		1			8
Participative and collective efficacy					1	1								3
Professional balance					1	1		1						3
Commitment		1	1		2	2		1						6
Political responsibility	1			1	1									3
Indirect effects of an environmental or sustainable mindset		2	1											3
Resource use	1	5	2	1			1							5

Item	Input Variable	Output Variable	Internal Variable	Parameter	Function Now	Function Future	Class	Attribute	Relationship	Patch	Equilibrium	Derivative	Other	Diversity
Sustainable initiatives	1	1												3
Public transport	2	1		1	1	1								5
Pathway					1	1					1		Emergent outcome	5
Visions: macroeconomic aspects											1			2
Behavioural assumptions		1	1	2	4	1								5
Adopting sustainable routines		1	1	2										3
Mobilization for bottom-up initiatives				1										1
Implications of a degrowth society		1			1						1		Scenario variable	5
The rebound of having more sustainable lifestyle	1	2	1		1	1					2			6
TOTALS	12	20	12	17	27	18	3	5	5	1	10	2	3	

Table 9. Summary of reasons given for each item on the checklist. Highlighted items are recorded in Table 1 as being something that all models should address

ID	Item short name	Project commitment	Related to other concepts	Relates GLAMURS to other work	Integrates work in GLAMURS	GLAMURS / visions	Critical evaluation of policymakers	Interesting to	Everyday behaviour	Characteristic of initiatives	More sustainable	Motivation / might lead to more sustainability	New view of sustainability	Explains obstacles or unintended consequences
1	To eat							■		■				
2	Capabilities											■		
3	Social attachment						■				■			
4	Autonomy		■						■		■			
5	Connectedness to Nature										■			
6	Self experience						■				■			
7	Voluntary simplicity lifestyle						■			■				
8	Social responsibility						■				■			
9	Authenticity								■					
10	Self esteem						■				■			
11	Purpose in life								■		■			
12	Group identification										■			
13	Social influence						■				■			
14	(Participative and collective) efficacy										■			
15	Professional balance						■				■			
16	Commitment						■		■		■			
17	Political responsibility						■				■			
7	Voluntary simplicity lifestyle								■	■	■			
18	Indirect effects of an environmental or sustainable mindset						■							■
19	Resource use			■										
20	Visions	■												
21	Sustainable initiatives	■				■								
22	Public transport									■				
23	Pathway				■									
20	Visons: macroeconomic aspects					■								
24	Behavioural assumptions					■								
25	Adopting sustainable routines	■												
26	Mobilization for bottom-up initiatives					■								
27	Implications of a degrowth society: from macro to micro effects	■				■	■							
28	The rebound of having more sustainable lifestyle						■							■

10.5. Results from the discussion of the health check at the Delft consortium meeting

Health Check 1 - Plenary inputs for the health check

Moderator: Tony Craig

Tony Craig (James Hutton Institute, Scotland) – Health check session

- Tony Craig starts the session by explaining the underlying argument for the health check, i.e. that it's worth reflecting where important terms and notions in the project come from, and what they are intended for;

- he explains that the aim of this health check activity is to facilitate integration between different parts of the project, channelling everything towards policy implications;

- a further aim is that of getting a comprehensive overview of empirical aspects that the models should be addressing, and to check whether this is actually being done;

- Tony adds that if any issues emerge from the health check discussions and results, the consortium has the opportunity to address remedial actions during the course of the current meeting;

- the presentation then proceeds to the question of why are the items collected for the health check questionnaire important - Tony presents a rundown of the collected arguments;

- after compiling information from the first survey, there will be second survey for addressing the integrating the collected items: 10 models in total will be created;

- there are only 3 items on checklist that no model addresses;

- following the introductory presentation, Tony describes the group exercise that will take place in the next part of the session – several subgroups will be formed and each group will have to discuss 5 particular items out of the collected list; following this, each group will report its discussion in a plenary session;

- the consortium members attending the session were given the opportunity to add additional items that were not present in the health check report, and that the items were assigned to subgroups following a small exercise where people put a sticky dot on the item that they felt was most important to discuss. Those items with the most dots were prioritised for discussion.

- the session proceeds with the subgroup exercise.

Health Check 1 – Group1:

Facilitator: Anke Fischer

Participants: Gibran, Michael, Udo, Sjak, Julia, Moritz, Fridanna, Helena, Vlad, Maxie (Minutes)

5 concepts that were discussed:

- Connectedness to nature
- Group identification
- Sustainability initiatives

- Adopting sustainable behaviour
- Governance

1. Connectedness to nature

It was noted, that modellers have a different way of accessing this concept than psychologists. Psychological surveys (i.e. the initiative survey) measure connectedness to nature (CtN) with standardised scales (although the validity of these scales is unclear). Besides, it is normally used as an explanatory variable. Three items reflecting this construct had been included in the GLAMURS survey (e.g. "I think of the natural world as a community to which I belong.") and were answered on scale from "strongly disagree" (1) to "strongly agree" (7). By contrast, the modeller's approach would be to rather research "how much value is put into nature" in terms of monetary value. An extraction from the psychological approach could enrich the economic perspective by giving information about range and variation, percentage and indication of low/ middle/ high agreement, proportion of the sample and describing general patterns. Additional information about connections/ correlations with other constructs provided by the survey results would be helpful as well. Moreover, from a modeller's perspective, it would be interesting to investigate a preference for social interactions and the relations to CtN. Especially interesting are results which can be generalised for the broad population. A possible statistical relation to well-being (i.e. Backcasting results) was suspected as well.

Who knows about it?	*Who needs information about it?*	*What kind of information should be exchanged?*
• *OvGU Team →initiave survey data* • *Helena →Spanisch Backcasting Workshop* • …	• *Sjak* • *Michael* • *Gibran*	• *extract information by giving a range/ variation; info: percentage of high/middle/low answers; proportion in the population* • *Correlation* • *Preference for social interaction vs. CtN* • *results and follow-up literature*

2. Group identification

Different topics and considerations were mentioned. The identification with a group should be stronger the more important you perceive identification. Therefore it could be interesting to investigate the role of group identification for stability of groups. It was expressed group identification could play an intermediary role for descriptive norms and injunctive norms. Descriptive norms are related to what "most people do" in certain situations. Injunctive norms apply to moral and ethical accepted behaviours and what kind of behaviour certain groups approve or don't approve of. From a modeller's perspective it would be interesting to 1. Know how important group identification is and to which degree injunctive and descriptive norms are influencing behaviour and 2. How the strength of group identification influences different kinds of behaviour (consumption). Finding an answer to this question could be difficult because data is needed to distinguish whether the behaviour was adopted because it was understood as group behaviour or because someone wanted to do something differently (i.e. wanting to stand out from the crowd). Furthermore, the tipping point for behaviour change is interesting and it would be helpful to find information in the empirical data. In a second step, the variation in the subsamples in the behavioural items could be addressed as well.

How to continue?

For modellers it would be helpful to have one page of results written up. Conversely, it was proposed to discuss results of the empirical work in a workshop. The interviews (e.g.) can contribute a lot of information to clarify the process of joining (social aspect is very strong but procedural values are important as well → draw s.o. in → stay engaged →more deeply involved and so forth).

The group identified the search for a "pattern" in the data especially valuable for the integration of the empirical results into the models. Most important are the descriptions of the phenomena in the data. In a second step, researchers engaged in the modelling process provide characteristic values to quantify these for the models.

From a modeller's point of view it's interesting to explore if and how groups matter, with which group people identify with and which influence this has on specific decisions on behaviour (e.g. holiday destination → Bandwagon effect). Equally important is to have a closer look on the data related to motivations (e.g. initiative survey) with respect to similarities of interest of the initiatives. The Spanish Backcasting results already gave insight into people not being happy and not identifying themselves as part of a "higher engaged class fighting for common goods"

Furthermore, the discussion about group identification involved the topic of status. Status effect is an important variable in the view of economists. A series of questions emerged: Would everyone be better off, if status didn't play a role? Can the empirical data within GLAMURS say anything about people feeling worse because they are not meeting (status-) requirements? How does culture play a role (supposedly a big one)? It was discussed whether status is going to play a role in a sustainable future and which role this could be. On the one hand it was considered that status is expressed materially with sustainable products inheriting a lower footprint. On the other hand it

was argued that different material things might play a role for the initiative members and they might use an internal reference system. The difference would be how status is labelled. Following this line of arguments it would be helpful to explore status from the "inside" and have a look into the visions and the qualitative data (i.e. interviews, Backcasting). For future research it's a new perspective to have empirical data confirming status manifesting in a "nonmaterial" (or maybe better: in a low-footprint) way. In addition the idea was brought up to calculate an economic "vision model". The questions arise who has expertise for the status concept and who can define it? It was assumed some content in the visions could be used for further envisioning. Also an analysis of the self-expressing values (comparison initiative- region) could give some clues.

Who knows about it?	*Who needs information about it?*	*What kind of information should be exchanged?*
• *OvGU →initiative survey* • *Helena →Spanish backcating visions* • *Anke (or Irina for issues specifically related to motivations for joining an initiative) →Qualitative Interviews*	• *Sjak* • *Michael* • *Gibran*	• *What kind of issues can group create? Do you want to be the member of an exclusive group? Which kind of group? How dominant is this picture? Main reason to join an initiative?* • *Information about the process of joining: → What's the trigger? Start your own procedures? Is it like a habit once you are in the initiative? Does it get it easier? (motives?)* • *To what kind of groups are people referring?* • *group identification and its relation to descriptive and injunctive norms (positive or negative)* • *descriptive and injunctive norms: difference region/ initiative* • *Differences between initiatives (pattern?) → Variation in subsamples and behaviour*

- *To which degree influence injunctive and descriptive norm*
- *How much do you identify with a group → what to expect in terms of the behaviour (consumption)?*

- ***Status:*** *what is the signal?*
- *Replace the classic materialistic understanding? 1. Is status important 2. Can it be nonmaterial?*

→ in-depth analysis of self-expressing values

3. Sustainability initiatives

This concept is strongly linked to upscaling (and therefore topic of GLAMURS in whole). Moritz, who brought this concept in, saw it more related to the ABM. To contribute to these models research about what fosters innovation and what the initiatives would need to develop on a higher level (e.g. networks) is needed. The project TESS examined the trajectories of initiatives and can provide information on this matter.

It was discussed what exactly was meant by upscaling. Consequently not only spreading e.g. repair cafes can be addressed but instead something broader directly linked to the society and values. One point of view focussed on spreading a sustainable lifestyle in order to gain a footprint. In other words, this would focus more on the effect than on the initiative level. A contrary contribution indicated repair cafes in every block could also signal a societal change, because of the change in certain expenditure domains. One possibility to include these dynamic into economic models is to model R&D interventions. In summary sufficiency and eco-efficiency strategies are both needed and upscaling is meant in a double sense here. These ideas are especially interesting for policy implications.

Who knows about it?	*Who needs information about it?*	*What kind of information should be exchanged?*
• *Michael* • *Project TESS (e.g. coordinator Anne Holsten*	• *Modellers*	• *What fosters innovation and what would they need → network etc., what is the pattern?*

holsten@pik-potsdam.de)

- *Sjak*

- *Initiatives → why did it take off and why not?*
- *policy implications*

4. Adopting sustainable routines

The big question brought up was how routines can be changed. How is it possible to influence decision making considering some decisions are not made consciously? From the economic perspective people are behaving in a certain way and at some point an external influence (i.e. tax) triggers a change, which will take some time to manifest itself.

Decision making is not costless and there is only a limited capacity which can be used to make certain decisions. Add to this to foster change in personal routines often mayor lifestyle changes are needed (marriage, child birth, retirement).

The empirical data (e.g. interviews) offer information about the efforts and intrapersonal conflicts. Family responsibilities seem to have a strong influence in decision-making (e.g. provide good food). It would be interesting to search for patterns in the interview data, which relate context change to behaviour changes. People normally use heuristics, which they are aware of and also reflect these rules too. The focus group data provides different results and is worthy to be looked at. In the Romanian data people describe how habits developed in their family.

Who knows about it?	*Who needs information about it?*	*What kind of information should be exchanged?*
• *Vlad →Rom. Focus groups*	• *Modellers*	• *How important are routines and how do people reflect on that*
• *Anke or Ines Thronicker → Interviews, e.g., on use of heuristics*		• *Channel motivations to use heuristics? When, for what reason? When are they changed?*
• *Scottish survey →comparison*		• *Schwartz values (in connection to motivations)???*
• *Adina →Focus groups*		• *Relating context changes to behaviour changes*

comparison

- *1. BC Workshop*

5. Governance

This term was not discussed due to time restrictions.

It was proposed to have informal workshops/ skype conferences offered to all consortium members to participate to discuss in-depth further implications for the project.

HEALTH CHECK - GROUP 2

In our group the following items were discussed in depth:

- Social influence
- Commitment
- Mobilization for bottom-up initiatives
- Rebound of more sustainable lifestyles
- Wellbeing

SOCIAL INFLUENCE

The discussion with psychologists over this item was extremely useful for modelers, because it was an opportunity to refresh some concepts and get a better understanding of the different social and personal norms relevant to the models of sustainable lifestyles.

We focused on descriptive social norms, subjective norms, and injunctive norms, as the instance of social norms that look more relevant to models in WP6 at the moment.

Descriptive social norms are "what I see others doing". This concept looks close to what in economics has been addressed with social interactions, and is currently modeled by Bath within their evolutionary discrete choice models.

Subjective social norms are "what I see my 'relevant' others doing". 'Relevant' others may be members of the family, friends, but also public figures or representatives of particular initiatives.

Accordingly, subjective social norms look a concept close to what in economics has been referred to as "peer effects". This item is interesting and relevant to modeling in WP6, although not implemented so far. It represents a step up in complexity, by introducing a further dimension e.g. with the introduction of `groups' of individual agents. It links with concepts in psychology already addressed in the Bath – Roma discussion over the past year, and in particular with "group identity" and the so-called "meta-contrast ratio". The latter measures the individual motive to be similar to one's reference group together with the need to be different from another group.

IMPORTANT: subjective social norms are affected by personal norms, because they are interpreted through personal values and beliefs.

Injunctive social norm is "what I am expected by others to do", where 'others' are typically the society. A classical example of this norms are rules and laws.

There may be 'conflicts' between different social norms, as for instance between injunctive social norm and subjective social norms. An example of the latter is norms indicated by an environmental initiative like the ones in GLAMURS. It may well be that initiative indicate a behavior which is different from what society as whole indicates. Moreover, norms are not static, and can influence each other.

Sometimes the 'spatial' dimension is important for social norms. This is the case with "proximity influence" to motivate local effects in a social network structure.

A psychology theory that is relevant to subjective social norms and the example of initiatives is Minority Influence Theory, according to which the social influence of small groups is stronger than social influence from the entire society. This is due to a more pronounced identity of the small group.

The empirical dimension of social influence has been addressed in the second part of the discussion. There is an established approach, named Schwartz Values Questionnaire. It is made of 15 items, and has been used in the regional surveys (Anke Blobaum). This also involves individualism/collectivism measures. All this can be useful to calibrate the models.

COMMITMENT

This item sounds interesting and relevant, however it needs a more precise definition with exemplification.

To the extent that it relates to "personal norm" and to "internal ethical code", it may represent an individual motive that is 'personal' and complements social influence. In economic modeling terms, this is the idiosyncratic shock that is known to the individual, but not to others and not to the modeler. It falls then into the 'noise' that describes variability across individuals in random utility models and in particular in population discrete choice models –based on random utility - as the ones developed in Bath (Paolo Zeppini).

Commitment together with 'engagement' can be considered in relation to the role of groups and initiatives in shaping individual behaviour, as follows:

- Members of a group: they are committed by 'acting';
- Aspiration to a group: being 'engaged', 'aware', but not committed;
- Non-members: they are not engaged and not aware.

According to this classification, a model should consider three individual states, and a population discrete choice model should have three population fractions - only two, after normalization (Paolo Zeppini).

MOBILIZATION FOR BOTTOM-UP INITIATIVES

The main point of this item is scaling up initiatives to a considerable size in terms of followers/adopters in a society. Scaling up requires economic and social contexts, but in the initial stage we need mobilization.

Scaling up is then an issue that follows the stage of "joining an initiative". Interviews asked explicitly about the "barriers to join". Following this stage, relevant psychology theories for scaling up are Minority Influence Theory and Self-determination Theory.

Self-determination Theory relies on the following motives, as resulted from the qualitative interviews:

- Need for competence,
- Need to belong and relate to a group,
- Need to autonomy

Self-determination starts with 'learning', and can explain the motivation to join an initiative. The questionnaire for initiatives asked explicitly about 'motivation'.

From the interviews it resulted that initiatives have a 'core' leading group, and a larger group of 'followers'.

Within Bath group we learned from the Delft meeting that social motivation can be stronger than intrinsic motivation in the motivation to join an initiative, and "social approval" seems to be a

fundamental determinant of such motivation, possibly stronger than environmental motivation. Lucy O'Shea pointed this out during the discussion of Adina Dumitru's presentation.

It seems that a model of sustainable lifestyles should consider a driver made of the interaction between "intrinsic motivation' such as a personal norm, e.g. the environmental motivation, and "subjective social norm", in the form of "peer effects", giving place to "social approval". This also relies on the understanding that subjective social norms are interpreted through personal values and beliefs.

Intrinsic motivation and extrinsic motivation (e.g. money) can be reported as the two dimension of a motivation 2-dimensional plane.

This item looks a promising link between initiatives and models.

REBOUND OF MORE SUSTAINABLE LIFESTYLES

This item is one of the main points studied by the group at NTNU as a relevant factor of the environmental footprint.

Rebound is a very broad concept, and entails cases of unwanted side effects from a technology shock or a policy initiative. In terms of environmental footprint a rebound effect is always negative.

For instance, the adoption of a more energy efficient equipment can induce more energy use, and the fall in price of a harmful consumption good can induce to more consumption later on.

The presence of rebound effects adds to the uncertainty of policy interventions' outcomes, since these effects are by no means easy to anticipate and evaluate.

Rebound effects can be of economic nature, as income and substitution effects. A rebound effect from the market price of a consumption good is present in the Consumption Discrete Choice model developed at Bath.

In psychological terms rebound effects are difficult to explain, since what counts there are real motivations (Anke Blobaum). Possibly rebound in psychological terms could be captured by a "theory of regret" (Irina Macsinga).

Summarising, there are three main types of rebound effects:

- Accounting (economics),
- Technological,
- Behavioural.

The third types can also be positive, and is neutral regarding whether the effect is good or bad for the environment:

- Negative behavioural spillover: cleansing, or licensing;
- Positive behavioural spillover: consistency of behaviours.

One of the models developed in Bath addresses behavioural spillovers explicitly: it is a model of multiple discrete choice, where two or more decision categories interact in an individual. The model is intended to be empirically validated on a UK survey (UK Household Longitudinal Study), but could also be validated on the GLAMURS survey.

WELLBEING

There is empirical evidence of a positive correlation between life satisfaction and pro-environment behavior. This is just one component of subjective wellbeing. Other components are positive emotions and dominance over negative emotions.

Subjective wellbeing consists of different components:

- Psychological wellbeing
- Social wellbeing
- Physical wellbeing

Psychological wellbeing itself is characterized by 6 dimensions, according to the Ryff Theory of Psychological Wellbeing. These dimensions have been used in the questionnaire for all GLAMURS initiatives.

In economics, a number of empirical articles have focused on the concept of `warm-glow' (Andreoni), as a personal benefit that individuals derive from charitable giving. This can be used in the context of pro-environmental behavior (Paolo Zeppini). However, warm-glow does not have any psychological status. Instead, the same effect can be described in different ways, as for instance

- Acting in accordance with one's personal norm'
- A sort of moral benefit,

- Self-esteem.
- Feeling proud
- Do not want to feel guilty, no moral cost

The important point to capture warm-glow with psychological concepts is that it has to be 'personal', and not depend on social influence

In terms of micro-economic models, this personal moral benefit can be capture with a positive term in the utility that rewards the pro-environmental behavior, together with a noise term that accounts for the variability across agents (Paolo Zeppini).

CONNECTEDNESS TO NATURE

This item was not planned for this group. However, some discussions followed with other participants that are relevant to the arguments above. In particular, connectedness to nature can be the channel through which individuals weight environmental damage in their 'enlarged' utility function. The ore they are attached to nature, the more they care for environmental damage, and accordingly the more they internalize such damage in their (consumption, time, etc.) decisions. Psychological wellbeing is the positive terms that rewards individuals for this suboptimal decision.

Minutes Health Check 1 – Group Three:

Concepts that were discussed:

- autonomy
- voluntary simplicity lifestyle
- resource use
- motivations
- time affluence

Autonomy

This concept showed to be very differently defined by different disciplines. In addition to the original definition used in the initiative survey, it was explained that – in a more macro-economic sense – autonomy would be looked at in terms of e.g. autonomous exchanges, no dependencies on actions done by others or tasks. Another aspect that was mentioned covered the idea of being independent from labels. In agent based modelling, agents are treated as autonomous individuals. To explain the definition used in the survey, it was added that the implications of autonomy reach

into the role of social contagion and being less dependent on social constraints. Self-determination theory was brought into the picture (which defines autonomy in means of acting coherently throughout your entire life considering values and beliefs) and it was discussed that initiatives might yearn for this possibility – and it that sense, that autonomy could be linked to time scarcity and financial questions. If there was this kind of immediate relationship between the concept of autonomy and linked concepts, it could work for macro-economic models as well; i.e. life and market injections would lead to autonomy, different groups would need to be integrated in terms of their dependence on time and income while the market stays autonomous. However, it was also noted that the linked concept of 'time pressure' could become a problem, since it is not easy to model these kinds of social conditions. Nonetheless a connection between macro-economic models and the survey results was found to be promising.

Voluntary Simplicity Lifestyle

When discussing this idea, it was discovered that it was listed twice in the Health Check List. The carbon footprint for this kind of lifestyle can easily be calculated. The idea came up that – for further research interests – it would be great to have the opportunity of doing a consumer survey with a convenient sample of people who already adapted a voluntarily simple lifestyle to be able to compare carbon footprints. Another interesting aspect would be behaviour potentials, but some input from other sources would be needed. It was also discussed to use percentages of usage for desired lifestyle changes from the regional surveys as another way to feed in data.
In terms of economic models it was mentioned that if 100% of the people were to adapt another lifestyle, the models would easily collapse, since the entire economic structure would change. Starting from this point, we looked deeper into how people change their lifestyles, since some would do it in selected lifestyle domains, others would do an overall change, covering all domains. Information on this can be taken from the surveys. It would be interesting to analyse these changes both over time and from a content-related point of view.
In terms of enriching the definition for this concept, we found it to be strongly connected to de-growth and sufficiency. While discussing the relations to macro-economic models and agent based models, we also found it to cover a trade-off between material consumption and the time spent with family, for example. Within agent based models, it was discussed whether a voluntary simplicity lifestyle concept would be treated as a parameter (if this lifestyle was chosen because of an intrinsic motivation) or a mechanism (external motivation) – the latter would be very suitable for agent based models, since there are a lot of elements of interaction and tipping points to be modelled.
Another research question that was discussed covered the idea that intrinsic motivation should be higher in some members of initiatives than for others – how are different lifestyle domains affected by this? Maybe people started out with being extrinsically motivated to adopt a simple lifestyle and the concept became internalized to be treated almost as intrinsically over time.
The discussion was concluded by the idea to create models for one specific lifestyle domain for one specific region that could be used to be adapted for different regions and/or initiatives.

Resource Use

We mostly skipped discussing this one since it will probably be dealt with by everyone anyway and only made a few remarks on how footprint calculations by the NTNU team will mostly cover input were made.

Motivations

This concept was introduced as an addition to the list, so we started off the discussion with trying to find a common understanding. In most economic models, human beings are being treated as making rational choices when acting, which brought up the question of how rigid people's motivations are in those models and if motivational models would be suitable for having a deeper look into this. In example, the motivation to join sustainable initiatives or to adopt a sustainable lifestyle is more than just a rational choice; the decision could be motivated by e.g. benefits, but just as likely be morally motivated (to not damage the environment). Those motives should be treated as more than the calculation of costs of not consuming vs. costs of not damaging the environment alone. This, of course, depends on how motivation itself is actually calculated. We agreed that the whole concept would be more suited for psychological models – when it comes to questions of comparability, economic models can always be used though.

Time affluence

Time affluence is strongly linked to time pressure, which mostly means stress – time affluence is more of a 'neutral' term, describing the 'feeling of having enough time'. Essentially, one can have little time but doesn't need to feel pressured because one still has a lot of control over how to spend this little time. In economic models, this would be called time choice. It is strongly linked to the question of employment – unemployed people might feel they have too much time – employed people may not even wish for more time per se, but for more flexibility in spending their time. If one's work is meaningful, less time pressure is felt. In that sense, time affluence cannot be calculated out of working hours, contextual factors need to be considered as well. Two such related concepts could be time quality and purpose of life.
Since this concept consists of many dimensions, it is also important to note that only one aspect could be picked up in a model. – e.g. it would be difficult to model, if unemployed people were to engage in activities at home. The parameters for leisure time would have to be changed to explore this concept further.

General remarks

Group 3 arrived at the conclusion that it would be very useful to create something like a shared dictionary or a file that can be accessed by different project partners. In that file, people would be able to enrich each other's definitions of concepts and leave notes on how they use different concepts in different models etc.

It was also agreed that it shouldn't be an aim to try to use all kinds of models to explain all kinds of concepts or relationships between them. It would be better to choose those aspects that work for e.g. economic models to be looked at by those models and leave other concepts to e.g. psychological models. Modeling is not to be treated 'as a magic box'.

Summary

Item/Concept	*Who has information about it?*	*Who needs information about it?*	*Conclusions*
autonomy	*OvGU Team (initiative survey)* *Additionally: Romanian Team*	*Macro-Economists, Micro-Economists* *Agent Based Modelers* *Good Life Model*	*if adressed in models, both definitions should be considered (integration)*
		→ increases in time affluence will increase autonomy → will increase activity → will increase *- Sjaks good life model: time was increased →autonomy is automatically increased (?)*	
Voluntary simplicity lifestyle	*OvGU (Initiative survey)* *NTNU team (footprint calculations)* *UDC team (regional survey)* *Case Studies (Backcasting)*	*Good Life Model* *Carbon footprint* *Agent Based Models*	*→ could be added to Agent Based Models – where does input come from? → initiative members are motivated differently – you have joined initiative but your spouse hasn't – influences?* *→ models for food data ? → regional / initiative level? → not one model for each region, but something that can be adapted for different regions/initiatives?* *→ input can be taken out of system analysis!* *- networks are in that* *- model: how people influence others –how do preferences change?? Difficult to model?*

			- Gary is planning to model cooperatives – a mix can be done – focus is on governance, that could be expanded to initiatives etc
		'using as little resources as possible' → changes in material consumption, sjaks model: consume – negative impact on environment: good life – enjoy environment etc - direct link?	
Resource use	*NTNU team* *Surveys*	*Everyone?*	
Motivations	*OvGU team (initiative survey)* *Case Studies (Qualitative Interviews, Focus Groups, Backcasting)*	*Modellers*	
		- implement certain restrictions to calculations → but people normally don't calculate but use heuristics, rules of thumb *- fixed preferences – economic models* *- tools that can be used → slowly changing components* *- challenge of multi-dimensionality* *- fundamental elements can be put into macro models though*	
Time	*UDC team (regional*	*Modelers*	

affluence	*survey)*		
		- sjaks model: time affluence included – "good life" is connected to having time to enjoy nature etc – time affluence creates income increases consumption ? *- - macro-economic models can incorporate this – level of richness – just simulation → values of estimations needed of how people define employment* *- independent parameter needed to explore relationships*	
General Conclusions			*- models should quantify some relations and show them* *- useful for writing up results → all modelers to relate to some of these concepts, to use the same language and definitions* *- conclusions that can be directly used → final report integration of different parts of the project*

1.2.1. Session. Health Check Wrap Up. 16.15-17.00

Wrap Up

Anke Fischer presented the results from group one, Jaco from group two and Karen from group three. In general, participants perceived it as very helpful to hear the questions from modelers and to channel this information into questions addressing the empirical data. Adina mentioned that there is a need to complete the list of people having information on different concepts. All three groups reflected that the sessions was very fruitful and successful, especially the exchange between disciplines. The results (minutes) can help to make models more precise. Also models

have already grown since Trondheim. It would be useful to create something like a shared dictionary or a file that can be accessed by different project partners. In that file, people would be able to enrich each other's definitions of concepts and leave notes on how they use different concepts in different models etc. Furthermore a short list of the sessions topics should be circulated and people who can provide expertise on a certain topic can comment or put down their names for further discussions. Then a "menu" of models should be put together (which model, uses which variable, to which items in the list do they relate (working consensus which model covers what), remaining questions) and be circulated among modelers. They can use this possibility to calibrate their findings

Open questions are:

- Which models can be modeled and how? →refining before modeling
- Terms have different meanings in different disciplines and how can these meanings be related (i.e. warm glow and well-being)?
- Additional ABM suggested (on food)
- How are we going to work with the results of the session in the future of the project? → detailed minutes are provided and can be used as a starting point for future in-depth workshops → Carry on in smaller groups to discuss the selected topics

11. Appendix: Research implications of the first workshop with European stakeholders (Brussels, 19 November 2014)

11.1. Introduction and method

This document summarises the way in which the Brussels workshop with European stakeholders has been used to affect the GLAMURS project. Due to the conventional means of contracting GLAMURS as a research project, full transdisciplinarity is not practical. However, the GLAMURS project plan in the Description of Work provided tasks in this workpackage with the specific aim of exploring opportunities to better respond to the project's stakeholders as the project evolves, whilst not detracting from the research goals.

A meeting with various European stakeholders was organised in the Dissemination WP (8) on 19 November 2015; minutes of that meeting have been circulated separately. The process of determining the effect that workshop has on GLAMURS from henceforth began on 17 April in a Skype meeting between The James Hutton Institute and Universidade da Coruña. In that meeting, we agreed a method to use with the Consortium to elicit suggested changes to proposed work during the Trondheim meeting. Broadly, this consisted of the following:

- Agree on four themes emerging from the Brussels workshop minutes.
- Annotate the minutes document highlighting areas of the minutes relevant to each theme.
- Circulate the annotated minutes document around the Consortium prior to the meeting in Trondheim.
- In the Consortium meeting:
    - Present the Brussels workshop (Ines Omann)
    - Present the four themes (Gary Polhill)
    - Break out into four groups to discuss the impact of the theme in the meeting (themes led by Adina Dumitru, Ines Omann, Diana Ivanova and Tony Craig).

In each group, participants had a table to complete, structured in six columns:

- Point from the minutes to which we might make a response
- What we would do in the ideal world (with no constraints on time, money, etc.)
- Feasibility of making a response: (i) We are already doing it; (ii) We could do it with minor alterations to the workplan; (iii) We should do it but it would involve major changes to the research plan that would need agreement with the Commission; (iv) Any appropriate response would be completely out of scope for the project.

The four themes discussed in this case were:

- Concrete visions of alternative lifestyles with quantified environmental, social and economic impacts at the regional scale (led by Diana Ivanova)
- Examples of good practice and awareness-raising (led by Ines Omann)
- Policy landscape in the six domains and seven regions of GLAMURS, and support for adoption of alternative lifestyles (led by Adina Dumitru)
- Current and prospective regional differentiation (led by Tony Craig)
-

11.2. Results

In this section, the tables returned by each of the themes are collected.

Concrete visions

Point raised in the Brussels meeting minutes	**Ideal response**	**Out of scope?**	**Already doing it?**	**Minor changes?**	**Major changes?**
B-GOT (Beyond GDP/OIL/Tangibles)	Green growth and de-growth scenarios Links between levels of theories (from the micro to the macro) SWB as an indicator. An example was given about the Scottish government, which already uses different indicators to measure development and GDP is only one of them		X		
Changes in metrics and indicators of success (e.g. for companies and countries)	A multi-dimensional approach would be more satisfying but then which dimensions need to be captured to provide key measures. What are the trade-offs, conflicts and priorities? Make a recommendation about what is important and base policy integration on the result. The main contribution – the role of how group dimensions could inform social policies etc.		Yes, the survey		
How to design cities; how to influence where people want to live	The group was divided on this question. If viewed as a parameter which influences in the behaviour – within the scope; however, the evolution of infrastructure – not within the scope (which city structures sustainable? – you should be aware of this when designing policies). Jiaqi suggested that ABM can be used to assess the	X		X	

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?
	sustainability of different city designs – which could inform about urban planning and density. Others argued that it is not within the scope of the project. Ellen argued that the recommendations would vary greatly across the regions and the domains. Jaco agreed that the question is not systematically addressed within the project, though it could be explored through ABM.				
Changes in preferences and aspirations	This topic is present almost everywhere in the project (e.g. back-casting, agent-based models)		X		
Defining and quantifying lifestyles and sustainable lifestyles	Different parts of the projects adopt different definitions of sustainable lifestyles – and there could be differences between the conceptual definition and the result from an impact assessment (e.g. carbon footprint per capita meeting the 2 degree target).		X		
Quantification of likely uptake	Quantifying the likelihood of uptake is complicated. The back-casting can infer something about the conditions under which a lifestyle transition can be realized, not how likely it is. An initial stage will be for the policy leaders to facilitate such conditions for transition, and then one can talk about the likelihood of changing behaviour based on individual factors.	X			

Good practice

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?
Examples of good practice	Look for more examples, initiatives, include everybody. *- you always need examples where something already worked; this is what we're doing in the case studies – do we want to find more?* *- Q: how will the stakeholders access this knowledge? A: newsletter, CS Exchange movies, policy briefs* *examples of sustainable production – not yet included; some say it's beyond the scope – but what about food producers (included in case study)?* *- we have enough in the 7 CS's, should not look for more – but think about how to bring the rich material in a well-structured manner to the stakeholders;* *- **3 questions are all linked**: good dissemination -> raises awareness -> showcases, encourages good practices*	X			
Project should support awareness raising (necessity to change, env. issues, need for transition etc.) – citizens, companies, policy makers	Perfect synergy and involvement between researchers, members of academia and initiative members - low awareness of issues of sustainability, sustainable lifestyles – we have to provide really good examples of sustainable lifestyles, this will make things more clear for the wide audience - ideal: include multinational companies & co. in CS's & workshops - we tried to invite MP's to Brussels WS, but none were available/only 1 wanted to come – who has/can facilitate access to stakeholders at this level? - maybe make a film about the 7 CS's? maybe disseminate through initiatives' websites (transition networks, degrowth communities) - for policymakers: a "teaser" (1 minute film, 1 page document)			X	

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?
Knowledge networks are extremely important – not enough awareness about them, we should support them, bring them together (Help support networks, help them expand, spread awareness of them)	Long-term online platform/wiki/forum – maintained by SERI and afterwards somebody else, contributions from initiatives - CS Exchange – perfect for this - stakeholders should come together and think of programs they can do together – transition, spreading knowledge etc. - do we want something beyond the project (a database, a wiki) – budget, people? - GLAMURS website – CS section very short; maybe expand it? - maybe post Netmap results and the sort, ask initiatives to submit materials to the site (texts, videos), maybe tie this together with post-Exchange platform - non-scientific dissemination was promised by the project – necessary to improve this aspect				X
Dissemination of pro-environmental values as intrinsic motivation -> enacting sustainable lifestyles in communities	- we have both situations – pro-environmental intrinsic motivation, but also other motivations with pro-environmental outcomes - enacting sustainable lifestyles in communities – yes, we are doing it, the communities in CS's; ideally we would do it in a lot more communities, but not in this project		X		

Policy landscape

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?
Policy recommendations to businesses		**X [added]**			
Power structures and systems of provision more generally			Models: Lock-ins of current infrastructures interviews: calls for system change are taken up	Cooperatives???	
Social science support for adoption of new technology		X			
Internalising values; education			Interviews: Contextualising and explaining the call for education surveys; WP7 models		
How could lifestyles be influenced by policy			X		
New indicators	***There is:*** *Gibran: Needs-related consumption indicators (in different project); TESS is assessing all different types of impacts*		Sjak: Gross National Happiness?	Recommendations for new indicators to be developed (work life balance); suggestions for how to measure	

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?
New policies: Work life balance, Ecolabelling and general regulatory framework around production and consumption			Christian?	Bath: Including work-life balance in models	
Political will	***Ideally**, endogenised policies could be integrated in the models. Perhaps through scenarios*			ABM: Discuss whether minor, major or out of scope	
Map of the current policy landscape and how it COULD influence lifestyles	***Ideally**, policies in all six domains and at all levels would be assessed with regard to their influence on lifestyles. **There is** Christian's milestone from UBATH on EU level policies. TESS is doing it with regard to initiatives, but not with respect to lifestyles.*		Include this question in backcasting workshops	WP4&5: Ask initiative representatives about their view on policies' impacts, combine it with expert knowledge.	
How is GLAMURS addressing policy-making processes in the six behavioural domains?					

Regional differentiation

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?
Sustainable lifestyle is contingent on cultural background	*Qualitative interviews as well as the focus groups refer to it (coding of the focus groups as well as the interpretation of the interview analyses)*		x		
cultural diversity within Europe	*Drawing out of the diversity will hopefully become more salient in Deliverable 5.1 (net map, interviews, focus groups). Also during the case study exchange (referring to the research questions from Gary)*			x	
common ground for sustainable Lifestyle policies	*We assume, that most of the GLAMURS results should have this function??*		x		
dialogue between north and South		x			
a deconstruction of certain constructs	*We are anticipating that backcasting Is going to refer to it? FOCUS groups (partly), and WP 6*			x	
identify potentialities of regions	*There will be no empirical data input from the case studies. It might take place in the backcasting workshops. However, probably not for all of the case studies..*		x		
taking diversity of lifestyles more in consideration by combining both, material assets and cultural influences		x			
Taking into Account the Social differentiation of groups	*misunderstanding: should not be blue?*				

Point raised in the Brussels meeting minutes	Ideal response	Out of scope?	Already doing it?	Minor changes?	Major changes?
Considering the increase of an aging society	*Data from the survey is expected to provide some information on this topic. Different data analyses will be possible (Survey, ABM)*		x		

11.3. Summary of action points

For each of the points raised in the meeting to when each of the themes prepared a response, we consider the following:

- Actions
- Workpackages and deliverables affected
- Expectations to manage (constraints / scope)

Points raised by the workshop that we are already addressing

Numbers of points raised in the workshop were deemed already to be part of the project with existing plans addressing them. However, these still may involve action points to ensure that project reporting addresses the points, and to manage expectations about how we are addressing them.

- Beyond GDP/Oil/Tangibles – being addressed by green growth and degrowth scenarios in the macroeconomic work, and linking micro and macro theories.
- Change in metrics and indicators of success – planned in the survey
- Changes in preferences and aspirations – the topic is present everywhere in the project
- Defining and quantifying lifestyles and sustainable lifestyles – different parts of the project are adopting different definitions of sustainable lifestyles, and there could be differences between the conceptual definition and the result from impact assessment
- Dissemination of pro-environmental values as intrinsic motivation and enacting sustainable lifestyles in communities – we are also looking at other motivations with pro-environmental outcomes, but the work with communities is confined to the case studies.
- Power structures and systems of provision more generally – models are looking at lock-ins due to existing infrastructure, and the interviews are looking at calls for system change.

- Internalising values: education – interviews are contextualising and explaining the call for education and WP7 models
- New indicators – Sjak is looking at Gross National Happiness
- New policies – Christian?
- Map of the current policy landscape and how it could influence lifestyles – this is planned for the backcasting workshops.
- Sustainable lifestyle contingency on cultural background – qualitative interviews and focus groups
- Common ground for sustainable lifestyle policies – assumed part of GLAMURS results
- Identify potentialities of regions – no empirical data, backcasting may handle it but not for all case studies
- Considering the increase of an aging society – Survey and ABM.

Points raised by the workshop that are deemed out of scope

- How to design cities; how to influence where people want to live – Planning issues are not part of GLAMURS. Housing is considered in terms of its status (building fabric) and energy consumption, rather than location. A small part of this question is being examined in the agent-based model DIReC, if feasible, but the residential choice part is seen more from an individual perspective rather than designing cities.
- Quantification of likely uptake – Although some information on uptake is possible from the backcasting, largely in the form of the conditions under which it might occur, the project simply doesn't have access to data (or staff time to analyse it) that would allow this sort of quantification to take place (if it were even feasible).
- Examples of good practice – Note that the TESS project, funded under the same scheme, has Aberdeenshire as a case study, and has documented numbers of other examples of good practice in the area. Task 2.5 in WP2 also encourages looking for further examples beyond the seven case studies. There are therefore sufficient examples in GLAMURS already.
- Policy recommendations to businesses – This is too far outwith the remit of GLAMURS for us to consider it.
- Social science support for adoption of new technology – GLAMURS is not studying new technologies, so cannot provide this.
- Dialogue between north and south – Although the case study exchange programme will in some sense encourage this, it is not the reason for which this programme was initiated. The

theme of any perceived north/south divide in Europe is not one GLAMURS has set out to explore or analyse.

Points raised by the workshop that require minor alterations

Point	**How to design cities: how to influence where people want to live**
Action 1	Modify TiPaC to include an urban population density parameter among the treatments, using the 8-fold classification of accessibility in Scotland. This will allow the exploration of scenarios where people are more, or less likely to live in urban areas than now.
WP affected	WP6, Task 6.5
Persons responsible	Jiaqi Ge, Gary Polhill
Constraints	This will only show how different scenarios of urban density affect commuting time and CO_2 emissions arising from commuting.
Agreement to proceed?	The feature is already implemented in the model following the November 2014 Brussels meeting, and is being included in the current simulation runs.

Point	**Project should support awareness raising (necessity to change, env. issues, need for transition etc.) – citizens, companies, policy makers**
Action 1	Invite representatives of multinational companies in case studies and workshops.
WP affected	WP8, Task 8.5
Persons responsible	Moritz Kammerlander, Gillian Stirton
Constraints	Details of relevant organisations to invite and contacts need to be sought
Agreement to proceed?	This has already been suggested for the next workshop, but no formal decision has been made yet
Action 2	Make a film about the seven case studies
WP affected	WP8
Persons responsible	Moritz Kammerlander, case study lead contacts.
Constraints	Access to case studies needs to be sought.
Agreement to proceed?	Not yet acquired.
Action 3	Disseminate findings through initiatives' websites

WP affected	WP8, WP5
Persons responsible	Case study lead contacts.
Constraints	We need to have findings that will interest the initiatives enough that they will consider it interesting to their audiences and put them on the website. We need to avoid confusion about what, precisely, the findings mean.
Agreement to proceed?	Not yet obtained
Action 4	Make a teaser film for policymakers
WP affected	WP8
Persons responsible	Moritz Kammerlander
Constraints	The film would only be seen by those who view it on YouTube or our website.
Agreement to proceed?	Not yet obtained?

Point	**Power structures and systems of provision more generally**
Action 1	Studies of co-operatives and modelling thereof
WP affected	WP5, WP6
Persons responsible	Adina Dumitru, Giuseppe Carrus, Gary Polhill
Constraints	Will probably have to be a conceptual model since commitments to data gathering have already been made.
Agreement to proceed?	We have already agreed to model co-operatives as a second ABM case study. The minor change involved is to ensure that this model somehow addresses power structures.

Point	**New Indicators**
Action 1	Recommendations for new indicators to be developed (e.g. work-life balance); Modelling of Gross National Happiness
WP affected	WP6 (macro), WP7
Persons responsible	Sjak, Gibran

Constraints	?
Agreement to proceed?	?

Point	**New policies: work-life balance, ecolabelling and general regulatory framework around production and consumption**
Action 1	Include work-life balance in models
WP affected	WP6
Persons responsible	Bath team
Constraints	?
Agreement to proceed?	?

Point	**Political will**
Action 1	Endogenise policy choice in the ABM (e.g. agents periodically vote for parties endorsing different policies)
WP affected	WP6, Task 6.5
Persons responsible	Jiaqi Ge, Gary Polhill
Constraints	The voting model will need to be very simple, probably along the lines of people voting for something different if they are unhappy.
Agreement to proceed?	To be discussed, depending on progress with DIReC.

Point	**Map of the current policy landscape and how it could influence lifestyles**
Action 1	Ask initiative representatives about their views on the impacts of policies, and combine with expert knowledge
WP affected	WP4, WP5
Persons responsible	Jaco, case study teams
Constraints	There are no policy experts on the team, though Christian has a milestone from UBATH on EU level policies. The project can address this by including questions on

	policy in backcasting scenarios, and asking case study representatives about their view on how policies have affected them.
Agreement to proceed?	Not yet obtained.

Point	**Cultural diversity within Europe**
Action 1	Draw out diversity themes from analysis of net mapping, interviews, focus groups and case study exchange, when writing up D5.1
WP affected	WP4, WP5
Persons responsible	Case study teams
Constraints	?
Agreement to proceed?	Not yet obtained?

Point	**A deconstruction of certain constructs**
Action 1	Ensure this is addressed in backcasting
WP affected	WP5
Persons responsible	Jaco
Constraints	?
Agreement to proceed?	?

Points raised by the workshop that require major alterations

Point	**Knowledge networks are extremely important – not enough awareness about them. We should support them, bring them together (help support networks, help them expand, spread awareness of them).**
Action 1	Case study exchange. See case study exchange proposal document.
WP affected	WP2, Deliverable 2.1. No specific task in the DoW for this activity.
Persons	Irina Macsinga, Moritz Kammerlander, Ines Omann, Adinu Dumitru, Gary

responsible	Polhill
Constraints	The knowledge network we support in GLAMURS will be defined by the attendees at the case study exchange.
Agreement to proceed?	Obtained from Ricardo on 11 April 2015
Action 2	Expand the case study section of the website
WP affected	WP8, Task 8.3
Persons responsible	Moritz Kammerlander, Case study partners (NN)
Constraints	The website will only affect those who visit it; information on the website will only pertain to case studies in GLAMURS.
Agreement to proceed?	Not yet obtained.
Action 3	Long-term online platform/wiki/forum maintained by SERI and afterwards by someone else with contributions from initiatives. This was raised as a 'follow-on' to the case study exchange programme in an early version of the case study exchange proposal.
WP affected	WP8, Task 8.3
Persons responsible	Moritz Kammerlander
Constraints	Not currently budgeted for in the GLAMURS project
Agreement to proceed?	Not yet obtained.

11.4. Conclusion

The project's reflection on the feedback we have received from the Brussels workshop has identified one major area where it should change what was proposed. A plan has already been prepared and implemented to address that area. The implementation of alterations responding to other feedback requiring minor adjustments to the project plan will need to form the subject of future discussions among the project team.

12. Appendix: The GLAMURS Glossary

12.1. Aim of GLAMURS Glossary

The general purpose and aim of GLAMURS Glossary is the development of a word list – or terminology review – in order to coordinate activities related to the connection between empirical research and modelling in the different microeconomic, macroeconomic and agent frameworks, within the GLAMURS project research field.

The glossary will facilitate communication and understanding between team members, and thus it will enhance the effectiveness of the decision-making process associated to the project.

12.2. Description of GLAMURS Glossary

The GLAMURS Glossary of terms and definitions include a comprehensive review of concepts that partners involved in the project consider that are relevant for the purpose of GLAMURS research in general, or concepts that are considered that affect a given project work package in particular.

Each project partner -specialist or every differential disciplinarily team- have provided a list of between 10 and 20 words, with their definitions and their different meanings, as starting list or draft glossary, within the conceptual jargon of its discipline. Unless necessary for better understanding and clarity, the definition should not exceed 80 words as a general norm.

12.3. Terms

Items listed under **A**

Abilities

Abilities are given or acquired cognitive, physiological, and emotional competences to act. *(Definition from UFZ)*

Agent-based computational economics (ACE)

It is the computational modelling of economic processes (including whole economies) as open-ended dynamic systems of interacting agents. ACE modelling is analogous to a culture-dish laboratory experiment for a virtual world. Starting from an initial world state, specified by the modeller, the virtual world should be capable of evolving over time driven solely by the interactions of the agents that reside within the world. No resort to externally imposed sky-hooks enforcing global coordination, such as market clearing and rational expectations constraints, should be needed to drive or support the dynamics of this world.

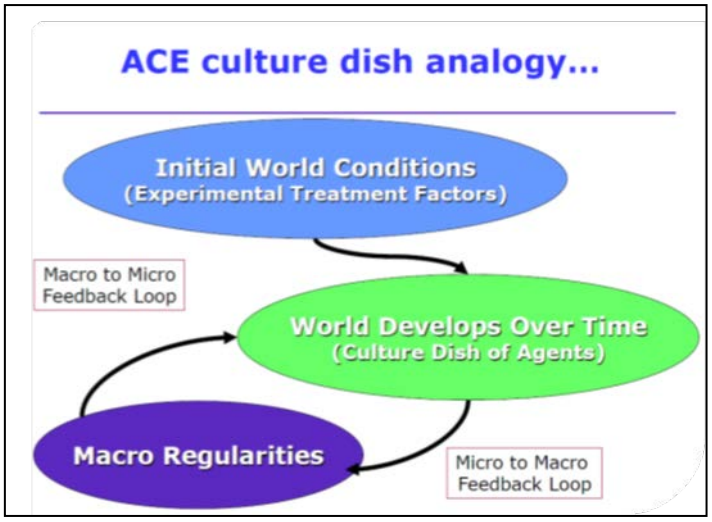

Figure 19. (See Leigh Tesfatsion. *ACE Tutorial Presentation*. http://www2.econ.iastate.edu/tesfatsi/ace.htm. Accessed: 17/09/14)

Current ACE research divides roughly into four strands differentiated by objective:

- Empirical understanding
- Normative understanding
- Qualitative insight and theory generation
- Methodological advancement (Borril & Tesfatsion,2011)

(See also http://www2.econ.iastate.edu/tesfatsi/ace.htm)

(Definition from JHI)

Actor

An actor is an individual person, a group of persons or an organisation. Actors are part of a network; within an initiative there are actors or networks of actors. You can either use their name (Tim Miller) or their role (representative of the community. *Taken from Network Analysis guidelines by UFZ. (Definition from TUD)*

Adaptive beliefs

Economic agents make decisions based on their beliefs and those beliefs may adapt to changing conditions. In particular, an individual's decision frame responds to a state variable, e.g. the price of a product, the fraction of agents choosing a particular option, etc.. *(Definition from UBAH)*

Agents

Refers broadly to a bundle of data and methods representing an entity residing within the dynamic simulated system. Examples of possible agents include: individuals (e.g., consumers and

producers); social groupings (e.g., households, firms, communities, and government agencies); institutions (e.g., markets and regulatory systems); biological entities (e.g., crops, livestock, and forests); and physical entities (e.g., infrastructure, weather, and geographical regions). Agents can also be composed of other agents, permitting hierarchical constructions. In various degrees, agents are capable of:

- adaptation to environmental conditions,
- social communication with other agents,
- goal-directed anticipatory learning, and
- autonomy (self-activation and self-determinism based on private internal processes), (Borril & Tesfatsion, 2011).

(See also http://www2.econ.iastate.edu/tesfatsi/ace.htm)

(Definition from JHI)

Agent-Based Modelling (ABM)

It is the computer simulation modelling of systems as collections of heterogeneous interacting entities (agents) with encapsulated functionality that operate within a computational world. (See also http://www2.econ.iastate.edu/tesfatsi/ace.htm) *(Definition from JHI)*

Altruism

Concern for others. Environmental concern may be a form of altruism. *(Definition from UBAH)*

Assertive behaviour

Behaviour which enables a person to act in his or her own best interest, to stand up for herself or himself, without undue anxiety, to express honest feeling comfortably or to exercise personal rights without denying the rights of others. *(Definition from UVT)*

Attitude

A psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor. *(Definition from UVT)*

Attribute

In OWL, attributes are called datatype properties. They provide a vocabulary for describing individuals according to data values, such as age or date of birth (See http://www.w3.org/TR/2012/REC-owl2-primer-20121211/#Datatypes). *(Definition from JHI)*

Attribution Theory

Attribution is the process by which individuals explain the causes of behaviour and events. Attribution theory is the study of various models that attempt to explain those processes. *(Definition from UVT)*

Items listed under **B**

Backcasting

Backcasting literally means looking back from the future. It can be defined as "generating a desirable future, and then looking backwards from that future to the present in order to strategize and to plan how it could be achieved" (Vergragt & Quist, 2011: 747). *(Definition from TUD)*

Behaviour

Behaviour is the range of actions towards the social and physical environment. It is a response to various stimuli or inputs, whether internal or external, conscious or subconscious, overt or covert, and voluntary or involuntary. Behaviour can be observed objectively (http://en.wikipedia.org/wiki/Behaviour). For Glamurs, it is essential to agree on the level of the behaviour in order to operationalized it, i.e. is it defined as "daily water usage", "number of baths", "way of washing-up", and so on? *(Definition from UFZ)*

Bounded rationality

When making decisions individuals/agents possess limited information and computational ability. Thus, they make resort to simple rules or heuristics instead of following optimal rules derived from the assumption of perfect rationality. (See definition of rational expectations below.) *(Definition from UBAH)*

Items listed under **C**

Carbon footprint

The "carbon footprint" of a functional unit is the climate impact under a specified metric that considers all relevant emission sources, sinks, and storage in both consumption and production within the specified spatial and temporal system boundary. Other names that refer to it are "consumption based emissions" or "consumer emissions". The total global long-lived greenhouse gas emissions of a system is aggregated using 100-year global warming potential (see Global Warming Potential (GWP)), hence, greenhouse gases with various radiative properties are compared and weighed for a time horizon of 100 years. *(Definition from NTNU)*

Carbon leakage

In general, the greenhouse gas (GHG) emissions that occur outside of a country in order to satisfy its final demand. Weak carbon leakage (or demand-driven carbon leakage) in a country refers to the GHG emissions outside of that country in order meet domestic consumption (i.e. emissions embodied in imports). Strong carbon leakage (or policy-induced carbon leakage) describes the increases in GHG emissions outside of a country due to climate policy in that country. *(Definition from NTNU)*

Class

A class defines a group of individuals that belong together because they share some properties (See http://www.w3.org/TR/2004/REC-owl-features-20040210/#Class). A class can be considered as a label for a set of individuals – for example, the class of Adults (by convention classes are given an initial capital letter) is the class of Persons who are 18 or more years old. As the above example shows, classes can be subclasses of each other (Adults are a subclass of Person because all Adults are persons). Other terms from set theory (intersection and union) can also be applied to class descriptions. (See also: http://www.w3.org/TR/2012/REC-owl2-primer-20121211/#Classes_and_Instances). *(Definition from JHI)*

CO_2-equivalents

Measure to express the emissions of different greenhouse gases in one single unit, i.e. the global warming potential of a tonne of CO2. *(Definition from NTNU)*

Cognitive schema

Is a structure of knowledge derived from experience containing information organized around a particular concept. *(Definition from UVT)*

Community resilience

A capability of a community to anticipate risk, limit impact, and bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change. *(Definition from UVT)*

Consumption-based emissions (or carbon footprint)

The global supply chain emissions associated with the delivery of a certain set of goods and services for final consumption. *(Definition from NTNU)*

Consumption categories

Footprint analyses can allocate total environmental footprints among categories of consumption, typically Food, Shelter, Mobility, Goods (Manufactured Goods, Clothing etc.) and Services. Consistent categorization across studies allows for comparison of the footprint of individual consumption components across regions, and the relative contribution of each category to the region's overall footprint. To avoid double counting of environmental impacts coming from the production of goods and services, it is important that consumables are allocated to only one consumption category. *(Definition from NTNU)*

Contemplative practices

Activities aiming at revealing, clarifying and making manifest the nature of reality. Broad sense: Practices intending awareness and communion (religious or secular). Narrow sense: Practices leading to inner change in terms of mindfulness, compassion and pro-environmental orientation. (*Definition from UFZ)*

Consensus-based decision making

Consensus decision-making tries to avoid "winners" and "losers". Consensus requires that a majority approve a given course of action, but that the minority agree to go along with the course of action. In other words, if the minority opposes the course of action, consensus requires that the course of action be modified to remove objectionable features. *(Definition from UVT)*

Coping Strategies

Coping is expending conscious effort to solve personal and interpersonal problems, and seeking to master, minimize or tolerate stress or conflict. The effectiveness of the coping efforts depend on the type of stress and/or conflict, the particular individual, and the circumstances (http://en.wikipedia.org/wiki/Coping_(psychology)). We distinguish 2 broad types of coping strategies:

- problem-focused: Directed towards reducing or eliminating a stressor, adaptive behavioural.
- emotion-focused: Directed towards changing one's own emotional reaction (also via challenging one's own assumptions).

For Glamurs, coping strategies are relevant in terms of dealing with internal conflicts, time scarcity, difficulties in adopting a sustainable lifestyle, or dealing with certain governance policies. (*Definition from UFZ)*

Items listed under **D**

Defensive coping

The state in which an individual has a repeated projection of falsely positive self-evaluation based on a self-protective pattern that defends against underlying perceived threats to positive self-regard. *(Definition from UVT)*

Description logics

A family of logics used for describing things, which form the basis of ontologies. The logics are named according to the descriptive terms they allow you to use; more terms means higher 'expressivity', but typically less tractability of reasoning. *(Definition from JHI)*

Descriptive model of decision

Descriptive model of decision assumes that the decision maker has a limited rationality and will choose the alternative that satisfies a specific need at time. *(Definition from UVT)*

Discrete choice

A decision environment where agents have two or more options to choose from, e.g. green and brown goods / activities. This is an alternative way to modelling choice when the decision variable is assumed to be continuous, e.g. level of consumption. *(Definition from UBAH)*

Dispositional factors

Individual characteristics/internal drivers that affect choice, e.g. age, income, personal norms, environmental concern etc. *(Definition from UBAH)*

Driver

An individual's personal drive is often the starting point of motivation. This drive helps individuals focus on specific goals they wish to achieve or how they wish to improve their life. *(Definition from UVT)*.

Downshifting

Is a social behavior or trend in which individuals live simpler lives to escape from the materialism and to reduce the stress, overtime, and psychological expense that may accompany it. As a concept, it shares many characteristics with simple living, but is distinguished, as an alternative form by its focus on moderate change and concentration on an individual comfort level, a gradual approach. *(Definition from UVT)*

Dual-process models

Distinction between human processes that are fast, automatic, and unconscious (also defined as 'hot') and those that are slow, deliberative, and conscious (also defined as 'cold'). Human behaviour results by interaction of these processes. This macro theoretical account represents the framework of the most popular psychological models currently available in the literature. *(Definition from UNIROMA3)*

Items listed under **E**

Ecological footprint

An aggregated indicator intended to be a proxy of environmental impact by estimating a hypothetical area (footprint) of biologically productive land needed to support the consumption of products and services, or at the aggregate, countries. It can be calculated via many of the existing methods for embodied emissions and land use calculations. *(Definition from NTNU)*

Ecovillage

Human-scale full-featured settlement in which human activities are harmlessly integrated into the natural world in a way that is supportive of healthy human development, and can be successfully continued into the indefinite future. *(Definition from UVT)*

Ego-depletion

Ego-depletion is a state in which people are temporarily less successful at self-control and sustained motivation. It is typically attributed to a short-term loss of mental energy due to previous efforts at control. This ability to attain deliberative control over impulses is extremely adaptive as it makes people capable in engaging goal-directed behaviour to bring about long-term desirable outcomes. *(Definition from UNIROMA3)*

Emissions embodied in exports

The emission occurring in a specific country in order to produce products which are exported to other countries. The same principle can also be applied to land/water use and material extraction. *(Definition from NTNU)*

Emissions embodied in imports

Emission occurring in other countries to satisfy intermediate and final consumption in one specific country or region. The same principle can also be applied to land/water use and material extraction. *(Definition from NTNU)*

Emission intensity

Average emission rate of a given pollutant from a given source relative to the intensity of a specific activity; e.g. ratio of greenhouse gas emissions produced to gross total output of a sector in €; grams of carbon dioxide released per total megajoule of energy produced. *(Definition from NTNU)*

Emotion

Emotions are composed by a subjectively experienced feeling, a physiological response, and a behavioural and/or expressive response (Hockenbury & Hockenbury, 2007). Emotions refer to an object or an event and they are conscious and in the centre of attention (Rothermund, 2011). Examples for emotions are: anxiety, anger, disgust, jealousy, surprise, grief, joy, sympathy, gratitude, love and hope. For Glamurs, emotions are of importance as consequences of or motivation for membership/engagement; and in relation to endeavours of sustainable living, internal conflicts, reactions to governance policies, and time-use. *(Definition from UFZ)*

Endowment effect

Endowment effect is a term describing the reluctance of people to part from assets that belong to their endowment. When it is more painful to give up an asset than it is pleasurable to obtain it, buying prices will be significantly lower than selling prices. *(Definition from UVT)*

Environmentally extended (multiregional) input-output analysis (EE-MRIO analysis)

As opposed to purely economic input-output models (see input-output (IO) analysis and multiregional input-output (MRIO) analysis), an environmentally extended IO model includes a complete inventory of selected environmental extensions (stressors) of individual sectors within a specified region during a period of time. Environmental (and social) extensions of input-output tables enables the identification of primary resource use and incurred emissions. Combined economic-environmental models use IO analysis to trace the direct and indirect environmental impacts of industrial activities along the supply chain and to assign the negative environmental impacts of production to final demand categories instead of the producing sectors. EE-MRIO analysis incorporates emissions and resource usage from the production of exported and imported products. Environmental impacts embodied in exports from a specific country are not part of its

final demand, but are instead allocated to intermediate (e.g. industries) or final users (e.g. households) from other regions (see Figure 20).

Figure 20. Example of an EE MRIO table

(Definition from NTNU)

Environmental impacts

Environmental stressors can be aggregated into environmental impact categories using life-cycle impact assessment methods. Environmental impact categories (e.g. land use, global warming potential, freshwater use etc.) can be computed by multiplying the emissions of stressors with their equivalence factors. (Definition from NTNU)

Environmental stressors

The generic term to refer to a list of environmentally relevant flows or 'stressors' that are required for industrial activity such as chemical as well as physical stressors (e.g. emissions of greenhouse gases, land use, use of fresh water etc.). (Definition from NTNU)

Eudaimonic well-being

Eudaimonic advocates argue that living a life of virtue, and actualising one's inherent potentials is the way to wellbeing. (Definition from UVT)

Expectations

Beliefs formed about the probability of certain events occurring, e.g. future prices, proportion of agent types within a population etc. (Definition from UBAH)

Expenditure elasticity (in the context of environmental footprints)

Expenditure elasticity, ε, in the context of footprint indicators measures the change of a footprint indicator (e.g. carbon, land, material and water footprints) with respect to expenditure of a specific consumer group (e.g. households). It is the percentage change in environmental footprint with respect to a one percent rise in expenditure. Expenditure elasticity, ε, across footprint indicators can be interpreted via the following equation:

$$\varepsilon_i = \frac{y}{f_i}\frac{\partial f_i}{\partial y}$$

where y represents yearly expenditure by final consumers and f represents the resulting footprint from consumption for each of the footprint indicators i. (Definition from NTNU)

Items listed under **F**

Families of codes

Families of codes (from Atlas.ti) are containers or holders for different kinds of objects (documents, codes, memos). *(Definition from UVT)*

Final demand

Final demand of goods and services within a specific geographical region arises from households, non-profit institutions serving households (NPISH), governments, gross capital formation and changes in inventories and valuables. Additionally, the System of National Accounts considers exports as a separate source of final demand, although in an input-output framework exports are instead allocated to intermediate (e.g. industries) or final users (e.g. households) from other regions. *(Definition from NTNU)*

Fitness measure

In the dynamic setting of evolutionary selection among agent types or alternative routines, utility can be regarded as a fitness/performance measure describing how well one option performs compared to the other options of the choice set. *(Definition from UBAH)*

Focus groups

Are research tools that allow access to people's attitudes, beliefs, values, and also to the meanings that individuals attribute to their life experiences in situations of social interaction. *(Definition from UVT)*

Flourishing

The term is used to describe the combined presence of both hedonic and eudaimonic wellbeing concepts. *(Definition from UVT)*

Framing effect

The framing effect is a cognitive bias in which people react to a particular choice in different ways depending on whether it is presented as a loss or as a gain. *(Definition from UVT)*

One can get a framing effect when objectively equivalent information resulted in different judgments and decisions depending on the way in which the information was labeled or "framed." Specifically, a framing effect occurs when equivalent descriptions of a decision problem lead to systematically different decisions among people. Framing effects are commonly taken as evidence for incoherence in human decision-making, and for the empirical inapplicability of the rational actor models used by economists and other social scientists. *(Definition from UNIROMA3)*

Functional unit

The precise object of study, e.g. 1 kg of a certain material, one product, a specified service, etc. All calculations are normalized in terms of the functional unit. *(Definition from NTNU)*

Items listed under **G**

Gift economy

An economy based on giving in the context of relationship rather than making transactions simply for profit or personal material gain. Instead of monetary gain, gift economies often rely on intangible rewards like a sense of contribution, community, honor or prestige. *(Definition from UVT)*

Global Warming Potential (GWP)

The GWP has been defined as the ratio of the time-integrated radiative forcing from the instantaneous release of 1 kg of a trace substance relative to that of 1 kg of a reference gas (IPCC, I990)

$$\mathrm{GWP}(x) = \frac{\int_0^{TH} a_x \cdot [x(t)]\,dt}{\int_0^{TH} a_r \cdot [r(t)]\,dt}$$

where *TH* is the time horizon over which the calculation is considered, a_x is the radiative forcing due to a unit increase in atmospheric abundance of the substance in question (i.e. $Wm^{-2}\ kg^{-1}$), $[x(t)]$ is the time-dependent decay in abundance of the instantaneous release of the substance, and the corresponding quantities for the reference gas are in the denominator. *(Definition from NTNU)*

Governance

The preferred definition: "The sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuing process through which conflicting or diverse interests may be accommodated and co-operative action may be taken. It includes formal institutions and regimes empowered to enforce compliance, as well as informal arrangements that people and institutions either have agreed to or perceive to be in their interest" (Commission on

Global Governance, 1995). DOW tells us: Body of mechanisms regulating the use and management of resources (including time); Further definitions:

"The structure and processes for collective decision making involving governmental and non-governmental actors" (Nye and Donahue 2000);

"The reflexive self-organization of independent actors involved in complex relations of reciprocal interdependence, with such self-organization being based on continuing dialogue and resource-sharing to develop mutually beneficial joint projects and to manage the contradictions and dilemmas inevitably involved in such situations" (Jessop, 2002: 1).

"Governance refers to sustaining co-ordination and coherence among a wide variety of actors with different purposes and objectives such as political actors and institutions, civil society, corporate interest and transnational organizations" (Pierre 2001: 3)

(Definition from UFZ)

Grassroots movement

Is driven by a community's politics. The term implies that the creation of the movement and the group supporting it are natural and spontaneous, highlighting the differences between this and a movement that is orchestrated by traditional power structures. *(Definition from UVT)*

Grassroots innovations

Are community-led solutions for sustainability. They can offer promising new ideas and practices, but often struggle to scale up and spread beyond small niches. *(Definition from UVT)*

Grounded theory

Is an approach for collecting and analysing qualitative data, and it revolves around the progressive identification and integration of categories of meaning. The term grounded theory refers both to the method by which the categories are established and the links and relationships between them are established, but it also refers to the end-product of said method – an explanatory framework for the research phenomenon. *(Definition from UVT)*

Group cohesion

This concept can be more specifically defined as the tendency for a group to be in unity while working towards a goal or to satisfy the emotional needs of its member. *(Definition from UVT)*

Items listed under **H**

Hedonic adaptation

The psychological process by which people become accustomed to a positive or negative stimulus, such that the emotional effects of that stimulus are attenuated over time. *(Definition from UVT)*

Hedonic well-being

The hedonic perspective on well-being suggests that maximising one's pleasurable moments is the pathway to happiness. *(Definition from UVT)*

Heterogeneous agents

Within the framework of discrete choice, heterogeneity may arise in two ways: there may be alternative choices, such as competing products; or, more fundamentally, there can be different agent types who hold different preferences or adopt different forecasting rules. *(Definition from UBAH)*

Heuristics switching

In a dynamic setting, agents may change their type or routine, according to an evolutionary selection dynamic where the performance of competing types or routines change endogenously due to previous decision events through the history. *(Definition from UBAH)*

Household

A small group of persons who share the same living accommodation, who pool some or all of their income and wealth and who consume certain types of goods and services collectively, mainly housing and food. The individual members of multi-person households are not treated as separate institutional units, because many assets are owned and liabilities incurred jointly. Moreover, many expenditure decisions, e.g. relating to the consumption of food or housing, may be made collectively. This is why the household must be treated as an institutional unit. A person living alone may also constitute a household. *(Definition from NTNU)*

Household environmental impacts (HEI)

Includes all environmental effects (e.g. CO_2 emissions, resource use etc.) from economic activity that can be linked to households either directly, through their use of products (e.g. driving a car, using electricity at home), or indirectly, through the impacts embodied in their purchases (e.g. use of energy to produce consumable items). *(Definition from NTNU)*

Household final consumption expenditure

The expenditure, including imputed expenditure, incurred by resident households on individual consumption goods and services. *(Definition from NTNU)*

Household production

Household production is the production of goods and services by the members of a household, for their own consumption, using their own capital and their own unpaid labor. *(Definition from NTNU)*

Items listed under I

Individual Decision-making

Dual process of heuristic-holistic and systematic-analytic motivations, influenced by the emotions and habitual behaviour of the individual. *(Definition from UFZ)*

Input-output analysis (IOA)

IO analysis is a mathematical tool widely used in economics to analyze the flows of goods and services between economic sectors, using physical and/or monetary data from IO tables. IO tables provide information about the flows of goods and services in an economy for a given year. An economic IO table shows the 'uses' (purchases made by each sector of the economy necessary to produce their own output, including domestic produce and imports) and 'supplies' (goods and services produced for intermediate and final domestic consumption and exports). Furthermore, IO analysis assumes that production from different industries in a specific year can be traced to either intermediate consumption (consumption by industries) or to final consumption (consumption by final consumers such as households, governments etc.). It also contains information about purchases made by a specific group of final consumers, such as households and governments, from each industry (by each product). *(Definition from NTNU)*

Intention

By intention we refer to what Bamberg (2013) calls goal intention, namely the willingness to alter a current or show a new behaviour (i.e. a single action or a set of actions). Goal intention is a substantiation of a motivational background. In Glamurs, we focus on people with an intention to behave sustainably. *(Definition from UFZ)*

Intentional communities

An intentional community is a planned residential community designed from the start to have a high degree of social cohesion and teamwork. The members of an intentional community typically hold a common social, political, religious, or spiritual vision and often follow an alternative lifestyle. *(Definition from UVT)*

Intentionality

Intentionality refers to the personal engagements with the world.. Intentionality is considered to be a requirement for any affect state to be subjective or phenomenal. *(Definition from UVT)*

Interactionism

Human behaviour is best predicted from a comprehensive understanding of the person, the situation, and the interaction between person and situation. It emphasizes the importance of both the person and the situation in predicting outcomes. Specifically, this approach points out that

human behaviour is due to the combination between person-based and situational factors. *(Definition from UNIROMA3)*

Interactions

They are the behaviours of agents that may affect the decisions of other agents. Interactions may be direct (norms, negotiation, markets, imitation) or indirect ('stigmergic': ant trails, signs, writing, traps). (See also http://www2.econ.iastate.edu/tesfatsi/ace.htm). *(Definition from JHI)*

Intrapersonal conflict

An intrapersonal conflict comprises the following: incompatible motivations based on incompatible needs, values, goals that lead to incompatible behavioural tendencies. Intrapersonal conflicts might be indicated or mediated by positive, negative or incompatible emotions (e.g. guilt, anger, anxiety). For Glamurs intrapersonal conflicts are important because they might hinder an individual who wants to live more sustainably from doing so. *(Definition from UFZ)*

Item

An item is the basic element of a standardized questionnaire or test. It can be a question, opinion, or statement that induces a person's reaction (-> indicator). *(Definition from OVGU)*

Item analysis

The item analysis refers to a statistical technique that aims on the identification of the effectiveness of tested items. It can be used to eliminate ambiguous or misleading items. *(Definition from OVGU)*

Items listed under **L**

Land footprint

Life cycle land use of final consumption, commonly expressed in square kilometers (km^2). Land use data underlying the land footprint calculations include cropland, pasture and forest. *(Definition from NTNU)*

Learning

Related to adaptive beliefs/expectations which lie between rational and naïve expectations. Agents learn about future realizations of variables by extrapolating from the past. *(Definition from UBAH)*

Leisure

Different from the free-time, leisure is an uncoerced activity undertaken during free time where such activity is something people want to do and, at a personally satisfying level using their abilities and resources, they succeed in doing. *(Definition from UVT)*

Structural leisure

An "external vantage point" on leisure engagement because it aims to measure the extent to which one participates in leisure activities as normatively defined by researchers. In contrast, the subjective approach or the "internal vantage point" considers leisure engagement to be the

amount of time, diversity, or frequency of one's participation in activities that individuals view as leisure. *(Definition from UVT)*

Lifestyle

Patterns of consumption/activities that take place in given locations and have associated time patterns. *(Definition from UBAH)*

Aggregation of an individual´s behaviour; PP1: "as patterns of activities and behaviours that fulfil a variety of human needs and hold psychological and social functions, such as self-definition and social interaction, group membership and status signalling, and the pursuit of individual development, happiness and wellbeing". Sociologists define lifestyle rather as an analytical category for groups of people showing similar variables relevant for the specific context (e.g. hedonic lifestyle). *(Definition from UFZ)*

Life satisfaction

The cognitive component of subjective well-being, that is, people's evaluations of their lives. This component of subjective well-being is typically assessed by life satisfaction judgments, (e.g., ''I am satisfied with my life''). *(Definition from UVT)*

Loss aversion

Loss aversion describes a general tendency according to which individuals are often more sensitive to losses than gains. *(Definition from UVT)*

It postulates that people place a greater emphasis on avoiding losses than obtaining gains of the same size. The idea behind the losses aversion concept consist in showing that people are much more sensitive to losses – even small losses – than to gains of the same magnitude. *(Definition from UNIROMA3)*

Items listed under **M**

Material footprint

Life cycle material use of final consumption expressed in tons (t). This only includes economically used materials. The indicator reflects the raw material extraction, particularly that of primary crops, crop residues, fodder crops, grazing, wood, aquatic animals, metal ores, non-metallic minerals and fossil fuels. *(Definition from NTNU)*

Materialism

A philosophical position that states that everything in existence is composed of physical matter and therefore subject to the laws of physics. It states that physical matter comprises everything in the universe and all things, even mental processes and consciousness, results from matter and its movement. *(Definition from UVT)*

Maximizer versus satisficer

In the decision making process, the *maximizer* will choose the alternative that maximizes the benefits, while the *satisficer* simply encounters and evaluates goods until one is encountered that exceeds the acceptability threshold. *(Definition from UVT)*

Mediation

In this type of analysis, evidence supporting a mechanism is found in the existence of an indirect effect of X on Y through the proposed mediator variable M. The causal chain of effects from X to M to Y—the indirect effect—represents the mechanism through which X's effect on Y operates. One can hypothesize the existence of a mediation model when a variable (X) affects one or more mediating variables (M1, M2, ... Mx), which in turn, affect an outcome (Y). *(Definition from UNIROMA3)*

Memory

In a dynamic setting, agents may consider more not just the last value of the fitness of a choice option but some number of previous realizations. In the limit, this may be a weighted average of all past realizations, with an exponentially decaying memory factor. *(Definition from UBAH)*

Mental models

Mental models are knowledge structures that individuals construct to understand and explain their experiences. *(Definition from UVT)*

Mindfulness

Mindfulness involves the reflexive contemplation of one's own experience in the domains of the body, states of mind, feelings and experiential phenomena. It is a process of observation and lucid awareness of one's experience, which leads to the development of clear comprehension, a cognitive element that helps distinguish between wholesome and unwholesome mental factors. Mindfulness has a strong ethical and emotional component, as it involves qualities such as kindness, tolerance, patience, generosity, courage and equanimity.(cf. Bodhi 2011, Dreyfus 2010). *(Definition from UFZ)*

Model

A representation or description of something (a phenomenon or set of relationships) that aids in understanding or studying it; a set of assumptions about relationships used to study their interactions. Usually the purpose of constructing a model is to test it. The most common form of model is an equation, which is a model that states a theory in foral, symbolic language, as in a regression equation. *(Definition from UDC)*

Moderation

Moderation approach establishes whether an effect exists under conditions in which the mechanism is allowed to operate but not under conditions in which it is disrupted. For example, a moderation model occurs when a third variable (M) dampens or enhances the effect of an

independent variable (X) on outcome (Y). Again, moderation occurs when a third variable (M) reverses the relationship between an independent variable (X) and an outcome variable (Y). *(Definition from UNIROMA3)*

Motivation

Motivation is the active orientation on a specific outcome with the aim of reducing needs, maximizing benefits and attaining goals. Internal processes like considerations, behavioural planning, perceptional preparedness, and arousal translate these orientations into specific conduct (Heckhausen, 1980). For Glamurs, motivation is important to be considered in terms of (non-) membership, (non-) engagement, and (non-) sustainable lifestyles. *(Definition from UFZ)*

Multiple equilibria

A decision system may be characterized by more than one equilibrium. In a coordination problem, for instance, agents end up with choosing either one or the other of two alternative options. *(Definition from UBAH)*

Multiregional input-output (MRIO) analysis

Multiregional input-output analysis is an extension of standard input output analysis (see input-output (IO) analysis) but to cover the production systems in multiple countries in one integrative calculation matrix. Only a handful of global MRIO tables are available including EXIOBASE, EORA, GTAP/OPEN: EU, WIOD and GRAM. *(Definition from NTNU)*

Items listed under **N**

Naïve expectations

In a dynamic decision setting, agents only rely on the past period realizations of the dynamic variable(s) which enter the utility measure. This is the opposite with respect to rational expectations. *(Definition from UBAH)*

Nature connectedness

The extent to which individuals include nature as part of their identity. Characteristics of nature connectedness are similar to those of a personality trait: nature connectedness is stable over time and across various situations. There are three components that make up the nature connectedness construct: the cognitive component is the core of nature connectedness and refers to how integrated one feels with nature; the affective component is an individual's sense of care for nature; the behavioral component is an individual's commitment to protect the natural environment. *(Definition from UVT)*

Needs

Most basic reasons for action that require no further explanation or justification. Such abstract needs (for freedom, subsistence, understanding, …) are to be differentiated from the means or strategies used to satisfy/realize the needs (e.g. cars, specific food, large apartment, university

education, …). The fulfilment of needs creates objective and subjective wellbeing. *(Definition from UFZ)*

Need for autonomy

The need for autonomy (or self-determination) refers to the human need to feel that the origin of the individual's behaviour exists within the individual's self. *(Definition from UVT)*

Need for competence

The need for competence refers to the human need to control outcomes and feel effective in bringing about desired outcomes. *(Definition from UVT)*

Need for relatedness

The need for relatedness refers to the human need to feel a sense of belonging to a social group. *(Definition from UVT)*

Netlogo

An Agent-Based Toolkit. Netlogo is a cross-platform multi-agent programmable modelling environment. (See also http://www2.econ.iastate.edu/tesfatsi/ace.htm). *(Definition from JHI)*

Network

"A network is a more or less stable patterns of social relations between interdependent actors, which take shape around policy problems and/or policy programmes" (Klijn, 1997, 30). In these networks, the institutional context and rules limit and structure the possible range of activities (Ostrom et al., 1994). In our case the region is a network of initiatives or of single actors. *Taken from Network Analysis document by UFZ. (Definition from TUD)*

Normative model of decision making

Normative model of decision assumes that the decision maker is entirely rational when analyzing alternatives, and choose the optimal one. *(Definition from UVT)*

Items listed under **O**

Ontology (in computer science)

A formal, explicit representation of a shared conceptualisation. Formal in that the ontology document is machine-readable and allows inferences to be made; explicit in that all concepts are represented; shared in that there is some agreement by a group about the ontology (debatable), conceptualisation in that it is an abstraction of reality. (Gruber 1993; Fensel 2001) *(Definition from JHI)*

Opportunities

Situational conditions that enable or prevent, facilitate or impede certain behaviours. Application of the term opportunities is based on the NOA-Model (Vlek, Jager, & Steg, 1997 (Needs Opportunities Abilities (NOA) Model). *(Definition from UFZ)*

Optimism bias

The optimism bias is a bias that causes a person to believe that they are less at risk of experiencing a negative event compared to others. *(Definition from UVT)*

Items listed under **P**

Path analysis

A kind of multivariate analysis in which causal relations among several variables are represented by graphs (path diagrams) showing the "paths" along which causal influences travel. The causal relationships must be stipulated by the researcher. They cannot be calculated by a computer; the computer is used to calculate "path coefficients", which provide estimates of the strength of the relationships in the researcher's hypothesized causal system. In path analysis, researchers use data to examine the accuracy of causal models. A big advantage of path analysis is that the researcher can calculate direct and indirect effects of independent variables; this cannot be done using ordinary "multiple regression analysis". *(Definition from UDC)*

Path coefficient

A numerical representation of the strength of the relations between pairs of variables in a path analysis when all the other variables are held constant. Path coefficients are standardized regression coefficients (beta weights); these are regression coefficients expressed as z-scores. Unstandardized path coefficients are usually called path regression coefficients. *(Definition from UDC)*

Perceived time scarcity

Perceived time scarcity is the individual perception that there is less time available than time required for a task, process or action. For Glamurs, we should agree upon which aspect (time scarcity, perceived time scarcity, perceived time pressure) we refer to. *(Definition from UFZ)*

Perceived time pressure

Perceived time pressure is a stress reaction (physiological, cognitive, emotional reaction) caused by perceived time scarcity. For Glamurs, we should agree upon which aspect (time scarcity, perceived time scarcity, perceived time pressure) we refer to. *(Definition from UFZ)*

Permaculture

A system of agricultural and social design principles centered around simulating or directly utilizing the patterns and features observed in natural ecosystems. *(Definition from UVT)*

Positive feedback

This is the self-reinforcement mechanism of a decision system where an increase (or decrease) of a dynamic variable in the utility leads to higher incentives for agents to increase (or decrease) that variable even further. *(Definition from UBAH)*

Positive (PA) and negative (NA) affectivity

PA and NA are measures that gauge the propensity for an individual to assess life events in either a positive or a negative manner, respectively. The two constructs are moderately inversely correlated but clearly separable. *(Definition from UVT)*

Privately optimal choice/lifestyle

Pattern of consumption/activities that maximises the individual utility. *(Definition from UBAH)*

Process

A process is a dynamic that causes the state of the world to change – specifically, assertions about classes, attributes, relationships and individuals would be retracted after the process has run, and new assertions might be made. For example, aging-by-one-year is a process in which an individual's age is increased by 1. This means retracting the assertion that they are, say, 44, and adding the assertion that they are 45. *(Definition from JHI)*

Prospect theory

The prospect theory refers to the process of decision making. According to this theory, the utility of an alternative is substituted with the value of an alternative: if utility is defined in terms of net benefit, the value is defined in terms of gain and loss. *(Definition from UVT)*

Psychological lock-in

Lock-in situations may be differentiated into physical and socio-psychological lock-ins. Physical lock-in situations result from (one-time) lifestyle decisions that lead to patterns of intensive resource consumption (e.g. living far away from work and thus being forced into certain mobility choices). Psychological lock-ins are the result of internal conflicts preventing the individual from acting in a sustainable way. A psychological lock-in is a manifested, long-term intrapersonal conflict for which no resolution is in prospect. *(Definition from UFZ)*

Items listed under **Q**

Quality of life

Quality of life can be defined as subjective wellbeing and personal growth in a healthy and prosperous environment (Lane, 1996). Thus it has two components, an objective which is given by the frame conditions (income, security, institutions, quality of nature, access to education, talents etc.) and the subjective feeling about one's own life. *(Definition from UFZ).*

Quotations

In ATLAS.ti, are segments of the Primary Documents that the researchers select to note its importance. *(Definition from UVT)*

Items listed under **R**

Random utility

In a discrete choice setting, a noise term limits the precision of utility evaluation by agents. This may be due to limited information, limited computational ability, or even the bounded rationality of agents. (See definition of utility function below). *(Definition from UBAH)*

Rational expectations

This is the limit case where agents are able to correctly evaluate the realization of a state variable which is relevant to their utility, due to full information (zero variance noise) and unlimited computational ability. *(Definition from UBAH)*

Rationalization

Where you choose to do something on emotional grounds (because it feels good) but you don't want to admit that, so you make up reasons after the fact to justify your choice. *(Definition from UVT)*

Relationship

In OWL, relationships are called object properties. They allow the assertion that individuals are linked in some way, examples being 'spouse', 'owns', 'part'. Relationships can also be asserted to be subproperties of each other. For example, 'husband' is a subproperty of 'spouse' because if one person is the husband of another, they are necessarily also the latter's spouse (See http://www.w3.org/TR/2012/REC-owl2-primer-20121211/#Object_Properties). *(Definition from JHI)*

Reflexive governance

Continuing modification of ongoing interactions and feedback relations leading to open-ended learning by repeatedly examining the own presuppositions and assumptions and thereby using social learning and plurality of networks to make a process resilient against unexpected changes. *(Definition from UFZ)*

Repertory grid

The repertory grid is a cognitive mapping tool used to elicit and analyse the mental models of individuals through a structured interview technique. *(Definition from UVT)*

Representative sample

A sample that represents the group as a whole. A random sample is the best way to get a representative sample. If this is not possible (because the group is too small), a selected segment of a group that closely parallels the population as a whole in terms of the key variables and characteristics that are under examination has to be drawn. Factors that have to be considered when selecting a representative sample might include sex, age, educational level, and socioeconomic status. *(Definition from OVGU)*

Risk

"Risk is commonly defined concerning two quite distinct dimensions -one concerns probability and the other one concern the effects-, so risk concept arises as the probability of a particular adverse event that occurs in an explicit period of time, (…) but in practice these two dimensions tend to be examined in tandem. (...) In terms of likelihood, risk refers to the probability of concrete negatives events -outlined in terms of amount, intensity and duration- resulted from an exposure to a hazard -anything that could be detrimental-, and in terms of effects, risk is referred to the extent of the detriment -a numerical estimate of the harm- associated with the adverse event." (Breakwell, 2007, pp. 1-2). *(Definition from UDC)*

Risk perception

Social perception is a psychosocial process, and this process applied to risk generates the concept of risk perception, as that one derived from the perception of a group of people of a risk in a specific environment or context.

In comparison to risk perception, "risk assessment is the label used to refer to the systematic analysis of risk that is undertaken in formal studies or by professional (for example, scientists, engineers, actuaries). What people without professional expertise in the area (often called "lay people") do is not called risk assessment. It tends to be labelled in more subjective terms. Traditionally, it is called risk perception." (Breakwell, 2007, p. 13)

"Risk perception is used in the literature to refer to various types of attitudes about risks and hazards and judgements about them. Analysis of risk perception deals with explicitly subjective responses to hazard and risk. Risk perception cannot be reduced to any simple subjective correlate of an estimate of risk based on the product of probability and consequences. Formal risk assessment attempts to systematise the estimation and evaluation of risk such that subjectivity is excluded as far as possible." (Breakwell, 2007, p. 14)

"(…) Understanding risk perception is important in its own right, since it can explain why people choose to act in particular ways. However, it is also important because it can contribute to effective risk assessment since the human factor is often an ingredient in determining the likelihood of an adverse event occurring and in influencing its consequences." (Breakwell, 2007, p. 14)

(Definition from UDC)

Risk Perception (Environmental)

In the context of risk perception, an environmental risk seems to refer to something more objective, which is not linked to the subjective perception, but to the objective and experiential characteristics that give rise to risk. *(Definition from UDC)*

Items listed under **S**

Self-concept

It is a collection of beliefs about oneself that includes elements such as academic performance, gender roles or racial identity. *(Definition from UVT)*

Self-determination theory

Self-determination theory postulates that is a continuum between behaviours that are self-regulated and those that are regulated by forces outside the individual. According to this theory, three basic psychological needs support self-determined motivation: competence, autonomy, and relatedness. *(Definition from UVT)*

Self-schema

Is a cognitive generalization about the Self, resulting from past experiences that organize and guide the processing of self-relevant information. *(Definition from UVT)*

Semantic heterogeneity

Various problems of data integration that can occur when bringing data together from diverse sources, including naming conflicts (from synonyms and homonyms), scaling conflicts (when different units are used to measure the same thing), confounding conflicts (when concepts seem to have the same meaning but don't because of context) and representation conflicts (when things are described in different ways). (Bellatreche et al., 2006) *(Definition from JHI)*

Situational factors

Everything that is external to the individual that can affect their choice, e.g. social norms, political climate etc. These factors make up the context in which a decision is made. *(Definition from UBAH)*

Social capital

"A lot of research has been carried out focusing on the relations between social capital and subjective wellbeing. Helliwell (Helliwell, 2001) for instance argues that social capital has substantial effects on wellbeing, and also Diener and Suh (Diener et al., 1997) emphasize the importance of social relations related to subjective wellbeing. […] Social capital generally represents the degree of social cohesion which exists in communities (WHO, 1998) and encompasses networks, together with shared norms, values and understandings which facilitate cooperation within or among groups (OECD, 2001). However, there is a broad variety of definitions related to "social capital". Coleman (Coleman, 1988) describes social capital as a variety of different entities with two common elements: social structure and certain actions of actors within the structure, which includes vertical (bridging) as well as horizontal (bonding) associations. Social capital is closely linked to existing ties in terms of closeness, kindness, or support, to norms in terms

of obligatory rights and duties as well as to mutual trust. On the individual level, social capital is used in order to maximize the level of individual happiness. On the societal level (communities, etc.), social capital is developed and applied in order to assure adequate functioning of societal processes. Social capital can be seen as a measure for the number and strength/intensity of social relationships and can be examined on three levels: the micro-level, the meso-level and the macro-level (Gehmacher et al., 2006)." (Grünberger & Omann, 2011).

Taken from "Background information for questions to be included in the in-depth interviews, resulting from 5.1" internal document (Definition from UFZ)

Social Dilemma

Situation where each member of a group has a clear and unambiguous incentive to make a choice that – when made by all members – provides poorer outcomes for everybody, compared to the reward that each single individual would have received if none had made the choice. *(Definition from UNIROMA3)*

Social interactions

Agents are not isolated in their decisions and other agents' decisions influence them with a (network) externality. Social interactions enter the utility with a term which depends on the distribution of decision variables across other agents. *(Definition from UBAH)*

Social norms

We adopt the same definitions from psychology, i.e. descriptive, injunctive, subjective. However, when capturing social norms within a framework of utility maximisation we cannot distinguish between these different norms. The gain/loss in utility from compliance/non-compliance relates to all three norms depending on the context. Social norms are generally incorporated within the utility function as the negative of the distance function (absolute or squared) between the individual's choice variable (to be decided as an outcome of the utility maximisation process) and the norm. Modelled in this way means that a choice variable different to the norm generates negative utility whereas perfect compliance implies a zero negative term. *(Definition from UBAH)*

Social welfare function

Aggregation of individual utility functions, e.g. utilitarian – a sum/weighted sum of individual utilities. *(Definition from UBAH)*

Spillover

The term spillover in the domain of pro-environmental behaviour refers to the relations between different behavioural domains (e.g. electricity consumption, recycling, car use…). In most empirical studies a moderate positive correlation between such behaviours was found. The correlation is stronger if behaviours are more "similar" (e.g. different forms of recycling). *(Definition from OVGU)*

Stakeholder

"A stakeholder can be any relevant person, group or organisation with an interest in the issue, either because they will be affected by the subject (victim, gainer) or because they have influence, knowledge or experience with the subject" (European Commission, 2003: 63).*Taken from Network Analysis guidelines by UFZ. (Definition from TUD)*

Standardized interview

An interview based upon a standardized questionnaire. Interviewers have to follow a strict standardized guideline. Every Interview of one survey is conducted under the same condition in order to avoid deviations by the measurement itself. *(Definition from OVGU)*

Standardized questionnaire

A standardized questionnaire has a determined question-order, a determined number of items, and a determined response format. Interviewers should not vary the introduction and/or explanations. *(Definition from OVGU)*

State variables

In a dynamic context, the state of an economic system at a given time *t* is fully determined by state variables, while parameters are constant. The value of state variables at time *t*+1 is a function of their value at time *t*. *(Definition from UBAH)*

Subjective well-being

"refers to emotional states and reflections of meaning in life based on the subjective experience of one's fulfilment of needs. Its hedonic part reflects the pleasure experienced and is linked to emotional wellbeing, its eudaimonic part reflects the striving to realize one's personal and social potential." (Rauschmayer, Omann &Frühmann, 2010).

Psychological approach to the definition of well-being:

- conglomerate of wellbeing, life satisfaction, quality of life
- linked to positive psychology, academically contested
- measurement: e.g. Wellbeing Five (WHO): http://www.psykiatri-regionh.dk/NR/rdonlyres/3F12728C-B0CD-4C50-A714-B6064159A314/0/WHO5_German.pdf and further life satisfaction surveys

(Definition from UFZ)

Our starting point are "concepts that define quality of life through an objective component on the one hand, such as available resources, income, and the capacities to meet needs with these resources, and a subjective component on the other, related to a person's subjective well-being or perception of his/her life (Zapf, 1984). Objective conditions are generally seen as being constitutive of subjective perceptions. This integrated concept of quality of life facilitates a holistic and comprehensive approach to the observation of material and non-material values" (Grünberger &

Omann, 2011).The focus of GLAMURS is on individual lifestyles, hence we will focus in the in-depth interviews on the subjective part of quality of life, on subjective wellbeing. "Of the many definitions of wellbeing that exist (Dodds, 1997), we focus on enduring, overall life satisfaction, as this seems to be the most salient aim of policy (Veenhoven, 2000). Following the psychological literature (Westerhof et al., 2008), we differentiate between hedonic and eudaimonic wellbeing (Samman 2007). Hedonic wellbeing is a multidimensional concept which includes cognitive evaluations of life in general (i.e. life satisfaction) as well as positive and negative affects (Diener et al., 1997; Diener et al., 1999). This is the kind of wellbeing that most economists refer to when they measure happiness. The second concept of wellbeing, eudaimonic well-being, dates back to Aristotle, for whom the actualization of virtues was the way to live a good or meaningful life" (Grünberger & Omann, 2011). During the interviews it is not necessary to differentiate between both forms; however if the interviewee talks about different ways of wellbeing, we can go into more depth. For the analysis the distinction can be used. As social relationships are (one of) the most important dimensions of subjective wellbeing we analyse this category more in depth through the concept of social capital.

Taken from "Background information for questions to be included in the in-depth interviews, resulting from 5.1" internal document (Definition from UFZ)

Sustainability engagement

Engagement is the active participation in sustainability related actions (concerning own conduct and/or initiative membership). In order to be called "engaged" one has to use individual resources (such as time, money, cognitive and emotional effort) to follow the aim of sustainability. For Glamurs, we should carefully distinguish between the terms membership and engagement. There can be a member who does not use any individual resources for sustainability related actions or a non-member using a lot of them. (Definition from UFZ)

Sustainability transition

Grin (et al. 2010:1): "a radical transformation towards a sustainable society as a response to a number of persistent problems confronting contemporary modern societies". (Definition from UFZ)

Sustainable community

A sustainable community is one that unites people in a place or through space and is, based on ecological balance, community self-reliance and participatory democracy. Communities that meet the diverse needs of existing and future residents, their children and other users, contribute to a high quality of life and provide opportunity and choice. They achieve this in ways that make effective use of natural resources, enhance the environment, promote social cohesion and inclusion and strengthen economic prosperity. (Definition from UVT)

Sustainable lifestyles

Patterns of consumption/activities that can be continued for the long-run taking into account resource constraints. (Definition from UBAH)

Items listed under **T**

Territorial-based emissions

The emissions occurring in a certain territory. *(Definition from NTNU)*

Time scarcity

Time scarcity is the quotient/ difference of the amount of time necessary and the amount of time available for a certain tasks, process or action. For Glamurs, we should agree upon which aspect (time scarcity, perceived time scarcity, perceived time pressure) we refer to. *(Definition from UFZ)*

Transition

Rotmans et al. (2001: 16): transitions "can be described as a set of connected changes, which reinforce each other but take place in several different areas, such as technology, the economy, institutions, behaviour, culture, ecology and belief systems". *(Definition from UFZ)*A transition can be defined as a gradual, continuous process of change where the structural character of a society (or a complex sub-system of society) transforms. Transitions are not uniform, and nor is the transition process deterministic: there are large differences in the scale of change and the period over which it occurs. Transitions involve a range of possible development paths, whose direction, scale and speed government policy can influence, but never entirely control *(Definition from TUD)*.

Items listed under **U**

Utility

Satisfaction/enjoyment/well-being derived from certain elements, e.g. consumption, leisure, environment. *(Definition from UBAH)*

Utility function

How elements, e.g. consumption, leisure, environment translate into well-being. The functional form assumed captures preferences, e.g. whether consumption contributes more or less to overall well-being. This function can be assumed to be deterministic so that preferences translate into utility in a fixed way or stochastic where the translation of preferences into utility changes. A stochastic function assumes randomness in the relationship between preferences and utility. However, we can also envisage preferences changing but in an expected way or following a certain pattern depending on circumstances. *(Definition from UBAH)*

Items listed under **V**

Values

Philosophy: The attribution of a specific degree of importance to a need or strategy or to a set thereof. In this regard, sustainable development is a value as it confers high importance to specific strategies to particularly meet the needs of PROTECTION and AFFECTION (Rauschmayer et al., 2011). Psychology approach: Values are general preferences for end states or ways of acting; they serve as goals and guiding principles that apply across different contexts and underlie more

specific attitudes, preferences, and behaviours. Values vary inter-individually and intra-individually (between situations) in their importance. Examples for values are: beauty, peace, and wealth (Clayton, 2009) (Schwartz, 1992, p. 21). For Glamurs, it is important to be clear of whether we mean

a) the importance of a need, or
b) general preferences for end states or ways of acting/ guiding principle, and whether
c) we refer to values of individuals and/ or social entities (initiatives,…)?

For empirical work (e.g. task 5.2) the psychological definition seems appropriate, for conceptual work (e.g. parts of task 3.3) the transition science definition seems appropriate.

(Definition from UFZ)

Voluntary Simplicity Lifestyle

A conscious choice to reduce material consumption in order to increase nonmaterial benefits. *(Definition from UVT)*

Items listed under **W**

Warm-glow

A sense of enjoyment from undertaking an activity irrespective of the impact of that activity. Thus, it is the private benefit associated with an activity. For example, individuals donate because the care about others welfare and they feel good about themselves if they do so. The latter is warm-glow. So, undertaking a pro-environmental activity because it helps the environment in general is not a private benefit and therefore does not constitute warm-glow. Individuals do things for many reasons of which warm-glow might be one. *(Definition from UBAH)*

Water footprint

The volume of water consumed as a result of the delivery of a set of goods or services for final consumption, expressed in cubic meters (m3). The indicator reflects water use for agriculture and livestock, manufacturing, electricity and the direct demand for water. The water footprint can be calculated for blue water (surface, e.g. river and lakes, and groundwater), green water (rainwater), and grey water (freshwater required to assimilate the load of pollutants) consumption/extraction. *(Definition from NTNU)*

Web Ontology Language (OWL)

A language for writing ontologies with a formally defined meaning based on description logics. *(Definition from JHI)*

12.4. ANNEX I: Terms collected from Initial Ontology Report

(Provided by Gary Polhill and Tony Craig -The James Hutton Institute, Aberdeen, UK, May 2014)

Actor

An Actor is something that has a part to play in the story of how we transition to sustainable lifestyles and a green economy. It may have Interactions with other Actors, and be changed by a Process.

Alternative

Alternative links Choices to other Choices that are possible alternatives.

Applied By

Shows a Resource that is needed to perform a Practice, but is neither produced or consumed by it.

Aspects

This links a Choice to the various Actors (e.g. Resources) that are entailed in making that Choice.

Collective

A Collective is a Network that (objections to structural functionalism aside) can be said to make choices.

Competence

A competence is knowledge, skill or other non-physical attribute needed by an Actor performing a Practice.

Consumed By

Shows a Resource that is consumed by the performance of a Practice.

Culture

Culture is an Interaction from a Collective to an Individual.

Changes

Changes links a Process to things that are affected by it.

Choice

A Choice is an Interaction between an Intentional Actor and some other Actors (which could be Resources, Practices, Networks or other Intentional Actors) in which the Intentional Actor makes a decision among a number of options.

Economic Interaction

An Economic Interaction is one that involves the exchange of money.

Efficacy

Efficacy is a Competence needed to Perform a Practice. It is the sense of being capable of doing the Practice effectively.

Emotion

Emotions are Competencies needed to perform a Practice. It is an emotional state of the Individual performing the Practice.

Environmental Outcome

An Environmental Outcome is an Outcome that pertains to the environment.

Has Competence

Has Competence links an Intential Actor to their Competence(s).

Has Meaning

This links a Practice to the Meaning (an Interaction) it has for an Intentional Actor.

Identity

Identity is an Interaction from an Individual to a Collective.

Indicator

An Indicator is an Interaction between any Actor and an Intentional Actor that entails some form of measurement.

Individual

An Individual is an Actor that makes choices, but is not a Collective.

Intentional actor

An Intentional Actor is an Actor that makes Choices.

Interaction

An interaction is one of a number of significant ways in which Actors (and by implication their subclasses) may relate to each other.

Interaction From

This links an Actor to the Interaction they have with another Actor.

Interaction To

This links an Actor to an Interaction they have with another Actor.

Knowledge

Knowledge is a Competence needed to perform a Practice.

Meaning To

This links the meaning a Practice has to the Actor to whom it has that meaning.

Mediates

This links a Network to the Process it mediates.

Network

A Network is an agglomeration of Actors and Interactions.

Norm

A norm is an Interaction between Intentional Actors that can influence decisions.

Options

This links an Actor to the Choices they have to select from.

Outcome

An Outcome is the result of a Process.

Part Of

Identifies the 'parts' of a Network: the entities and relationships among them that are involved.

Practice

A Practice is a Network of (intentional) Actors who perform or observe the Practice and Resources the Practice uses or generates. Practices are intended to focus on everyday behaviours of individuals and collectives (e.g. companies, industries, governments). Practices are associated with Competences needed to perform them, and the Networks they create have a number of different relations among the Actors that are parts of the Network.

Process

A Process is the transition from one set of Practices to another by changing Competence, Actors (Resources, Intentional Actors or Networks), and/or Interactions.

Produced By

Shows a Resource that is produced by the performance of a Practice.

Region

A Region is a physical space – a Resource that Practices may need either as an area needed to perform the Practice because doing so takes space, or because it is a specific location in which the Practice may be performed.

Relationship

Relationship is a property chain allowing the inference of a relationship between a pair of Actors given that there is an Interaction that is the interaction From one Actor and the interaction To another. It effectively 'de-reifies' Interactions.

Resource

A Resource is something that is consumed, applied or generated by a Practice.

Result

A result links a Process to its Outcome.

Salience

Salience is an interaction between Intentional Actors highlighting or giving extra weight or influence in contemporary decision-making.

Time

Time is a Resource needed to perform a Practice.

12.5. ANNEX II: Nomenclature, Acronyms & Units

Nomenclature & Acronyms

(Provided by NTNU)

EE-MRIO: Environmentally Extended Multiregional Input-Output

GDP: Gross Domestic Product

GWP: Global Warming Potential

HEI: Household Environmental Impact

HPF: Household Production Function

IO: Input-Output

IOT: Input-Output Table

MRIO: Multiregional Input-Output

Units

(Provided by NTNU)

t: Tonnes

kt: Kilo tonnes (1000 tonnes)

Mt: Mega tonnes (million tonnes)

Gt: Giga tonnes (billion tonnes)

bt: Billion tonnes

m^3: Cubic metre

Mm^3: Mega cubic metres (million cubic metres)

Km^3: Cubic Kilometres (billion cubic metres)

Km^2: Square Kilometre

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