DELIVERABLE 3.2 : SCENARIOS METHODOLOGY FRAMEWORK AND TRAINING GUIDE

19-10-2016

Joost Vervoort, Ariella Helfgott, Steven Lord
(The University of Oxford)

KBBE.2013.2.5-01
Assessment of the impact of global drivers of change on Europe's food and nutrition security (FNS)
Grant agreement 613532

CONTENTS

Scenarios and transition pathways part 1: Scenario methodological framework and training guide – scenario adaptation (D3.2)

In this deliverable, we present the first part of a training guide for local scenarios and transition pathways. This report focuses on the adaptation of local scenarios. Its companion, deliverable 3.3, focuses on the development of transition pathways and the testing of these transition pathways through the local scenarios created using the method proposed in this report. The two reports share a common theoretical framing, as scenarios and transition pathways are used in a combinatory fashion in TRANSMANGO. We end the guide with two background notes, one on conceptual modelling and one on scenarios and engagement.

1. Local scenarios to guide transition pathways: background

In TRANSMANGO, a number of diverse local practices have been selected as social innovation practices that can provide the seeds for transitions. We focus on developing scenarios and transition pathways at the level of specific practices rather than at a general national level, since our experience with action-relevant scenarios shows that scenarios should be used to investigate, challenge and inspire the feasibility of concrete actions, and broad national-level discussions can easily lead to proposals for actions that are too broad and general. In contrast, a specific community, project or organization has more focused objectives that are easier to investigate and develop, and against which the appropriate relevance and scope of scenarios can be more easily assessed.

Our experience shows that it is possible to design scenario-guided policy development in such a way that specific policies are challenged and improved using tailored scenarios. However, the imagining of transition pathways is different from more straightforward policy development. Because the goal is to come to new societal system structures, a wider range of stakeholders is involved. When scenarios are applied to a specific policy, they are powerful because they link to existing policies and try to make them better. When developing transition pathways, new plans and frameworks often have to be created.

In the development of local transition pathways in TRANSMANGO, we propose an approach that combines the benefits from the focus on a single practice with the ambitions of transition management. We do this by making the following question the central question in the local transition pathways process:

“How can this practice develop into the future in a way that it will contribute significantly to better food and nutrition security at the European level?”

Making this the central question of the local transition pathways process has several benefits:

1. It can inspire ambitious thinking among those involved with the practice to plan for its future
2. It requires the inclusion of those stakeholders that would be considered necessary to increase the practice’s impact, and therefore offers an opportunity for new conversations and partnerships

3. It provides strong local voice and content for the macro-transition pathways at the European level.

1.1 Transformations and transitions theory

Given the environmental and social challenges that humanity faces in the 21st century, interest has grown among researchers and in some policy and private sector spaces in notions of transformative change. There is an increasing need to understand how transformations to sustainability could be achieved. Typically, the word "transformation" is used to refer to fundamental changes in structure, functions and relations within (social-ecological) systems. Such transformations lead to new interaction patterns and have the potential for new emergent outcomes. Transformations are complex, dynamic and multi-dimensional, involving social, institutional, cultural, technological, ecological and political dimensions. Therefore, transformations have to be examined through inter –and transdisciplinary lenses. Transformations tend to be political, involving winners and losers, which means that aspirations for transformational change are often contested (Patterson et al. 2016).

Various streams of theory on transformations exist. Political economists describe transformations as deeply political processes that involve strategic actions by actor coalitions to shape institutional structures (Streeck and Thelen 2005). Researchers on resilience in social-ecological systems use the notion of 'transformability'. This has been defined as "*the capacity to create a fundamentally new system when ecological, economic, or social (including political) conditions make the existing system untenable"* (Walker 2004). The SES literature contains examples of actively nagivated transformation processes (Olsson 2006). These examples have led SES researchers to think of transformations as requiring three steps: 1) actively preparing a system for change; 2) navigating a transition in governance when windows of opportunity open; 3) building the resilience of the new regime (Folke 2006). Related research on social innovation in SES focuses on the role of agency within networks and institutions – conceptualising transformations as emerging from an interplay between institutional conditions and bottom-up innovation which is leveraged by institutional entrepreneurs and networks across multiple levels and scales (Vervoort et al. 2012).

Transition theory, by contrast, comes from research on socio-technical innovation. It seeks to understand how niche-level activities are up-scaled into broader socio-technical regimes, resulting in socio-technical transitions (Rotmans 2005, Geels and Schot 2007, Kemp et al. 2007). Transitions are conceptualised as co-evolutionary change processes involving many societal dimensions. The central idea in transition management is a multi-level perspective that identifies niches, socio-technical regimes, and landscapes (as the contexts for socio-technical regimes). When shifts in landscapes or socio-technical regimes happen, this can allow niche practices to flourish and create new socio-technical regimes. Transition theory elaborates on a typology of transition pathways (Geels and Schot 2007).

In TRANSMANGO, we draw on various streams of research related to transformations, but we use the general notion from transition theory that innovative niche practices can become part of new regimes depending on their interactions with their contexts. Along with social innovation literature in the SES

context, we consider agency among actors in the niches, as well as in institutional structures (like the European Commission), crucial for transformative change. Related to agency are notions of social learning and reflexivity as key elements in transformations (Armitage et al. 2008). We are also mindful of two challenges for current transformations literature: the role of power, and the difficulty of any ex-ante analysis of transformational change (Patterson et al. 2016).

1.2 Scenarios and transformations

Any planning for the future should be mindful of the context for which plans are being made. Food systems offer particularly complex, changing planning contexts. And when the goal is to explore the potential for transformative change in food systems, interactions between the (unprecedented) actions of those involved in potential transformations and their contexts become extremely hard to predict.

Therefore, those who wish to contribute to transformations to sustainable food and nutrition security should be aware of 1) what contexts should be considered and 2) how these contexts could evolve, both due to external factors and in interaction with attempts at transformational change.

Scenarios are a useful tool for future-oriented thinking in a way that is mindful of future uncertainty and the multidimensional scope required to look at planning contexts. From Vervoort et al (2014):

"Explorative scenarios are defined as ''multiple plausible futures described in words, numbers and/or images'' (van Notten et al. 2003). Scenarios methodology is based in systems science and seeks to recognize and explore uncertainty and complexity in the decision-makers' context rather than limiting or simplifying that context with the pretence of providing a single forecast when such prediction is not possible (van der Sluijs 2005, Kok et al. 2006). More linear sense- and decision-making processes that do not incorporate multiple scenarios still have underlying assumptions about the future, effectively operating from a single scenario that is not examined. This failure of traditional planning to engage with uncertainty has proven to be problematic in complex systems (van der Sluijs 2005, Wilkinson 2009). In multi-stakeholder contexts, exploratory scenarios can engage multiple legitimate perspectives involved in framing and addressing messy challenges such as food security and sustainability (Reilly and Willenbockel 2010). Bourgeois et al. (2012) give an extensive overview of scenarios used in the context of agriculture and food security."

On quantitative scenario simulation:

"Scenarios generated by groups of stakeholders will naturally be biased towards the perspectives of those groups (Schoemaker 1993). In addition, there may be aspects of future developments that the groups have difficulty exploring or producing, such as biophysical processes (e.g. climate change) or detailed land use change dynamics responding to international markets. Quantitative simulation modelling can provide a complementary perspective against which stakeholders can test their ideas about plausible futures. Simulation modelling has several benefits for this purpose. It can outline the scenarios in numbers that can be used for more concrete analysis of the consequences of the scenarios, as well as the impacts of policies, investments and strategies tested against the scenarios. Simulation modelling can test the coherence of stakeholder assumptions and help point out contradictory elements

in the scenarios. Through the application of a consistent set of assumptions, simulation models can generate counter-intuitive effects of the scenarios not originally imagined by the participants. However, simulation models are characterized by their own assumptions about systems. Whereas exploratory scenarios, developed as narratives and other formats, are able to incorporate a wide range of different factors and interactions, the scope of simulation models is pre-defined. Moreover, the models are developed in reference to the past and present and may not be able to adequately represent transformative scenarios (Reilly and Willenbockel 2010). Therefore, stakeholder generated scenarios can and should also challenge the assumptions of models. Explorative scenarios are suited for the exploration of multidimensional and multi-level aspects of decision contexts (Wilkinson 2009, Herrero et al. 2014). Zurek and Henrichs (2007) outline different ways in which scenarios processes as well as scenarios themselves can be integrated across geographical levels. A number of researcher-generated explorative scenario sets, notably the SRES scenarios (Nakicenovic 2000) and the Millennium Ecosystems Assessment (2005) scenarios, have been adapted across multiple geographic levels and yet their use in decision- making has been limited (Wells et al. 2006)."

The type of purely explorative, contextual scenarios described in the quotes from our paper above have other limitations when they are not used through other methods. Explorative scenarios are not plans: they offer diverse *contexts* for decision-making. Thus, by themselves, they provide no direction for action. Therefore, explorative scenarios are often used to test and inform the feasibility of plans. If a plan or policy is considered to be feasible under a wide range of challenging futures, it could be considered robust. However, this use of explorative scenarios has been criticized for encouraging a passive, reactive attitude to future contexts, stimulating adaptation rather than proactive transformation. An alternative approach is the development of normative scenarios that describe pathways of how actors can move from an undesirable present to a desirable future. This approach has the benefit of being inspirational and projecting proactive futures. However, this normative approach has been criticized as a form of utopianism, exactly because it is less concerned with contextual changes that may happen, whether those involved in the scenario process like it or not.

Figure 1. Combining scenario contexts with transition pathways.

In TRANSMANGO (figure 1), we combine the strengths of both approaches by developing both explorative scenarios describing food systems contexts, as well as normative "transition pathways" that explore the feasibility of transformative change toward better food and nutrition security in different scenario contexts. In this process, we recognize that the boundary between actors' sphere of influence and their larger contexts is important to understand, but that this boundary is not fixed. For instance, changes in EU-level policy may normally be considered as part of the decision context for local food initiatives that they will simply have to adapt to; but (optimistically speaking), the very participation of these initiatives in TRANSMANGO means that their ideas and recommendations could have some impacts at the EU level, which means that EU policy now falls within their sphere of influence to some degree. By contrast, other factors, such as global food prices or climate change, may remain out of the sphere of influence of an initiative's actors, and they will have to deal with these changes as best they can. By combining explorative scenarios and normative transition pathways as per the steps in this

training manual, we allow for a conscious focus on the changing interactions between actors' agency and their contexts.

2. Outline of the TRANSMANGO process for scenario-guided transition pathways

This section provides an overview, and explains the logic, of the TRANSMANGO scenario-guided transition pathways process (see figure 2). The overall goal is to explore how innovative local food practices could flourish under a range of different European futures, and how this diversity of food practices could be combined to lead to transformative change in Europe toward better food and nutrition security.

Four steps/workshops are proposed. First, two scenario development workshop steps are conducted:

- WS1: An EU level workshop in Brussels to develop EU scenarios in a global context (supplied by WP4). In this workshop, the participants will explore the relevant scope and key elements of future change for FNS (drivers, stressors, disturbances, actors, activities, outcomes) and use them to construct plausible scenarios.
- WS2 (in all case studies): Local-level scenario workshops that are inspired by the EU scenario contexts in terms of systems scope, elements and drivers, but interpret and combine these elements with a locally relevant scope and system elements and drivers to construct down-scaled plausible scenarios. A start is also made in the formulation of first-order local transition pathways.

Because scenarios are about decision contexts, it makes sense to start from larger scale scenarios and work down to local-level scenarios. However, it is also important to maintain independent space for the scope and key elements of the scenarios at each level. We are aiming for a degree of coherence between levels while ensuring enough freedom so that locally relevant futures can be explored.

After scenarios have been created at both levels, and local transition pathways have been initiated, the next two workshops/steps will be organized as follows:

- WS3 (in all case studies): Local-level workshops, based on the analysis of current niches for alternative FNS, will further explore local transition pathways and explore how these transition pathways can be developed through the different local scenarios. This includes how such pathways can change the direction of the scenarios, which can be treated as "multiple baselines" rather than unchangeable contexts.
- WS4 (EU level): The transition pathways explored in the local-level workshops will be used as a basis to explore macro-level transition pathways at the EU level, again to be explored in terms of their feasibility in the context of the EU scenarios. Again, the scenarios are to be treated as "multiple baselines" rather than completely unchangeable contexts – the transition pathways will result in what can be called "transformative scenarios" in that sense.

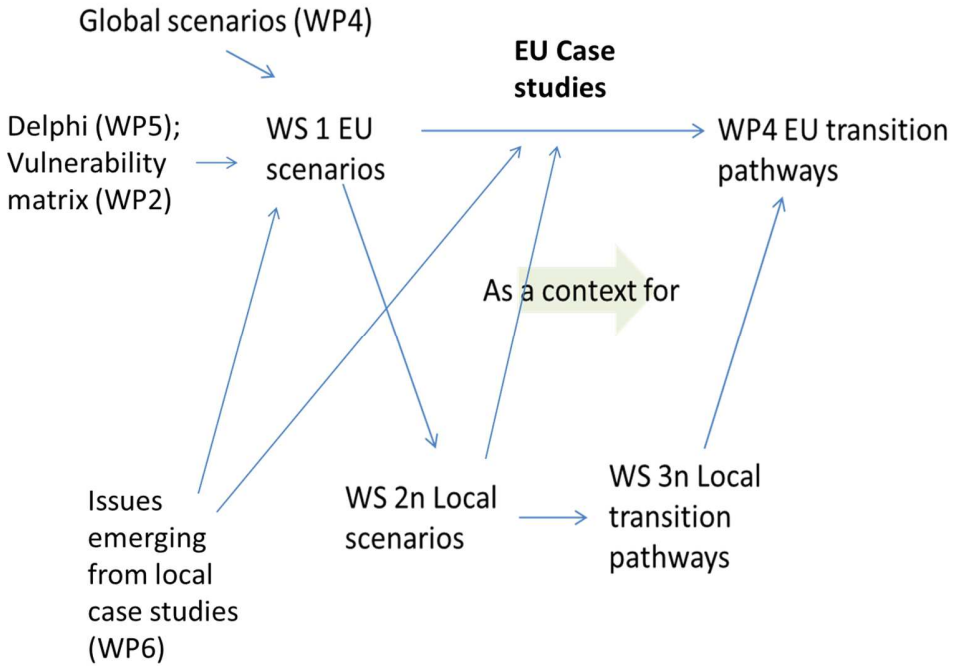

Figure 2. Steps in the TRANSMANGO scenarios and transition pathways process.

2.1 The European scenarios

European context scenarios (see table 1) were created through the identification and combination of key drivers of change according to a wide range of European stakeholders directly interviewed for the scenario process, a Delphi exercise and the TRANSMANGO vulnerability matrix. The primary set of four scenarios were fully developed by participants in a European-level workshop; the other four scenarios were given short narratives by the TRANSMANGO research team. For more details on the European scenarios, please see the European workshop report: http://www.transmango.eu/userfiles/final%20report%20transmango%20scenario%20workshop%2004_12_2015.pdf

	Consumption Patterns	**Environmental Degradation**	**Poverty and Economic Inequality**	**Social and Technical Innovation**	**Urban and Rural Population Dynamics**	**Power and Market Concentration**	**Trade Agreements**	**Resource Use**
Fed up Europe	High animal products, high sugar/processed food (unhealthy meat eaters)	Biodiversity loss, water pollution, soil degradation etc. Continued environmental decline	Low poverty high inequality – *few are truly poor, but some are extremely*	Low innovation, private sector driven: *Public and private sectors are inert,*	Increase in both urban and rural populations	Extreme concentration: several companies dominate the entire market worldwide	Free markets (more free trade agreements, removal of subsidisation)	Resource crisis

			rich	*despite interest in change among a minority in the private sector*				
Retro-topia	Low animal products, high sugar/processed food (unhealthy vegans and vegetarians)	Environmental degradation is reversed	Low poverty, low inequality	High innovation, public sector driven	Decrease in both urban and rural populations	Healthy competition exists in all sectors: significant role for SMEs	Protected markets (less free trade more subsidies)	Significant reduction in resource use/demand
The Protein Union	Meat consumption, low sugar/processed food: *strong innovation on animal proteins - insects*	Environment is stabilized but at lower levels than today	High poverty, low inequality – *people have less assets but strong state support.*	High innovation, public sector driven: *The public sector stimulates innovation, but there is an important role for the private sector*	Decrease in rural, increase in urban	Some sectors dominated by a few global players, others less concentrated	Protected markets (less free trade more subsidies)	Resource scarcity
The Price Of Health	Low animal products, low sugar/processed food (healthy vegans and vegetarians)	Environment is stabilized	High poverty, high inequality *-incomes are low, but quality of life has been decoupled from income through other means of subsistence. The rich lead very different lives.*	High innovation, needs driven, bottom-up: *local initiatives, local businesses and local governments*	Increase in rural decrease in urban	Extreme decentralisation dominated by SMEs	Protected markets (less free trade more subsidies)	Significant reduction in resource use/demand

Table 1. Drivers for four of the eight scenarios providing European contexts for local scenario planning.

2.2 The local process: step by step

Each of the steps of the local scenario-guided transition pathways process is described in this section. Following the step-by-step break down, we will discuss how this process is expected to achieve the goals of transition management.

The local scenario-guided transition pathways process is conducted in two stages over the course of two workshops. The first workshop focuses on down-scaling the European scenarios to the local level by examining what the local situation would look like in the context of each scenario, with attention to key variables that effect the goals of the focal project in the future. The second workshop focuses on developing desirable future visions and various transition pathways that could be used to achieve these visions in the context of the different local scenarios.

Participants are selected for the local workshop process. Around 20 participants are to be involved. First, TRANSMANGO facilitators discuss the process with the target initiative, to understand what the value would be for the initiative to engage in this process. The local processes have the highest chance at being seen as valuable to the initiative if they understand that the process will be tailored to improve the initiative's strategic planning to achieve their goals in an uncertain future. It may help to communicate to the initiative that scenario-guided planning is something that is normally done for organizations, by consultants, for a hefty price – so they are getting what is, in effect, a free consultancy.

To prepare the process and select further participants, a number of questions need to be asked to members of the initiative who are expected to participate:

- What are the long-term objectives of the initiative?
- Can initiative members give some preliminary ideas of what would be needed for this type of initiative to up-scale or otherwise make a significant contribution to FNS in Europe?
- Which elements are relevant to the initiative and to its future success or failure?
- Which actors are relevant to future success (include actors which could positively and negatively affect future success)?
- Who can provide critical, useful outside perspectives on the initiative?

Based on these questions, more participants can be selected, ending up with a mix of around 8-10 key people from the initiative, around 5 stakeholders who are considered to be able to play a role in the future success and up-scaling/out-scaling of the initiative or similar initiatives, and around 5 critical outside perspectives that can help create more diversity among the participants' worldviews and discourses. These critical outside perspectives can help ask difficult questions and generate more diverse scenarios and transition pathways.

These "outside" participants should also be asked to offer their visions for the future of the initiative and which elements are important for its future. Once all results have been collected, the facilitators combine these results in a basket of vision elements on the one hand and a master list of variables on the other.

2.2.1 SCENARIO DEVELOPMENT STEPS

Step 1: Generate list of variables relevant to the local case that will be examined in the context of each scenario as part of the process of adapting the European scenarios to the local level.

Firstly, ask participants to brainstorm the most important and uncertain factors in the local context, from this generate a preliminary list of variables to be considered. Then, review the information provided in the pre-workshop questionnaire on objectives of the initiative and the factors that effect success or failure of the initiative in the future. Based on these considerations add any variables to the list that have not yet been included that would enable or constrain the positive changes that the initiative is aiming to produce in the future. The outcome of this stage should be a list of locally relevant variables that will be examined in the context of each of the European scenarios. At this stage the aim is simply to create a list of variables relevant to the local case that will be examined in the context of each of the European level scenarios. This will serve as the basis for generating local interpretations, that is, scaled versions of the European scenarios – what is happening locally in each of those cases, and to make sure the key elements have been discussed in terms of each scenario.

If participants want to focus on their normative vision of the future in detail at this stage, reassure them that will be developed in detail at the beginning of the second workshop, but it is not the time for that now. It is important that the scenarios are not tied to a detailed vision in order not to limit the scope of exploration of uncertainty.

We need the most diverse set of plausible futures in order to develop roust transition pathways to that desired vision so this stage is much more about exploring uncertainty, and the reason for including elements of success or failure is as a checklist to ensure all relevant variables have been including in downscaling the scenarios.

Step 2. Reviewing and downscaling European scenarios

This step involves immersing the participants in the European scenarios. The group is split up into four groups, each with a diverse mix of participant types, and each group is assigned one scenario. Within each group, each participant reads the scenario they have been assigned individually and this is followed by an open, imaginative conversation about what the scenario could mean for their decision context. This conversation starts by each group member working in silence, thinking and writing down individual thoughts about what this scenario (as an end state) would look like for the initiative's context. This is done to ensure people have time to develop their own thinking before group work starts, ensuring a diversity of views is taken into account. Then, one by one around the circle participants share their imaginings. The whole group discusses these individual views and develops a coherent image of the scenario end state, which will be developed in further detail through the following activities.

Next, the participants in each scenario group discuss what the scenario means for the list of elements, to ensure that the scenario is elaborated in terms of the elements seen as relevant for the decision context of the initiative. Here, it is important to remember that the ultimate goal of the process is to explore transition pathways, and that this process can involve challenges around up-scaling and out-scaling, which means that while the scenarios are developed from a local perspective, they are not necessarily

only covering local contexts – any contextual factors relevant for the exploration of transition pathways are to be included.

Step 3: Develop scenario Fuzzy Cognitive Maps and System Dynamic Models

The next step is to develop a graphical model of the system being described each scenario (what is going on in the end state of the scenario), showing cause and effect relationships between the elements of the system, as shown in Figure 1. The same graph provides the basis for both Fuzzy Cognitive Maps (FCM) and System Dynamic Models (SDM) simply by asking participants two distinct questions about the links they have drawn: 1) How certain are you that there is a causal link between C1 and C2? 2) What is the magnitude of the effect that a change in C1 causes in C2?

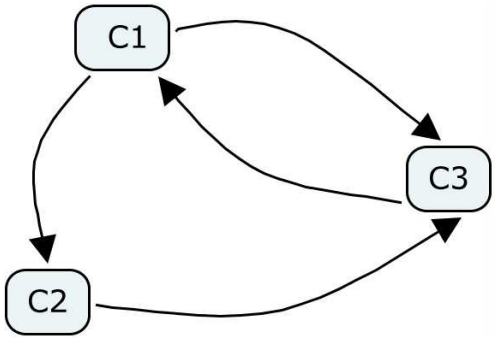

FIGURE 1 GRAPH SHOWING RELATIONSHIPS BETWEEN CONCEPTS C1, C2 AND C3

The steps to develop these semi-quantitative models are as follows:

Firstly the group determines the key elements of the system. These elements must be variable concepts (things that can increase or decrease, so “social unrest” rather than “society”, “climate change” rather than “climate”). In order to generate the key elements the participants can look to the list of variables they generated for inspiration, however they are not limited to those elements. They will choose 10-15 elements at most to include in the graph. Each element is written on a separate post-it note or card. These notes can be moved around on a large sheet of paper to allow participants to draw lines between the elements where they see a link between them. Arrowheads are used to represent the direction of causality – which element exerts causation on another element.

Once the links have been drawn participants are asked to say how certain they are that this causal link exists. They use a scale from 0 to 1 where 1 means they are completely certain that the link exists (C1 causes C2 to happen) and any number between 0 and 1 is a fuzzy degree of uncertainty about whether the link exists of not, 0 implying that there definitely is not a link.

For links that exist to any degree, participants are asked to estimate the strength of the effect that a change in one variable has on the other. We ask participants to say if the strength of the effect is high, medium or low and positive or negative. Positive if an increase in one variable causes an increase in the

other; and negative if an increase in one variable causes a decrease in the other. Plus and minus signs can be used to denote this as shown below:

- +++ Strong positive effect
- ++ Medium positive effect
- + Small positive effect
- 0 No effect
- - Small negative effect
- -- Medium negative effect
- --- Strong negative effect

Disagreements should be clearly indicated.

By focusing on capturing disagreements and uncertainty around causal links and strengths of effects, the exercise helps people understand the problematic nature of trying to map out a model of the future.

Step 4: Developing Fuzzy Cognitive Maps (FCM) and System Dynamic Models (SDM) of the present

Instructions are the same as with the FCM of the future scenarios: participants generate the elements of the system to be include in the model of the present, then draw arrows representing how these elements interact with each other, and finally indicate how certain they are about these relationships and estimate their strengths. Again, conflicting opinions are indicated.

Step 5: Develop scenario narratives

Comparing the descriptions of each future scenario with the present (drawing on all representations, text and graphs), participants develop a narrative describing how that future state is reached from the present through key story elements. However, the process for developing that narrative is conducted in reverse in that participants start in the future and work backwards to the present. This is called back-casting. It asks the question what would have needed to happen before this could have taken place? How could it have happened? The participants are encouraged to immerse themselves in the scenarios and use experientially powerful language. Collages and drawing can also be used bring further experiential life to the scenario. Also, participants are encouraged to develop various actor perspectives. Who are the key actor groups involved in or opposed to various changes? What would they think of the developments in the scenario?

2.2.2 SCENARIOS AS CONTEXT

The local scenario adaptation method presented in this document is meant to generate contextual scenarios, which in TRANSMANGO are used to test and develop local transition pathways. The development of these transition pathways and the use of the scenarios in combination with the pathways is outlined in TRANSMANGO deliverable 3.3.

3. Background notes on methods

These two background notes help provide additional backgrounds for those interested in deepening their understanding of aspects of the process described in this guide.

3.1 Methods background note 1

Using graphs to capture mental models of how the world works

There is growing interest in the use of graphical representations such as influence diagrams, causal mapping and FCMs as a participatory method for capturing mental models of how social-ecological systems function (Gray et al. 2014). Different individuals, and different groups of people have different mental models of what the system is, where its boundaries are (for example, what is part of the food system and what is not), what the key elements of the system are and what the relationships between system elements are. The graphs developed in the TRANSMANGO workshops surface these mental models and the causal reasoning of the participants. Surfacing this highlights why certain groups favour certain actions and policies over others, based on what they take into account and what they ignore, and their understanding of how the world works.

System boundaries are not given objectively and unproblematically by the structure of reality. Those involved in understanding or modelling human and natural systems make judgements about what is important to include in the analysis and what can be delegated to the system environment. These judgements are influenced by their education and disciplinary backgrounds, their social and cultural values, their purpose in conducting the analysis and a range of intangible factors. That is, what belongs to the 'whole system' is entirely dependent on and relative to the inquirers choice of conceptual boundary (Ulrich 1983). As such, whenever we speak of a system, it should be obvious that we are not speaking of transcendent reality (Matthews 2004) . In Ulrich's words, 'It is not the reality "out there" that determines the boundary between the system and the environment, but rather the inquirer's standpoint, the purpose of his mapping effort, his personal preconceptions of the reality to be mapped and the values he associates with it' (Ulrich 1983). System boundary judgements are inevitably partial and normative.

Furthermore, systems thinking literature highlights that we can only ever justify the merits of our claims regarding improvement, with respect to the original whole of system boundary judgements. This explains why there are so many disparate views on food system futures and the way to achieve sustainable food and nutritional security and where they are coming from.

Graphs are a fantastic way to make system boundary judgements and worldviews explicit in participatory processes. Different graphs of the 'same system' produced by different individuals or groups can be compared to highlight different knowledge bases, worldviews and agendas; and also can be combined to produce a picture of integrated knowledge.

3.2 Methods background note 2

The need for scenario processes to be emotionally engaging, challenging and evocative

Throughout the steps presented in this working paper, we've proposed methods that encourage experiential and performative engagements with visioning and scenario development, because this way, these activities become a lot more impactful.

From Vervoort et al. (2010): "If scenarios are to be impactful, creating change in individuals and organizations, they have to be emotionally engaging (Xiang and Clarke 2003). Schwarz (1991) has said that scenarios should "keep the decision-makers up at night". The power of scenarios to engage is partly a matter of content – do the scenarios foreground the concerns and interests of those who are meant to use them? When scenario processes are reflexive, they can explore futures that challenge deep assumptions in their participants – this can make them more engaging. However, engagement is also a matter of form and performance. If scenarios can be engaged with through a medium that makes them vivid and experientially engaging, their capacity for emotional salience is increased. Immersive, experientially engaging scenarios can create sensorially direct future worlds where more salient and challenging information can be presented, in a way that avoids cognitive friction through information overload, than through less immersive means (Xiang and Clarke 2003, Shaw et al. 2009). Scenarios also have a role in stimulating the imagination about future possibility spaces. Reflexive, challenging scenarios that are engaged with through experientially engaging means can stimulate the imagination and lead to creatively generative thinking."

References

- Armitage, D., M. Marschke, and R. Plummer. 2008. Adaptive co-management and the paradox of learning. Global Environmental Change 18:86-98.
- Bourgeois, R., J. Ekboir, C. Sette, C. Egal, M. Wongtchowsky, and G. Baltissen. 2012. The state of foresight in food and agriculture and the roads toward improvement. GFAR, Rome.
- Folke, C. 2006. Resilience: The emergence of a perspective for social-ecological systems analyses. Global Environmental Change 16:253-267.
- Geels, F. W., and J. Schot. 2007. Typology of sociotechnical transition pathways. Research Policy 36:399-417.
- Gray, S. A., E. Zanre, and S. R. J. Gray. 2014. Fuzzy Cognitive Maps as Representations of Mental Models and Groups.in E. I. Papageorgiou, editor. Fuzzy Cognitive Maps for Applied Sciences and Engineering, Springer-Verlag, Berlin Heidelberg.
- Herrero, M., P. K. Thornton, A. Bernués, I. Baltenweck, J. Vervoort, J. van de Steeg, S. Makokha, M. T. van Wijk, S. Karanja, M. C. Rufino, and S. J. Staal. 2014. Exploring future changes in smallholder farming systems by linking socio-economic scenarios with regional and household models. Global Environmental Change 24:165-182.
- Kemp, R., D. Loorbach, and J. Rotmans. 2007. Transition management as a model for managing processes of co-evolution towards sustainable development. International Journal of Sustainable Development and World Ecology 14:78-91.
- Kok, K., M. Patel, D. S. Rothman, and G. Quaranta. 2006. Multi-scale narratives from an IA perspective: Part II. Participatory local scenario development. Futures 38:285-311.
- Matthews, D. 2004. Rethinking Systems Thinking. University of Adelaide, Adelaide.
- MEA. 2005. Ecosystems and Human Well-being: Synthesis. Island Press, Washington D.C.
- Nakicenovic, N. 2000. Special Report on Emissions Scenarios. Cambridge University Press, Cambridge, UK.
- Olsson, P. 2006. Shooting the Rapids: Navigating Transitions to Adaptive Governance of Social-Ecological Systems. Ecology and Society 11:18.
- Patterson, J., K. Schulz, J. Vervoort, S. van der Hel, O. Widerberg, C. Adler, M. Hurlbert, K. Anderton, M. Sethi, and A. Barau. 2016. Exploring the governance and politics of transformations towards sustainability. Environmental Innovation and Societal Transitions.
- Reilly, M., and D. Willenbockel. 2010. Managing uncertainty: A review of food system scenario analysis and modelling. Philosophical Transactions of the Royal Society B: Biological Sciences 365:3049-3063.

- Rotmans, J. 2005. Societal Innovation: between dream and reality lies complexity. Erasmus University, Rotterdam.
- Schoemaker, P. J. H. 1993. Multiple Scenario Development: Its Conceptual and Behavioral Foundation. Strategic Management Journal 14:193-213.
- Schwartz, P. P. 1991. The Art of the Long View: Planning for the Future in an Uncertain World. Currency Doubleday, New York, NY.
- Shaw, A., S. Sheppard, S. Burch, D. Flanders, A. Wiek, J. Carmichael, J. Robinson, and S. Cohen. 2009. Making local futures tangible-Synthesizing, downscaling, and visualizing climate change scenarios for participatory capacity building. Global Environmental Change 19:447-463.
- Streeck, W., and K. A. Thelen. 2005. Beyond Continuity: Institutional Change in Advanced Political Economies. Oxford University Press.
- Ulrich, W. 1983. Critical Heuristics of Social Planning: A New Approach to Practical Philosophy. . Paul Haupt, Bern, Switzerland, and Stuttgart, Germany:.
- van der Sluijs, J. 2005. Uncertainty as a monster in the science-policy interface: Four coping strategies. Water Science and Technology 52:87-92.
- van Notten, P. W. F., J. Rotmans, M. B. A. van Asselt, and D. S. Rothman. 2003. An updated scenario typology. Futures 35:423-443.
- Vervoort, J. M., K. Kok, R. van Lammeren, and T. Veldkamp. 2010. Stepping into futures: Exploring the potential of interactive media for participatory scenarios on social-ecological systems. Futures 42:604-616.
- Vervoort, J. M., L. Rutting, K. Kok, F. L. P. Hermans, T. Veldkamp, A. K. Bregt, and R. van Lammeren. 2012. Exploring Dimensions, Scales, and Cross-scale Dynamics from the Perspectives of Change Agents in Social-ecological Systems. Ecology and Society 17.
- Walker, B., C. S. Holling, S. R. Carpenter, and A. Kinzig. . 2004. Resilience, adaptability and transformability in social–ecological systems. Ecology and Society 9:5.
- Wells, M. P., D. Grossman, and H. Navajas. 2006. Terminal evaluation of the UNEP/GEF Project 'Millennium Ecosystem Assessment'. Nairobi.
- Wilkinson, A. 2009. Scenarios practices: In search of theory. Journal of Futures Studies 13:107-114.
- Xiang, W. N., and K. C. Clarke. 2003. The use of scenarios in land-use planning. Environment and Planning B: Planning and Design 30:885-909.
- Zurek, M. B., and T. Henrichs. 2007. Linking scenarios across geographical scales in international environmental assessments. Technological Forecasting and Social Change 74:1282-1295.