Integrated EST framework (EST-Frame)

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EST-Frame deliverable 1.3 Criteria for an integrated analytical framework

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Preface

This deliverable is produced as a component of the research work conducted within a European research project on integrated assessment of emerging science and technologies (EST-Frame). It builds on work across four case studies, specifically:

i) nanotechnology in food,
ii) synthetic biology,
iii) biofuels, and
iv) cloud computing.

These case studies provide an overview of how technologies have been assessed nationally (respectively in the Netherlands, Germany, the UK and Denmark) and at an EU level. In addition, this work builds on studies of different assessment domains (viz. risk assessment, ethical assessment, foresight, technology assessment (TA), economic assessment and impact assessment).

Across all these studies, a number of individual assessments were reviewed using a standardised protocol. The results from these studies are published in four individual case study reports. Deliverable 1.1 reports on the results from these studies. These reports are published as deliverables on the project website (www.estframe.net).

EST-Frame deliverable 1.2 aims to add analytic layer to these studies by exploring how policy trends influence on technology assessment and how an integrated framework might respond to these. The work in deliverable 1.1 and 1.2, together with dialogues within the consortium, with the project advisory committee, and with other stakeholders and practitioners, has informed developing criteria for an integrated approach to EST assessment. This deliverable provides an overall justification of the general EST-Frame approach to integrated assessment, but does not present the details as these are still to be tested. The details of the framework will be published in later publications from the project. All project publications are available on www.estframe.net.

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1. Executive Summary

The case study and domain-based work in EST-Frame has highlighted the need for integrated assessments, and several integration needs related to assessments aimed at influencing policy making have been identified. A number of these are being addressed by various organisations. However, an important integration challenge remains which relates to integrating assessments from different assessment domains in a transparent way in an attempt to address practical governance problems that affect both science and values. The EST-Frame project here presents the initial development of a process framework for tackling this need, the Integrated EST Framework, that will be further tested within the project.

The Integrated EST Framework is a framework for organising problem-oriented, context sensitive assessment processes around societally contested technology issues. The approach involves organising assessment dialogues across institutional and disciplinary domains; transparent process design, collaborative situation analysis and problem framing; and continual process reflection to adapt to the situation under scrutiny. The integrated assessment process allows for integration of already existing assessments and initiation of new disciplinary assessments, ending up with an original trans-disciplinary assessment, through interdisciplinary dialogue between people involved in earlier assessments, and in interaction with decision-makers, stakeholders and the public.

Based on drawing lessons from earlier assessments and initiating new assessments/events to fill any residual knowledge gaps (including clarifying the extent of uncertainties that will have to be faced by decision makers), assessment practitioners and commissioners will produce integrated assessments of emerging science and technology to support the creation of responsible policies for research and innovation.

Recommendations to policy makers and assessment practitioners

1. In order to facilitate responsible research and innovation emerging science and technologies must be assessed in their practical contexts of use, taking into account the richness of impacts that appear in such concrete situations. Trans-disciplinary and trans-domain assessments must be carried out in order not to fragment complex real-life situations into generalised, abstract reductions.
2. Transparency of all assessments – also disciplinary assessments - is necessary for their inclusion into the evidence base for technology policy. In order to know whether an existing assessment can provide valid and relevant knowledge for solving the governance problem at hand the situation analysis and method choices must be justified and transparent. The EST-Frame project recommends that all assessments of new technology clearly show their situation analysis and method choices.
3. Assessment institution directors and managers should increase their strategic focus on the development of "home-grown" approaches to problem-oriented transdisciplinary research, to

develop transdisciplinary competences, to foster connections and interaction with other assessment domains, and to secure transparency in assessments with regard to situation analysis, dialogue and method choice.

4. Assessment commissioners, for example in European DGs and members state ministries and agencies, should help to foster problem-oriented transdisciplinary assessments by implementing an approach such as the Integrated EST Framework as a way of securing transparency with regard to situation analysis, dialogue and method choice in assessments and assessment-based policy-development.
5. Policy developers in European DGs and member state ministries and agencies should work to secure transparency in the use of assessments in policy-development through clearer presentation of the interpretations made of assessments and the conclusions drawn. Policy makers must ensure that the evidence base for EST related policy-making is integrated in a transparent and balanced way, taking into account the different framings, methods and approaches of the assessments making up the evidence base.
6. European and member state policy makers should work to secure the implementation of responsible research and innovation in the Horizon 2020 program. Such requirements would place demands on assessment researchers, encouraging that they apply the quality criteria of problem-orientation and transdisciplinarity and that assessment research is carried out in ways which secure transparency with regard to situation analysis, dialogue and method choice.

2. Introduction

Integrated assessment is not a new concept. Integrated approaches to assessing technology and policy choices have a long and diverse history. Integrated approaches are particularly appropriate for complex systems that are in danger of being reduced to their composite parts, and have as such been a subject of study within systems thinking (see e.g. Collingridge 1980 and Smith 2010). An important motivation for developing integrated approaches is to avoid reducing decisions with important social and ethical implications to an economic issue. It has long been realised in economic theory that policy decisions have costs to the environment and with regard to the quality of life for e.g. local communities that are difficult to internalise in monetary cost-benefit analysis (see e.g Pearce 2002). There are several ways to internalise such externalities (i.e. putting monetary values to these environmental or social costs), but reducing complex social goods into a set monetary figure is controversial (see e.g. Neumayer 1999 and Jackson 2010). This is an important reason why integrated (sustainability) assessments have become an increasingly significant area of research within environmental management. Recognising sustainability as a key goal of environmental management reinforces the significance of non-fragmentation and non-reduction. A wide range of researchers working on environmental management have contributed with important work on developing non-reductive integrated assessments over the last few decades (see for instance de Ridder et al. 2007, van der Sluijs et al. 2002, van Asselt et al. 2001). Some of these approaches are based on computational simulation models (e.g. Epstein 1999 and Hare and Deadman 2004), while others have been more deliberative (Soncini-Sessa et al. 2007 and Cohen and Neale (eds.) 2006).

Integrated assessment is a concept that is well established in the context of sustainability assessment. As a starting point we may therefore consult definitions of assessments and integrated assessments from this approach. Van der Sluijs (2002) provides the following definition:

> *Integrated assessment (IA) is a reflective and iterative participatory process that links knowledge (science) and action (policy) regarding complex global change issues such as acidification and climate change. IA can be defined as an interdisciplinary process of combining, interpreting and communicating knowledge from diverse scientific disciplines in such a way that the whole cause–effect chain of a problem can be evaluated from a synoptic perspective with two characteristics: (i) it should have added value compared to single disciplinary assessment; and (ii) it should provide useful information to decision makers (Rotmans and Dowlatabadi, 1997).*

However, integrated assessment can be understood in various ways, as will be clear below. The EC took a wider perspective in its 2010 Science in Society programme call for a more holistic and integrated framework for assessment of emerging science and technologies (EST) rather than frameworks that focus their attention only on a partial picture and which may fail to promote a wider debate. The EST-Frame project is a response to this call.

In this report we set out the EST-Frame approach to integrated assessment. In chapter 3 we appraise different integration dimensions that function as a basis for the choice of approach in this project. In

chapter 4 we outline some basic concepts that are important in our approach and the criteria for the Integrated EST Framework are briefly described and justified. Chapter 5 provides some more clarifications of the Integrated EST Framework. In chapter 6 we conclude the report and present recommendations to policy makers.

3. The project's findings on integration

It was not clear from the start of the project if increased integration was called for by assessment practitioners. Admittedly, it was called for in the call for this project (see European Commission 2010). However, many assessment practitioners and researchers we spoke with were sceptical about integration, and it turned out that it was highly unclear what was meant by integration and that different individuals had different conceptions of this. In order to clarify our discourse of integration we went to Scrase and Sheate (2002), who discussed different understandings of integration and integrated assessment in the sustainability assessment context. Although the notion of integrated assessment is firmly established in policy (such as in the integrated approach of European Impact Assessments), its meaning is not singularly defined. Scrase and Sheate have identified 14 different meanings of 'integrated' related to 'integrated assessments' in environmental governance: better coordination and dissemination of data; inclusion of specific environmental values into assessments; better coordination between high level and more local level governance; not isolating specific environmental problems at the cost of the whole; seeing regions as units of management; life cycle analysis; integration of business concerns into governance; integration of the three pillars of sustainability into governance; integration across policy domains; integrated computer modelling; integration of other stakeholders into governance; integration among assessment tools; integration of equity concerns into governance; and proper integration of assessment into governance. All of these interpretations have relevance for assessment of emerging food technologies.

However, assessment of emerging technologies raises some particular challenges that do not seem to be adequately addressed in this tradition. We can illustrate the even broader range of interpretations of integrated assessment relevant for emerging science and technologies by table 1. Here we have included Scrase and Sheate's 14 meanings, slightly modified (marked by an asterix in the table below). We have also included additional interpretations of integration, identified in our interviews, literature studies and dialogues with assessment practitioners and stakeholders.

Table 1. A matrix of interpretations of integrated assessment based on Scrase and Sheate (2002) and on interviews, literature studies and dialogues with assessment practitioners and stakeholders.

	Assessment data/topics	Assessment element (methods)	Assessment participants	Assessment as a whole	Governance

Assessment data/topics	a) Better coordination of data*				
Assessment element (methods)	b) Life cycle analysis* c) Integrated computer modelling*				
Assessment participants					
Assessment as a whole	d) Inclusion of all types of considerations into assessments* e) Inclusion of values into assessments* f) Inclusion of narratives/visions/worldviews into assessments g) Not isolating one topic at the expense of the whole* h) Explicating assessment framing *	i) Better integration among assessment elements* j) Some specific elements (like anticipation) are necessary in assessments k) Targeted use of methods in assessment	l) Integration of stakeholders/the public into assessments m) Integrated projects	n) Integration among assessments	o) Better integration of governance concerns into assessments
Governance	p) Better dissemination of data* q) Balanced integration of concerns into governance		r) Integration of stakeholders and the public into governance*	s) Better integration of assessment into governance*	t) Better governance coordination (between sectors, levels, etc.)*

Table 1

However, the rich description of interpretations of integration seemed to be unnecessarily complex for the purposes of the EST-Frame project and we chose to select a more focused list for analytic purposes. The EST-Frame project is specifically oriented towards the organisation and design of assessments. Therefore, the most important dimensions are those related to assessment design, including participation. We therefore excluded the questions of integration that focused solely on the governance level. However, the way assessment is incorporated into governance is of importance, and is included. We have also excluded data processing integration as such models of integration are on a level that is too technical for the purpose of the project. Finally, we chose to exclude integrated socio-technical research, as this is an interdisciplinary research strategy that is carried out internally in research projects and not intended as assessments targeted towards wider societal groups or policy makers.

This left us with the following ways to understand integration in assessments (table 2):

Integration of assessment topics	a) Inclusion of all areas of topics into assessments b) Inclusion of values into assessments c) Inclusion of narratives into assessments d) Not isolating one topic at the expense of the whole e) Explicating assessment framing
Integration of assessment elements/methods	f) some specific elements (such as anticipation) are necessary in assessments g) targeted use of methods in assessment
Integration of assessment participants	h) Integration of broader experts/stakeholders/the public into assessments
Integration between assessments	i) Integration among assessments
Integration of assessment and governance	j) Integration of governance concerns into assessments k) Better integration of assessment into governance

Table 2

In EST-Frame deliverable 1.1 we present our main findings on integration related to advisory domains[1]. Here we also present our main findings on integration from the case studies:

	Synthetic Biology	Cloud Computing	Nanotech & Food	Biofuels
a) Inclusion of all areas of topics into assessments	A majority of assessments include a large scope of topics	Many assessments cover a wide range of topics, but generally, assessments are divided according to scientific perspective between which there is little integration.	Perspectives already integrated. More data integration was not recommended.	Social issues lacking
b) Inclusion of values into assessments	Ethical issues are addressed in the corpus as a whole	Generally low level of reflection on values	Better normative positioning of the assessments needed!	Generally lack of explicit values and ethical discussion
c) Inclusion of narratives into assessments	Not considered much, though some scenarios are addressed	Although hype narratives play a great role in assessments, narratives are not explicated as such.	Not done!	Generally not included
d) Not isolating one topic at the expense of the whole	When synthetic biology matures and specific applications are being developed, this form of integration is likely to become more important.	Focusing specifically on cloud computing can be used as an excuse to not touch upon wider ICT-related issues (e.g. Big Data).	More topic focused assessments needed taking practical complexity into account	Call for increased consideration of alternatives
e) Explicating assessment framing	Explicit reflection on framing lacking	No	Transparency of choices should be increased!	The framing generally not clear

[1] See EST-Frame deliverable 1.1 for a discussion of the notion of advisory 'domain'.

f) Some specific elements (like anticipation) are necessary in assessments	Anticipation is appropriately addressed	Most assessments have a short-term anticipatory focus but neglect to investigate longer term implications	Systematic anticipation and scrutiny of alternative technology paths is needed!	No specific element seems to be called for
g) Targeted use of methods in assessment	In general not much reflection on methods	Some assessments use methods in a business-as-usual manner, others design methods to produce certain types of outcomes.	In general not much reflection on methods	Lack of transparency on methods, in particular concerning LCA
h) Integration of stakeholders/the public into assessments	Although stakeholder and lay people participation is lacking, how, and to what extent, more participation is required is not clear	Very little. More is needed!	Less participation over time	Much more participation is called for!
i) Integration among assessments	Currently not much integration	The integrating effect is in the policy, not among the assessments themselves	More systematic learning is needed	An integration institution was called for
j) Integration of governance concerns into assessments	Not systematically done, though there is reflection on current biotech. governance and regulation and to what extent this suits the (future) field of SB.	Due to many assessments being commissioned, in general governance concerns are well integrated in the assessments	Trends not included in a systematic way	Well integrated except for the social dimension of sustainability
k) Better integration of assessments into governance	Apparently low impact on governance	Some assessments seem designed to support policies, not the other way around. "Better integration" is therefore in this case a dubious term.	Hard to know how assessments are integrated into governance	There appears to be a potential better integration, at the expense of consultants

Table 3

Here we will make a synthesis of the project's findings and argue for our understanding of integration leading to what will be our criteria for an integrated framework. See also the analysis in EST-Frame deliverable 1.1.

a) **Inclusion of all areas of topics into assessments:** Such substantive integrated assessment approaches are, on the one hand, already being developed in the domains. On

the other hand, there is widespread scepticism to the usefulness and feasibility of such integration.

b) I**nclusion of values into assessments**: We see that though ethical issues are being addressed in the body of assessments as a whole, there is generally low level of reflection on values in the assessments.

c) **Inclusion of narratives into assessments**: Narratives can be held to function as a kind of lay ethics, i.e. normative stories of the world building cultural identity in groups, such as assessment groups. This is hardly made a topic at all in the assessments.

d) **Not isolating one topic at the expense of the whole:** One way to interpret this is to see single technologies as a part of a larger trend, for instance write about nanosensors in the context of nanotechnologies in general. Such general assessments are quite frequent, and they might be quite mono-disciplinary. What was not frequent was the rich, problem focused assessments, assessing the consequences of specific technology applications in their complex use situations with their multiple effects of highly interdisciplinary nature.

e) Explicating assessment framing: In this understanding integration includes reflectively positioning the assessment in a context of alternative framing options, showing an integrated perspective on its own assumptions. From the analytic studies we see that framing is often not transparent and from the practitioner workshop we see that such transparency is called for.

f) Some specific elements (like anticipation) are necessary in assessments: This understanding is inspired by current approaches to integration, such as Responsible Research and Innovation (RRI)[2]. In RRI both anticipation and plausibility assessment is crucial, however, there is no broader consensus on necessary elements in integrated assessments.

g) Targeted use of methods in assessment: This approach to integration is about designing assessments to fit the specific situation, determined in a comprehensive situation analysis of the dynamic technology and governance picture. Here we see that most assessments have not made such a careful method selection or they do not report it.

h) Integration of stakeholders/the public into assessments: This understanding of integration is frequently mentioned and more such participation is called for by assessment practitioners and researchers.

i) Integration among assessments: This is basically not found in the case studies, except in the ICT case study where the policy itself was found to have a formative effect on the assessments. There were some integration efforts between the assessments; ethical assessments and TA would refer to risk assessments. And impact assessments would refer to economic assessments and environmental assessments. Otherwise there was not much integration across the domains.

[2] See deliverable 1.2 for a brief discussion of RRI.

j) **Integration of governance concerns into assessments:** The integration of governance concerns varied across the case studies, but in general we could not find systematic tools for such inclusion, except in the area of impact assessments.

k) **Better integration of assessments into governance:** This is notoriously difficult to appraise, however, it is a finding in itself that such integration is hard and subject to different cultures in different departments, etc. In the project practitioner workshop[3] it became clear that an integrative perspective on assessments were not systematically taken. Rather, it was non-transparent how different decision makers selected from and used the different assessments.

From the very beginning of the project we got feedback from our advisory committee and others in the field that the most interesting aspect of the EST-Frame project was the fact that it was cross-domain. Many practitioners were not aware of the methods, challenges and practices of other domains. Moreover, we found very few studies studying the assessment of a technology field in general (a notable exception is the Rathenau study on nanotechnology assessment in the Netherlands, Est et al. 2012). We also saw that integration between assessments was a key, unresolved issue, and an issue with strong implications for policy making and responsible governance of EST. At some point some kind of integration of the evidence base will be done, either in the public domain of assessments or in the more closed domain of policy making and politics.

Our main concern thus turned out to regard the quality of integration of existing assessments. We saw from the case studies that there were many different kinds of assessments with very different kinds of purposes and assumptions, and integrating these into an evidence base for responsible EST governance is really a hard job! A challenge is that many assessments are not aware of or explicit about making value-laden judgements that affect the outcomes of the assessments and the way they can be integrated (assessment dimension b and c above). With regard to isolating topics at the expense of the whole (d) the problem was not that there are too few specialist assessments trying to rasp the full scope of issues in their fields, the problem was that too few assessments integrated the issues into real governance problems in their complexities. An identified lack of explicit situation analysis and method choice (e and g) is also a challenge because appraising the assessments necessitate knowing what assumptions they have made, how they have reached their results and why they believe this is the right way to assess. This is essentially related to the concept of transparency, as noted above, but transparency is not only related to assumptions and method choices, but also to the way the assessment process evolves in practice. Furthermore, the concerns involve, obviously, integration between assessments (i) and better integration of assessments into governance (k) because it is about the relation between assessment and governance. Integration of governance

[3] A workshop was organised by the EST-Frame project in Copenhagen in April 2013 with a number of assessment practitioners from different advisory domains. See also EST-Frame deliverable 1.1 for more information about the workshop.

concerns (j) is also important because real governance problems imply policy actions that will be influenced by e.g. the trends[4]. Finally, broader involvement (h) is necessary when governance problems are to be solved, because stakeholders and citizens are recipients of the policy and because they have important insights into the practical context.

Acknowledging that there are many integrated approaches that are already developed and are being applied we have developed the following criteria for the EST-Frame approach to integration:

1. It needs to be focused on governance problems.

This does not necessarily need to be a topic on the political agenda. It can well a topic that important stakeholders believe should be subject to policy making.

2. It needs to give guidance on how assessments in a larger body of assessments relevant for a particular problem, can be integrated.

From the above outlining of integration dimensions we can also infer that:

3. It needs to provide guidance on how to ensure sufficient transparency in assessments in general for such problem oriented integration can take place

These criteria have a number of implications that will be discussed below. In the EST-Frame project we have also developed an approach that addresses these criteria. This approach is under development and will be tested during the autumn and winter of 2013/2014. Therefore it will not be described in detail here. However, we will outline some main characteristics of the model.

4. Some fundamental assumptions

4.1 The need for problem orientation and trans-domain interaction

After having studied four technology cases and six advisory domains, as well as having discussed with practitioners in several different settings we have come to a common understanding of the most pressing integration needs. We have found that there are many good assessments mapping out the topics, whether they concern ethical impact, citizens' concerns, security issues, environmental impacts, etc. We have found that there are many ongoing discussions within the domains of how to advise best in situations characterised by potentially large uncertainties with regard to both benefits and risks. Even if the methods are far from perfect, EST-Frame will not engage in substantial discussions of domain specific integrated frameworks.

[4] For a discussion on the impact of policy trends on EST assessments please see EST-Frame deliverable 1.2.

The analysis in EST-Frame is that many assessments of EST are carried out at levels that are either too general or too specific to support specific policy-making processes. Emerging science and technologies are often assessed on a general level. There are general assessments of the ethics of synthetic biology, the risks of nanotechnologies, or the sustainability of biofuels. To be clear, both general assessments mapping out overall issues of concern and specific issues analysing in-depth specific problem areas are of course crucial to the formation of a policy-supporting knowledge base. However, from the empirical studies in EST-Frame we have found that there is in most fields of emerging science and technologies a gap between assessments and the problem-situation in which decisions-makers need advice on how to act. Discipline-based assessments addressing specific aspects of new technologies and their potential use too often fail to provide the necessary bridges from the specific knowledge generated in the assessment and the pragmatic issues of society and policy. Thus, in the EST-Frame approach to integrated assessment we take a *problem-oriented approach*.

Aiming assessments towards problems and specific ways to address them means to provide in and through the assessment some of that interaction between societal spheres, which all too often cause controversy and conflict. To take a problem-oriented approach to integrated assessment means to ground the assessment activity thoroughly in the embedding of science or technology into society. In such situations, logics of scientific and technological development meet the world in the sense of complex ecosystems and biological systems, market logics, governance processes and societal values in an often unpredictable manner. Issues arise about how techno-scientific development directions align with societal challenges, market trends, political programs and ideologies and citizens' wishes and dreams about the future. And knowledge which may seem uncontroversial in one sphere of society enters into a situation of contestation.

In this context, a 'problem' denotes specific EST options of emerging science and technology with their possible benefits and harms and the task of striking a proper balance between them. Assessing the complexity of such a problem may become necessary on the backdrop of societal controversy. But a problem can also be defined in an *anticipatory* way; anticipating future problems that should be addressed early. When used in this way to design anticipatory assessment process, the Integrated EST Framework may be applied to technology challenges defined in terms of societal goals, for instance how new technologies can contribute to solving grand challenges.

What come to the fore when a situation is turned into a governance problem are values and purposes and how they differ among different actors. To ground an assessment process in the situation it is therefore necessary to map these and place the integrated assessment among them. This means to clearly state the purpose to be achieved by carrying out an integrated assessment and which role the assessment aims to play. The Integrated EST Framework includes to this end resources for situation analysis, problem definition, and purpose specification.

As the real world is not bound by disciplinary borders, real world problems are necessarily *interdisciplinary*. We will argue that real world problems should be treated in a trans-disciplinary way, where the different disciplines need to develop common approaches and where even non-scientific competencies are included as important information providers on the practical consequences of issues. In this approach we follow a long tradition of thinking. Torgerson (2011) gives an interesting account of the historical development in the 1970ies (with thinkers like Laurence Tribe and Max Horkheimer) of the view that 'policy problems could not adequately be addressed by cogitation alone but required reliance as well upon processes of human interaction. This focus on interaction directed attention away from a charmed circle of experts, opening a door to democratic politics that the technocratic orientation was inclined to close' (p. 58). This stance was a result of a criticism of instrumental rationality which 'indicates a strategy of reduction and compartmentalization in addressing problems. The limitations of this approach are especially evident in addressing complexity' (ibid. p. 85).

In the context of assessment of technologies this means that in many cases several assessments domains needs to be included in order to appropriately shed light on the issue. There is for instance a need to get information on health risks and economic costs at once. This implies that there needs to be an integration of assessment domains to appraise the problem in its complexity and implies inviting representatives from several domains a dialogue in order to ensure good trans-domain processes. This kind of integration is a challenging affair and necessitates specific process management competencies.

The problem-oriented approach serves to heighten the general quality and usefulness of integrative assessments. Taking a problem-oriented approach implies the acceptance of imperfection and incompleteness as a condition for integrative assessment: no assessment activity can assess all aspects of new science or technology in all respects; and attempts to do so ultimately end up as politics in disguise. In the end any claim to integrated knowledge about a situation is always a political claim (Sarewitz 2010:73) and as such, it must be made open to scrutiny and critique. The process of reaching a working consensus in a trans-domain assessment process is in itself politics *in miniature*. 'Integrative' assessments, which do not include measures to create transparency around these dimensions, too easily lend themselves to "black-boxing".

Instead, revealing thoroughly the limitations and specific placement within the situation of the assessment means to reveal fully the assessment as an act carried out in the field and to allow recipients to take this into account in their own reflections. In this way, a problem-oriented approach makes it impossible to use integrative assessment processes as 'black boxes' of justification for political or societal action. By fully revealing the limitations of the assessment, the nature of the subsequent use by others of the results become transparent in turn.

There are different situations that lead to a greater need for trans-domain interaction. Most importantly, this is a situation where one or more interested parties believe that a problem cannot be solved by one domain solely. What domains should be involved will vary from problem to problem.

The European Commission High Level Expert Group on Converging Technologies (Nordmann 2004) recommended very strongly the strengthening of interdisciplinarity in Europe. The Integrated EST Framework is a practical framework way for responding to such calls.

4.2 Transparency as a condition for legitimate integration of assessments into policy

In this project the notion of legitimacy is relevant on at least two levels[5]. An assessment needs to be a legitimate contribution to a policy making process, and this legitimacy is determined by the quality of its input (input legitimacy), the quality of the methods applied to process the input (throughput legitimacy), and the quality of the output (output legitimacy). The quality of the output can be judged by debating the project's results. The quality of the input and throughput mechanisms can only be appraised if these dimensions are transparent.[6]

Legitimacy is also relevant for the body of evidence as such. How are all the contributions to policy being taken in? How are they processed through the state machinery? And are the resulting policies and governance measures good enough? The latter is a continuous topic for public debate. We have found in our case studies and practitioner dialogues that the throughput in policy making is often lacking in transparency. On the other hand the state democracy with its institutions is in principle legitimate, so the requirements for transparency in its procedures must be assessed in this perspective, and this is not a topic for EST-Frame. However, the quality of the policy input is a crucial matter for EST-Frame and here is the intersection between the quality of each individual assessment and the quality of the body of assessments as the evidence base for policy.

Thus transparency is a fundamental condition for appraising assessments as part of the evidence base for public policy-making. Transparency is about being open about all issues of public interest: the situation analysis (including the framing), the justification of the method choices and the hard and easy points of the dialogue process. Transparency is crucial in assessments that aim to 'close down' and give substantial advice. For assessment initiatives designed simply to open up reflection, transparency is not so essential, though still commendable. In the EST Frame project we find that transparency is often mentioned, but that concrete advice on how to practice transparency is often lacking. Health Technology Assessment is a notable exception, with a number of guidelines for increasing

[5] Franck (1999: 1) defines legitimacy as 'the aspect of governance that validates institutional decisions as emanating from right process'.

[6] For a discussion of input, throughput and output legitimacy, please see Werle and Iversen (2006), by Hahn and Weidtmann (2010) or Forsberg (2012).

methodological standardisation, evaluation and transparency in the assessments (see e.g. Hailey 2003).

As will be further outlined below the Integrated EST Framework focuses in particular on three dimensions that are crucial for the quality of EST assessment (situation analysis, method choice and dialogue). For each of these dimensions to be transparent a level of reflection on process design is implied that is not usually required in assessment processes and therefore represents a novel feature of the Integrated EST Framework. Such a strong requirement for transparency is particularly necessary in integrated assessment, but we also believe it is generally an important criterion for all assessments. Here we will discuss transparency with regard to all these three dimensions.

Transparency about method choice

The Heads of National Food Agencies Working Group on Transparent Use of Risk Assessment in Decision Making (2012) states that applying explicit frameworks in itself is a means for increasing transparency because it makes it easier to evaluate whether the assessment does what it intends to do: 'Frameworks for risk management can be helpful in building on these general principles, providing a clear, agreed view on how the process should work, while transparency in operation allows scrutiny and challenge on how things actually work in practice.' (p. 8). 'Development of frameworks and templates for the risk management process and for its communication, and dialogue between risk assessors and risk managers [...], can help to build common understanding and clear communication.' (p. 13)

They also discuss how risk managers must find ways to relate risk assessment to assessment of 'other legitimate factors', i.e. economics, ethics, consumer perception, enforcement, good agricultural practice, etc. (p. 12). The report predicts that such integration will be done in the context of the Codex Alimentarius and the authors believe that such discussions offer an opportunity to promote more transparent and consistent use of other legitimate factors in decision making (p. 13). 'While the legitimate other factors are not considered in the risk assessment, it is possible, at least in principle, to assess and evaluate them, and to weigh the impacts of different factors against each other, using structured, evidence-based approaches (for example: economic analysis; impact analysis; structured evidence on consumer concerns; risk-benefit analysis, multi-criteria decision analysis). Such methods could help to increase consistency, objectivity and transparency in the consideration of these other factors. This is by no means straightforward, but some useful work has been done, and other work is underway, towards developing robust procedures in a number of areas.' (p. 11)

The working group (WG) believes that developing and using systematic tools for risk management is hard and that '[r]isk managers, and other stakeholders, may be more comfortable discussing decisions in the context of scientific risk assessment, with its associations with neutrality and objectivity' (p.12). 'Greater clarity on the use of other factors may lead to more challenge in international fora. Even so, the WG believes that a lack of transparency and consistency carries far greater risks' (p. 15)

Doing meta-assessments and commissioning new assessments, the Integrated EST Framework takes on a role between assessment and governance of technology related problems. Participants in the EST-Frame practitioner workshop claimed that transparency in EST policy is perhaps a greater problem than transparency in the assessments, though we have found in our assessment reviews that assessments differ with regard to how transparent they are. As the Head of Agencies working group said: 'the principal challenge is for risk management to develop and promote transparency and rigour in the decision-making process comparable to that in the risk assessment process, so that the basis for risk management and the information and analysis used in this is clear' (p. 7). In this context the Integrated EST Framework can constructively contribute to increased transparency in broader risk management fora.

Transparency about situation analysis and framing

Situation analysis, or scoping, is the first phase of any assessment and ends up in a framing of the assessment. The European Food Safety Authority (EFSA) is one of the institutions that have developed transparency guidelines, and they have separate guidance documents on transparency of scientific and procedural issues. In the former they provide 'general principles to be applied in the identification of data sources, criteria for inclusion/exclusion of data, confidentiality of data, assumptions and uncertainties. […] All assumptions should be documented and explained. Where alternative assumptions could reasonably be made, the related uncertainties can be evaluated together with other uncertainties (see below).'[7]

They also advise on caution in using other institutions' assessments in an EFSA assessment: 'Risk assessments may be performed on a particular compound, agent or topic by different risk assessment bodies at national, European or international level. Such opinions should be considered by EFSA. Their relevance to EFSA's own risk assessment should be evaluated provided that a comprehensive description of all data, processes and methods is available. The same data set may, however, not be appropriate in a different context. Therefore, the terms of references need to be checked carefully before considering whether an opinion expressed by another body/committee can be used by EFSA' (ibid).

From our own studies we find a good example of transparency about framing issues in the European Impact Assessment on biofuels and indirect land-use. Here, one of their main conclusions is that 'the estimated indirect land-use change emissions are, despite the better understanding and recent improvements in the science, vulnerable to the modeling framework and the assumptions made' (UNEP 2009, p. 4).[8]

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[7] http://www.efsa.europa.eu/en/efsajournal/pub/1051.htm. [Accessed 01.05.2013]

[8] http://ec.europa.eu/energy/renewables/biofuels/doc/biofuels/swd_2012_0344_ia_resume_en.pdf [Accessed 01.05.2013]

Transparency about the dialogue process

Many articles and policy statements write about the importance of transparency about situation analysis, framings, assumptions and method choice. However, few discuss the importance of transparency about the dialogue process, although all who have ever been part of an advisory committee or assessment process know that they are essentially impacted by group dynamics and power relations. In interdisciplinary groups certain disciplines (most often the natural scientists) often regard themselves as having the epistemic authority (see e.g. Lidskog et al 2010, p. 125). Moreover, persons of higher academic status (professors) or higher positions may have more influence. In addition, other factors, such as age and gender, may also affect group dynamics and the equality of the way individuals' contributions are included. As we have seen, the scientific committee of EFSA provided in 2006 EFSA with advice to increase transparency in scientific and procedural aspects (see EFSA Journal 2006a and 2009). However, the report on the procedural aspects does not discuss aspects related to identifying group dynamics and exertion of power in the groups.

Any assessment process involving more than one person must be well facilitated in order to strengthen respectful dialogue aimed at learning from, and not defeating, other viewpoints. However, even the best facilitated process will have hard moments where participants oppose each other. This is in particular the case in processes where the participants have different professional backgrounds, with likely different underlying assumptions about science, the nature of assessment and the world.

These hard moments are the most important moments to record because they reveal where the controversies and/or uncertainties are. Therefore, instead of hushing up these moments, they should be recorded. It may well be that the dialogue moves on from there and consensus is achieved, but if these moments are recorded it will be transparent how initial disagreements were resolved. This will better show the mechanisms with which scientific knowledge on technology translate into becoming robust and available data resources to be applied in assessments and who is doing the translation work (translating scientific knowledge into political knowledge). Recording of the dialogue process will also reveal whether the translation process is done in a systematic and trustworthy way (ref transparency of method choice above).

EFSA acknowledges this when they say that: 'The reasoning leading to the conclusions should be described.'[9] A checklist for transparent process recording is developed in EST-Frame and will be tested in the upcoming workshop. A revised version will be published in later EST-Frame publications.

4.3 The importance of explicating underlying normative assumptions

Every choice and deployment of assessment frameworks is featured, though not always explicitly, by fundamental values that play a vital but also ambivalent role in the discussions about emerging

[9] http://www.efsa.europa.eu/en/efsajournal/pub/1051.htm [Accessed 01.05.2013]

science and technologies. Relating these (frames of) values to certain 'narratives' that represent political and cultural 'arche stories' about science, technology, and society, can be fruitful in several ways. Firstly, they can be helpful to recognize the deeply felt emotions and charismatic imaginations that influence the public debate about emerging science and technologies, and how these can be traced back to 'common' stories that sometimes have a long historical tradition (Dupuy 2010: 154, see also Davies et al. 2009, and Ferrari et al. 2009). Secondly, they can put us on the trail of fundamental normative beliefs that can be hidden behind rationally formulated reasons. Thirdly, whatever one may think about the (poor) coherence or (lack of) wisdom that characterise these narratives, they do give an integrated answer on the wide array of questions and uncertainties related to emerging science and technologies. Therefore, they remind us that strategies of breaking up these different questions and uncertainties in solvable issues and practical actions miss the point that the appreciation of one particular uncertainty is often related to the appreciation of other uncertainties. For instance, that people can still be very sceptical about the safety of a new technology although thorough risk evaluations show no reason for real concern can very well be related to the fact that they are uncertain that the responsible agency developing this technology is trustworthy. Biotechnology offers a good example that solving the main safety issues is not a guarantee for public support.

According to the researchers of the EU DEEPEN project archetypal narratives seem to receive little attention in technology assessments, although these are substantial for a good understanding of the 'lay ethics' that influence the public debate about science and technology. Here, we will also stress that narratives influence all groups, also the different cultures in EST assessment, such as ethical assessment, risk assessment and economic assessment. It is suggested that assessment strategies deliberately aiming at a rationally-motivated consensus may unintentionally filter out cultural values and feelings that are deeply rooted. The deliberative format of the Nanoplat consortium (Stø et al. 2010: 68-74) may serve as an example to illustrate this. In the criteria that are taken as a starting point for this online tool rational motivations are pivotal and the form of written exchanges should induce participants to take more composed attitudes. The fact that body language and tone of voice are not visible, and that 'mood is indicated only through the inflexion of written formulations of positions', is considered as constructive for more rational thinking (Stø et al. 2011: 68-69). Although there may be good reasons to 'slow down exchanges between potentially antagonistic parties' such an approach could be blind to charismatic imaginations that are not easy to substantiate but can be quite influential. In other words, this approach could overlook important narratives that cannot be easily translated into rational motivations but certainly make sense from a cultural-historical angle.

Narratives can be described as "arche stories" (in the sense of ultimate foundations) that are not just cognitively understood but also emotionally felt. Although the epistemological and ontological status of narratives is open for debate and also widely discussed – 'Are these fruitful constructions?; how can one know them?; how do they relate to reality and normativity? '- using them modestly as a heuristic means to unearth underlying values narratives can be useful for a more integral approach that aims to

cover a broad scope of 'frames and visions', particularly in the initial stage of assessing emerging science and technologies.

Combining the general findings and ideas of the EU DEEPEN project to the work of Schwarz and Thompson (1990) on culture and technology and to a more recent study of Lang, Barling and Caraher (2009), it is possible to sketch three general narratives that in our view contain fundamental values and characteristics that can be recognized in many if not all debates on emerging science and technologies:

- A (master) narrative that has as its core belief that science and technology are fundamentally positive and will solve social ills.
- A (sceptical) narrative that has as its core belief that technological innovations will distress communal values and social roots
- A (critical) narrative that has as its core belief that science and technology may harm the natural cycle of life (ecology).

The master narrative is the dominant narrative, which takes in principle a positive stance on the development of new science and technologies, whereas the sceptical and critical narrative are inclined to question emerging science and technologies and (can) oppose the master narrative.

It should be emphasised that these narratives are a simplification and capture in no way all possible combinations of fundamental values, believes, and concerns. Their main purpose is to identify and structure the more fundamental values, 'frames' and visions that are assumed to (explicitly or more implicitly) influence the public debate about emerging science and technologies. It should also be noted that the dimensions of nature and biodiversity are highly dependent on the characteristics and application of the technology. In the case of security and emerging ICTs it will probably be less of an issue than in the cases of biofuels, nanotechnology and synthetic biology.

<table>
<tr><th>MASTER NARRATIVE</th><th>SCEPTICAL/CRITICAL NARRATIVE</th></tr>
<tr><td rowspan="2">Conviction that science and technology are fundamentally positive
• Strong belief that technological solutions will or can solve social ills.
• Societies and markets are flexible enough to deal with the pace of modern innovations; the development of new technologies is inevatible.
• Natural environment is robust and thick-skinned.
• Public distrust or scepticism is due to lack of knowledge and/or irrational emotions.
• Key issues are health, environment, and safety (HES</td><td>Fear that technological innovations will distress communal values
• Strong orientation on social roots: historical tradition and cultural habits
• Societies do need a strong authority: clear rules must control and/or restrict technological innovations
• Natural environment is tolerant to human interference, but only to a certain limit.
• Public trust only when social roots and cultural habits are respected.
• Key issue is the (possible) impairment of communities and traditional values.</td></tr>
<tr><td>Critical about the ecological impact of science and technology
• Strong orientation on relationship between science/technology and the natural/human 'cycle of life'.
• Societies must arrange engagement models that guarantee early influence of the public on the development of new technology.
• Natural resources are very vulnerable to human interference.
• Public trust when technology is beneficial for nature and/or human emancipation.
• Key issue is the impact on the natural environment and biodiversity.</td></tr>
</table>

values).	

Table 4 Narratives/fundamental views on science-technology-society (including nature)

The challenge for an integrated framework lies for an important part in methodological suggestions and criteria that make the process of 'closing down' (see Stirling 2008) more transparent, so that it will become much clearer how and why certain questions and issues get a certain amount of attention and whether this does justice to the underlying archetypal values and narratives that (should) have been identified in the beginning of the process ('opening up').

The perspective of narratives is important because it reveals that 'no man is an island'; all people involved in assessments are social beings embedded in cultures with normatively laden cultural narratives. Because these are so deeply embedded in the cultures they are often hard to see – but may be revealed when the narrative is challenged. The assumption to be explored in practice in the Integrated EST Framework is that explicating this dimension may lead assessment practitioners to reflect on their underlying values; values that affect the way topics are framed. Moreover, acknowledging the normative dimensions in assessment implies that such issues are not simply technical issues. There is therefore no reason that the experts should set the premises alone. Many of the questions to be answered in assessments are best tackled by experts, but there are many decision points that need to be opened up to broader deliberation. In EST-Frame we will develop a checklist for identifying such important decision points, in order to allow for broader dialogue on these issues.

5. Outlines of the Integrated EST Framework

We have seen above a justification of three of the most important basic assumptions for the EST-Frame integrated approach. Here we will give an account of the approach's main elements. The Integrated EST Framework is a framework for organising problem-oriented, context sensitive assessment processes around societally contested technology issues. The approach involves organising assessment dialogues across institutional and disciplinary domains; transparent process design, collaborative situation analysis and problem framing; and continual process reflection to adapt to the situation under scrutiny. The integrated assessment process allows for integration of already existing assessments and initiation of new disciplinary assessments, ending up with an original trans-disciplinary assessment, through interdisciplinary dialogue between people involved in earlier assessments, and in interaction with decision-makers, stakeholders and the public.

Based on drawing lessons from earlier assessments and initiating new assessments/events to fill any residual knowledge gaps (including clarifying the extent of uncertainties that will have to be faced by decision makers), assessment practitioners and commissioners will produce integrated assessments

of emerging science and technology to support the creation of responsible policies for research and innovation.

Thus, the two main elements of the approach are:

1. **Criteria for the design of trans-domain integrative assessment processes**
   The criteria consist of process design fundamentals for trans-domain integrative dialogue processes appraising the current assessment state-of-the-art and deciding on ways to improve on it in support of responsible governance of emerging science and technology.
2. **Integration criteria for individual assessments to allow for assessment integration**
   These quality requirements apply to all assessments and include requirements for transparent communication of situation analysis and method choice.

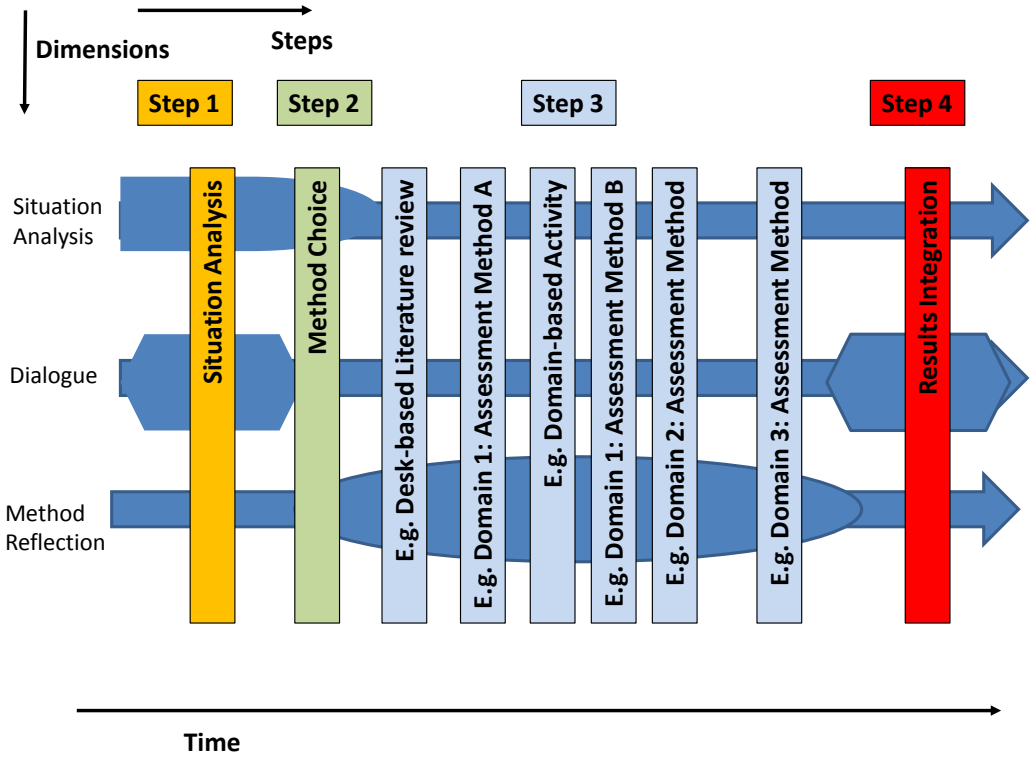
5.1 Criteria for the design of trans-domain integrative assessment processes

Technology problem situations may take several forms and may require different kinds of input, some existing and some to be supplied. When a technology-related governance problem is identified by an assessment team, they first need to carry out a framing of the problem (situation analysis). However, as all framing in a societally contested situation is loaded with controversy, this framing needs to be done in a broader dialogue. When framing the problem (determining what questions need to be answered) it will become clear what information is needed. This information may already be available in existing assessments. If so, the dialogue group needs to determine whether the framing of existing assessments is compatible with the desired framing of the issue. It will also need to reflect on the method choices of these assessments: have the assessments been carried out with acceptable choice of methods?

- Step 1: Situation analysis
  - Step 1a: Framing the issue in a dialogue: determining what problem needs to be solved (the problem definition), questions need to be answered on what information needs to be provided or what actions need to be initiated in order to answer these questions. Agreeing on the goal for the process and role it should play (impact it should have).
  - Step 1b: Identifying existing assessments that intends to provide such information (if any). Discussing in the dialogue whether the framing and method choices of these assessments make them apt for considering in answering the questions at hand.
  - Step 1c: Identifying assessment needs that are currently unmet (if any).

- Step 2: Method choice: Discussing in the dialogue how such new assessments/activities should be framed and what method choices would be necessary for providing the required information.
- Step 3: Initiating new assessments/activities (if necessary). This step may sometimes be seen as a preliminary phase before the integration and reporting below, which then counts as the "result". But sometimes new 'activities' may in fact be where the real value (real "results") lies – e.g. in establishing dialogue between otherwise separate groups.
- Step 4: Integrating the results from the requested assessments in a trans-domain, transparent dialogue process in order to yield the required answers to the policy problem.

How the 4 steps interrelate with the 3 dimensions (pillars) is shown in table 1.



The criteria for process design are further outlined in a restricted deliverable on the Integrated EST Framework prototype and will be tested in the EST-Frame project. When these testing processes are finalised these elaborated criteria will be published.

The Integrated EST Framework involves convening a group to perform a meta-assessment of existing assessments relevant for the governance problem at hand. It also involves identifying unmet assessment needs and initiating such assessments. Finally, at the point where there is a sufficient

evidence basis the group will provide advice to policy makers (or other decision makers). This advice may simply be to apply the precautionary principle, in the case the group finds that uncertainties are too comprehensive to promote the technology. Or it may be a recommendation to choose non-technological options for solving the problem at hand. Or it may be advice for initiating certain research and development programs.

5.2 Integration criteria for assessments

The integration criteria apply alike to the meta-assessment and to the assessments that form the basis for the meta-assessment, and consist of situation analysis and method choice as relevant in three related respects in the Integrated EST Framework:

a) The Integrated EST Framework is in itself a meta-assessment project. The first job of the Integrated EST Framework is to provide its own transparent situation analysis of the problem at hand and, based on this, determine a method/project design for how to work in the Integrated EST Framework group
b) When the Integrated EST Framework appraises the existing assessment state-of-the-art it needs to assess whether the situation analysis, framing and method choice of existing assessments make them apt for contributing to solving the problem at hand
c) When the Integrated EST Framework recommends assessment projects to improve the state-of-the-art, it will apply its own situation analysis of the problem into the recommended assessment project, as well as recommend methods based on this situation analysis

In order to have a transparent impact on policy making we believe that not only the integrated assessment, but all assessments should have explicitly justified situation analysis, method choice and dialogue process. This we may call integration criteria necessary for integration of assessments into policy.[10]

Situation analysis and framing

The situation in which an assessment (or assessments) is applied to emerging science and technology can have significant implications. It is therefore important to be clear about the nature of the situation through a process referred to here as situation analysis.[11] The nature of the situation can impact on many aspects of the assessment process. The implications of the situation can be seen to affect (i) the selection of the method, (ii) the application of any given method, (iii) the framing of any

[10] As we will see these criteria involve scrutinising what is called quality dimensions of assessments in del 1.1.

[11] Situation analysis roughly refers to the problem definition module in the Doing Foresight tool but modest differences exist in their respective emphasis on the various questions (see www.doingforesight.org).

recommendations or conclusions from an assessment, through to finally (iv) the use of the results by decision-makers. Situation analysis is a form of boundary setting that can occur at many levels, for example technological, spatial, political and/or governance level.

In addition, a number of assessment approaches or individual assessments applied to specific cases (such as genetically modified plants or biofuels) have been criticised for the assumptions embedded within the assessments and their applications. The call to make assumptions much more transparent is important at a number of levels but for this discussion it is a call to develop better situation analysis and make the outcomes from this type of analysis clear and available to all.

Stevens (2012) presents the SIMPLE approach to sustainability assessment and provides a helpful list of scoping questions (comparable to situation analysis) for assessing policy proposals (p. 62).

> In the scoping area of *relevance*, the scoping questions are e.g.: What is the policy or proposal being assessed? What are the objectives of the proposal? Who are the target groups of the proposal? What is the economic cost of the proposal? What scale of impacts is expected? Which economic, environmental or social areas would be affected? What is the potential for contradictory effects across these areas?
>
> In the scoping area of *extent*, the scoping questions are e.g.: Which potential impacts should be the focus of the assessment? What are the human and financial resources available for the assessment? How do available resources compare to the expected impacts of the proposal? How extensive should the assessment be? Would a quick scan of impacts suffice? Are there potential unintended side effects that warrant attention?
>
> In the scoping area of *procedures,* the scoping questions are e.g.: Who will conduct and oversee the assessment? What is the timing of the assessment? What data sources and information are available? What level of finance will be allocated to the assessment? How will the assessment process be monitored and evaluated?

A situation analysis ends up in a situation characterisation that includes important *framing* assumptions that may effectively determine the project output. Funtowicz (2006, p. 138) notes that 'the framing of the relevant scientific problem to be investigated, even the choice of the scientific discipline to which it belongs becomes a prior policy decision. It can therefore become part of the debate among stakeholders. (…) Acceptance of the principle of framing entails an acceptance of some degree of arbitrariness of choice, hence of the possible misuse of science in the policy context and, moreover, of the difficulty of deciding whether or not a misuse has occurred (the judgement will itself be influenced by framing).'

The International Risk Governance Council (IRGC) describes framing issues in risk assessment in the following way: 'Framing in this context encompasses the selection and interpretation of phenomena as relevant risk topics [...]. The process of framing is already part of the governance structure since

official agencies (for example food standard agencies), risk and opportunity producers (such as the food industry), those affected by risks and opportunities (such as consumer organisations) and interested bystanders (such as the media or an intellectual elite) are all involved and often in conflict with each other when framing the issue. What counts as risk may vary among these actor groups.' (p. 25)

They add that facts and values are both aspects of framing: 'Even within this preliminary analysis, dissent can result from conflicting values as well as conflicting evidence, and, in particular, from the inadequate blending of the two. Values and evidence can be viewed as the two sides of a coin: the values govern the selection of the goal whereas the evidence governs the selection of cause-effect claims. Both need to be properly investigated when analysing risk governance but it is of particular importance to understand the values shaping the interests, perceptions and concerns of the different stakeholders as well as to identify methods for capturing how these concerns are likely to influence, or impact on, the debate about a particular risk.' (ibid, p. 24)

Framing assumptions do not only hold for risk and economic assessments, but for all assessments, and they should be made transparent. Again, checklists for identifying relevant situation analysis and framing topics are developed in the Integrated EST Framework.

Method choice

The importance of justified and explicit method choice holds for all individual assessments and the Integrated EST Framework assessment itself. The method choice dimension refers to well-structured processes with the highest possible likelihood of the assessment process in its entirety successfully playing its intended role in the problem situation. At the heart of any assessment process design there is a relationship between method choice and situation analysis. Methods – or "ways of working" in the very practical sense addressed in these reflections - for many professionals involves layers of deeply ingrained disciplinary habits which are rarely, if ever, brought to light. Basic assumptions about what constitutes an assessment process easily become second nature.

However, some advisory domains have developed sophisticated frameworks for methodological choice. The TA community has in several European projects developed a framework for methodological choice, and the most updated version is the DoingForesight tool. As the name implies, this is also a tool for the foresight community. In integrated sustainability assessment several decision guides have also been developed; in particular the SustainabilityA Test project has developed a systematic methodological catalogue, and the Bellagio principles have been developed for Sustainability Assessment and Measurement. For the organisation of deliberative processes in particular, the OECD Working Party on Nanotechnology has developed a Planning Guide for Public Engagement and Outreach in Nanotechnology (http://www.oecd.org/dataoecd/51/12/49961768.pdf).

We have not been able to identify similar frameworks for methodological choice in the other advisory domains, though it is likely that such resources exist in different institutions.

Interviews and informal discussions with assessment practitioners reveal that such methodological tools are not much used. Practitioners largely rely on their professional judgements when making methodological choices. But the potential for greater transparency of the assessment lies specifically in greater transparency about, and clearer structuration, of these choices. Facilitating more explicit process design and method choices, the Integrated EST Framework will allow for greater transparency of assessments and thus greater usability in political processes. Furthermore, it will help to create a culture of continual learning among professional assessors and people otherwise involved in assessment in a manner fitting to this age of grand challenges, in the face of which we all remain in some sense remain amateurs.

In the meta-assessment process of the Integrated EST-Framework method choice becomes crucial. Problem-oriented and dialogue-based assessment processes demand a range of methodological reflections, which go beyond scientific expert assessments methodology into the area of interactive process design. Method reflection in this sense is a key element of establishing a process consensus, i.e. an agreement between assessment participants around how to proceed. As with the situation analysis, this agreement is far from given and it will often be renegotiated upon the inclusion of new participants to the process. Such assumptions, if unexamined in the process design phase, can make collaboration among assessment participants difficult later in the process and will make it very difficult to establish transparency. Therefore, structured dialogue methods again become key, and an element of “confession” of one’s habit may be necessary to establish a common working understanding of the way of proceeding in the assessment process.

“Method choice” can be said to be a positive demand arising out the negative realisation that in between the comfort zones (or domains) of different types of assessment participants, there can be “no more business as usual”. Specific aims in specific situations require specific approaches. So while existing assessment methods may be incorporated into an integrated assessment process in an off-the-shelf manner, they will ultimately have to be weaved together in a process design, which – while it may resemble previous assessment processes - must necessarily be custom-tailored to the specific situation.

An important part of the work in the assessment process thus becomes the systematic broadening of the process-methodological horizons of the participants. One step to be taken in this regard is the open exchange of methodological experiences between assessment practitioners. What have participants tried in different processes or witnessed or heard about, which bears resemblance to the current situation? Another step is to take on board method inspirations from outside sources such as handbooks and online method databases. Where can you see evidence of people successfully designing processes to meet needs similar to those identified in your situation analysis?

Dialogue

Good trans-disciplinary dialogue is a fundamental condition for the work in the Integrated EST Framework group, the interaction with the assessment domains, and the interaction with the assessment projects initiated by the Integrated EST Framework group (if any). Moreover, good dialogue with the public and the policy makers is crucial for the impact of the meta-assessment into the policy process. As such, dialogue is the fundamental mode in which an Integrated EST Framework assessment unfolds. Following this approach, there can be no integration in assessments without dialogue.

Any expansion of the assessment group necessitates an interdisciplinary stance in the assessment. Interdisciplinary dialogue acknowledges epistemological and methodological heterogeneity, but is based on an integration of a number of disciplines into a coherent cluster providing a new framework for understanding. Interdisciplinary research or assessment intends to challenge both the disciplinary boundaries and the dominating paradigms within the separate disciplines participating. Transdisciplinarity is by many (Bhaskar et al. 2010, Høyer 2010) understood to imply inclusion of other forms of knowledge than scientific knowledge in the research or assessment process; in more moderate forms with lay people and other stakeholders contributing with their perspectives and knowledge into the process, or in a more radical form with lay and other stakeholder knowledge given the same status and importance as the scientific experts in the assessments. The last implies to erase the boundaries between science and society at large, also as regards the knowledge produced.

In the TAMI project a framework was developed for outlining structured interaction with the project's context of debate positions, actors, and ongoing processes. Continuous dialogue with both input partners such as experts and stakeholders and target audiences throughout all phases of a project is a key component of this framework, establishing a firm foothold for the project in the situation it is trying to influence. Flexibility in the project plan is emphasised as a condition for the production of results with immediate relevance to target audiences.

Interdisciplinarity and transdisciplinarity are challenging exactly because there is no given disciplinary platform for the discussions. This might easily create an initial battle for defining the group and the assessment. This will happen by the exercise of different forms of power. Many factors will yield different kinds of power relations in the group (see e.g. Levi, 2007, for a general account of such factors). These will need to be facilitated proactively in the Integrated EST Framework.

We do not provide answers to any and all dimensions of process facilitation. The application of this framework will assume a great deal about the competencies of the user to run projects, both with regard to effective use of resources, planning, etc. and with regard to the ability to communicate openly and with people from many different backgrounds.

5.3 Frequently asked questions (FAQ)

Before concluding this report a few more issues should be clarified.

FAQ 1: Who are the users of and participants in an Integrated EST Framework process?

The users of the Integrated EST Framework can be located in different places: in a government agency, in an established assessment institution, or in an ad hoc institutional frame. The participants in the Integrated EST Framework consist of practitioners from the established advisory domains, as well as other practitioners having already been engaged in assessment or advisory activities that are not formally or informally connected to any domain. However, it is important to include representatives of the established advisory domains, because they will bring their method tool boxes as resources to the process. Participants may also represent stakeholder, policy makers or the public.

FAQ 2: What is the relation of the Integrated EST Framework to research?

We focus on assessments. We might be asked why we would not simply include ALL knowledge into the knowledge base appraised in the Integrated EST Framework, also scientific articles. This however would be contrary to positioning the Integrated EST Framework as a meta-methodology.

FAQ 3: How to determine the evidence/assessment base of a problem?

Determining what assessments are to be included in the evidence base to be assessed is an important decision and will frame the meta-assessment. When focusing on a particular governance problem, relevant assessments will be found that treat similar topics, though not the same. In this case the portability of the assessment will be crucial, i.e. whether the situation described in the existing assessment is sufficiently similar to the topic to be addressed that the results can be transferred. The fewer assessments in the evidence base for policy, the more vulnerable this evidence base will be for assumptions in these assessments and their situation analysis can be contested.

FAQ 4: Are you proposing yet another advisory committee and yet another framework on top of all the others?

The Integrated EST Framework does not involve institutionalisation, but gives tools for handling a reality with unclear institutional structures. The Integrated EST Framework is a process oriented framework, but not in competition with the domain specific frameworks. It appraises such assessments and integrates them into policy advice based on the whole evidence base.

FAQ 5: What if the group doesn't agree? Is it then impossible to do an integrated assessment?

Disagreement is allowed in the Integrated EST Framework. However, the group should strive to identify the areas of which there *is* consensus, for instance that more research is needed, that a decision is premature, that the decision boils down to a prioritisation of value, etc.. Establishing a

common ground on some facts and/or values, or clarifying how assessments have incompatible situation analysis, can then be said to be the most integrated assessment possible in such a situation.

FAQ 6: What is the relation of the Integrated EST Framework to other existing integrated approaches?

There are several advisory institutions that currently apply integrated approaches. The Dutch COGEM and the Norwegian Biotechnology Advisory Board are two examples. EU impact assessments and integrated sustainability assessments are other inherently integrated approaches. We will argue that anyone wanting to do "integrated assessments" (or claiming to be already doing it) must necessarily take our integration criteria on board. If not, they will deliver either insufficiently integrated or badly integrated assessments.

6. Implications

6.1 The importance of the institutionalised advisory domains in assessment quality control

We have here argued for the need for increased focus on transparency and justification in situation analysis, method choice and the assessment process. This may be seen as a quality control issue, and the domains with their institutionalising tools are invaluable for this quality control. From the interviews with assessment practitioners all the advisory domain institutions engage in continuous methodological development and learning processes, either within particular institutions or in advisory domain networks:

- The foresight community has the European Foresight Platform and the ForSociety ERA-net, as well as European projects such as the ForLearn project.
- TA has the European Parliamentary Technology Assessment network (EPTA), as well as several European projects (EuropTA, TAMI, PACITA)
- Bioethical committees are organised in a network called the EC International dialogue on bioethics, organised by the European Commission Bureau of European Policy Advisers (BEPA) at the request of the European Group on Ethics of science and new technologies (EGE). There have been European projects on methodological development, such as the Ethical Bio-TA Tools project.
- The economic assessment community has several networks, including the Society for Cost-Benefit Analysis, which organises international conferences and publishes the Journal of Benefit-Cost Analysis

- The impact assessment community is organised in The International Agency for Impact Assessment, which organises conferences, training, and publishes a journal. European impact assessment is also supervised by the Impact Assessment Board.
- Sustainability assessment has the Integrated Assessment Society (TIAS), with the journal Integrated Assessment, as well as the European projects Matisse and SustainabilityA Test. In a public-private setting, The Sustainability Consortium (TSC) though originating in the United States is gaining relevance in the European Union recently.
- Risk assessment has several professional communities, such as Society for Risk Analysis. The European Commission Risk Assessment Unit has a coordinating function towards EC scientific committees on risk. There are in addition a number of national, European and international projects on risk assessment methodology, such as the Safe Foods project.

These are important resources for further discussion of the recommendations of the EST-Frame project.

6.2 Summary

We have in this deliverable identified several integration dimensions, all of importance for the responsible assessment and governance of emerging science and technologies. We have furthermore argued for our choice of focus for the further work in EST-Frame. We have spelled out some of the fundamental dimensions of this approach, namely problem-orientation, transparency and the acknowledgement of normative assumptions in the assessments. We have also spelled out quality criteria relating to situation analysis, method choice and dialogue. The details of the approach are outline in a prototype description that will be the basis for four testing processes in the project, and for discussion with end users. At the end of the project the details of the Integrated EST Framework will be published in the project's final report and in a scientific publication.

We realise that the approach outlined here has an idealistic character, but still believe that such ideals should be defended.

6.3 Recommendations for policy makers and assessment practitioners

In line with the approach chosen in this project we have the following recommendations to policy makers:

1. In order to facilitate responsible research and innovation emerging science and technologies must be assessed in their practical contexts of use, taking into account the richness of impacts that appear in such concrete situations. Trans-disciplinary and trans-domain assessments must be carried out in order not to fragment complex real-life situations into generalised, abstract reductions.

2. Transparency of all assessments – also disciplinary assessments - is necessary for their inclusion into the evidence base for technology policy. In order to know whether an existing assessment can provide valid and relevant knowledge for solving the governance problem at hand the situation analysis and method choices must be justified and transparent. The EST-Frame project recommends that all assessments of new technology clearly show their situation analysis and method choices.
3. Assessment institution directors and managers should increase their strategic focus on the development of "home-grown" approaches to problem-oriented transdisciplinary research, to develop transdisciplinary competences, to foster connections and interaction with other assessment domains, and to secure transparency in assessments with regard to situation analysis, dialogue and method choice.
4. Assessment commissioners, for example in European DGs and members state ministries and agencies, should help to foster problem-oriented transdisciplinary assessments by implementing an approach such as the Integrated EST Framework as a way of securing transparency with regard to situation analysis, dialogue and method choice in assessments and assessment-based policy-development.
5. Policy developers in European DGs and member state ministries and agencies should work to secure transparency in the use of assessments in policy-development through clearer presentation of the interpretations made of assessments and the conclusions drawn. Policy makers must ensure that the evidence base for EST related policy-making is integrated in a transparent and balanced way, taking into account the different framings, methods and approaches of the assessments making up the evidence base.
6. European and member state policy makers should work to secure the implementation of responsible research and innovation in the Horizon 2020 program. Such requirements would place demands on assessment researchers, encouraging that they apply the quality criteria of problem-orientation and transdisciplinarity and that assessment research is carried out in ways which secure transparency with regard to situation analysis, dialogue and method choice.

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