EPINET

Funded under FP7-SiS-2011-1.1.1-4
Grant Agreement 288971

Deliverable D2.2

Documentation of case study progress ‘Disciplinary orientations and method - Interdisciplinary approximations and distantiations’

Authors: Niels van Dijk (Vrije Universiteit, Brussels, Belgium)
Kristrún Gunnarsdóttir (Lancaster University, UK)

December 2014

This deliverable is a progress DOCUMENTATION of the Epinet case studies. It focuses on key factors in the coming together of disciplinary orientations and methods, both within each case study and within the broader communities of expertise and experience who were involved in the embedding phase of the case work. This documentation provides preliminary analysis for thinking about what we can call the ‘materialities of interdisciplinarity’ in the integration of different innovation assessments. Two heuristic notions are introduced to study practical resources for achieving disciplinary approximations and distantiations in teamwork and leadership. These are the notions of ‘*infra-concept*’ and ‘*epigram*’.[1]

Cite as: Dijk, N. van. and Gunnarsdóttir, K. (2014). *Disciplinary orientations and method - Interdisciplinary approximations and distantiations. Documentation report of case study progress*. (EPINET Deliverable D2.2, Dec 2014).

1 The notion of an '**epigram**' was first introduced by Niels van Dijk at an EPINET meeting in Bergen, 17 Dec 2014.

Table of Contents

Executive summary **1**

Case study stories **2**

Methodologies: first hand at assessing assessments *2*

Publishing: the cases as teamwork and leadership as integration work *3*

Extending the network: embedding work *4*

Concepts and models for disciplinary convergence **4**

Caring for (infra-)concepts *4*

Epigrams *6*

Modes of integration **12**

APPENDIX I

A catalogue of (infra-)concepts **15**

APPENDIX II

Methodological complementarity amongst Epinet partners **37**

Executive Summary

Work Package 2 is designed to be a tool of *observation* and *reflexivity* for the Epinet case studies and, more generally, to support the project in meeting the criteria of the FP7-SiS 2011 call, to "*contribute to shaping an integrated framework, conducive to a better and more balanced assessment of emerging sciences, technologies and related societal innovations*".[2] Since the project commenced, we have observed how uncomfortably the idea of an *integrated framework* – inclusive of formal and informal assessments, knowledge claims, diverse experiences and views on the progress of innovation – sits with the expectation that different types of well defined technology assessments (TAs) *can be better integrated*. This tension we observe points to a two-fold problematic. One part underscores existing idealisations of what assessments can achieve, the purposes given to both formal and informal approaches and, in particular, how assessments are supposed to fit into one or another shaping of integration, including the shaping of a framework (integrated) for more balanced assessments overall. The other part raises the question of interdisciplinarity in multi-disciplinary assessment work, whereby also a debated aspect of interdisciplinarity is the very *process of integration*.[3] We deal with the latter issue in forthcoming publication,[4] but here we observe that integration *per se* is not what is achieved by the Epinet case studies. Rather, we observe a whole host of tools come into play, to facilitate communication, to establish shared concerns and points of convergence, all of which may lead to some breadth and depth of integration, however, depending on the nature of the teamwork and, not the least, the leadership.

With these considerations in mind, it has been our task to reflect upon the roles of various formal and informal knowledge productions, knowledge and technology assessments—to explore how diverse, but vested, involvements in the innovation domains in question here, come together and drift apart. For this documentation, we trace the case studies by accounting for their take on topical and policy-relevant questions. We explore the enablers and constraints in the coming together of disciplines and professions, of framings and entrenchments, challenges and learnings, orientations to reasoning and choice of language. But, in the main we orient our focus toward a number of endogenously emerging anchoring-devices, manifested in singular terms and notions that have enough traction to hold together common explorations of issues and concerns within each case study. We refer to these as ***infra-concepts***. We also orient our focus toward tools of direction and leadership, we have chosen to call ***epigrams***, each of which signify a moment of discovery, an affirmation or a situation and what to do about it, manifesting partial, however potentially transformational, interdisciplinarity. The aim of these exercises is to encourage and support further analyses of how disciplinary-specific investments approximate and differentiate in sharing and

2 Science in Society, WP 2011.1.1.1-4; also EPINET-D2.1-2012. Four case studies are part of the Epinet project: WP3, wearable sensors for health and self care, fitness and wellbeing; WP4, autonomy in robotic systems for care and companionship; WP5, synthetic/in-vitro meat, WP6, the future smart grid; plus, the cross-cutting case of Data Protection Impact Assessments (DPIA).

3 Huutoniemi, K., Thompson Klein, J., Bruun, H. and Hukkinen, J. (2010). Analyzing interdisciplinarity: Typology and indicators. *Research Policy* 39: 79-88.

4 Gunnarsdóttir, K. and Dijk, N. van. (in preparation). Responsibilising Interdisciplinarity and Integration in Horizon 2020: Teamwork, Leadership and the 'Sufficient Assessment'. (for EPINET D8.6).

communicating findings, methods, experiences and views for the betterment of innovations and the policy developments associated with them.

Case-study stories

In looking at the trajectory of the Epinet case studies, there are three major milestones to consider.

1. Sharing methodologies (in briefs), and sharing the first working papers, each of which scopes the innovation domains in question, as well as the assessments that were already in circulation about them at the time in scholarly and policy circles.
2. Sharing the first publications, each of which focuses on some particular aspect of development or of assessing an innovation and its trajectory.
3. Sharing the *embedding events*, each of which opened the doors to multiplicity of input from domain-specific expertise, professional and other relevant experience outside the Epinet consortium

Methodologies: first hand at assessing assessments

At the outset of the project, the partners were asked to provide some kind of declaration of the kinds of methods they normally apply, their orientation to reasoning and evaluation of new-emerging technologies. These methodological briefs were helpful in clarifying the different study orientations, which again were reflected to some extent in the first working papers or scoping exercises. However, there is very little in these early documents that clarifies adequately how or in what way the study groups can join forces, integrate their orientations or, at least, complement each other. This is of some curiosity, as we elaborated already in WP2 working paper[5] Some of the partners felt very strongly at the kick-off meeting (June 2012), about casually using the terms *Technology Assessment* (TA) and *Integrated Assessment* (IA) as shorthand to describe one of the key objectives of the Epinet project. On the one hand, the partners have all been encouraged to consider the respective roles of formal and informal evaluations and specifically also the role of non-economic factors in assessing new-emerging domains of innovation. It is clear that TA and IA are only two ways of many, of approaching what can be said of social, cultural, legal and policy-relevance about some domain or other. On the other hand, consortium members did not insist on using the shorthand to refer to a whole array of methodological and ideological orientations within the consortium, but WP2 made a point of clarifying early on the relationship (or non-relations) the partners have with that study tenets and history of TA and IA.

For example, a couple of the partners latched onto these terms immediately to draw attention to long-standing institutionalised practices of TA and IA, both of which have been supported by learned societies and advisory bodies in matters of innovation policy and S&T governance. They expressed a worry that Epinet was attempting to reinvent the wheel with no reference to or regard for the work of those societies—that the description of WP2, as stated in the DoW, was an attempt

5 Disciplinarity and value commitments. WP2 Working Paper on EPINET's formal and informal assessment methodologies (EPINET D2.1, Dec 2012)

at redefining *Integrated Assessment*. One of these partners explained that members of the IA society had already some time back attempted clarity in defining integrated assessment, i.e., as a "reflective and iterative participatory process that links knowledge (science) and action (policy). It could be defined as an interdisciplinary process of combining, interpreting and communicating knowledge from diverse disciplines in such a way that the whole cause–effect chain of a problem can be evaluated from a synoptic perspective. IA should add value to a single disciplinary assessment and provide useful information to decision makers" [6]

We brought this up in previous reporting, because the result of using the IA shorthand is potentially misleading. It effectively obscures what else can be said about the evaluation methods at work within the project and what WP2 may have to offer by identifying among them the potentials for *complementarity*, *expansion*, *modularity*, *convergence*, *harmonisation* and, to some extent also, *integration*. What the discussion at the kick-off meeting revealed is the historical state and the power structures dictating which meanings are given to the established practices of *technology assessment*, *impact assessment* and *integrated assessment*. As one other partner pointed out, the terminology is built into Epinet from the outset, however, suggesting that there are good reasons to step beyond the conventional definitions. However, a problem with the wider debate that took place at the kick-off meeting was how the 'official' terminology was never abandoned, i.e., consortium partners were persistently pulled towards the particular formulations of assessment that dominate TA and IA and related assessment traditions. Attempts to draw a distinction between those conventions and the ways in which the FP7 Science-in-Society call was phrased, and what that could mean for the case studies, seemed futile at the time.

That said, the partners clarify their study objectives and preferred objects of assessment in the first working papers of the case studies. Assessment procedures are approached in ways that exemplify biases and constraints as well as what they enable. Each assessment method orients to particular forms of knowledge-making which is always, however, only one of many ways in which we *can* acquire knowledge about new-emerging innovation networks and what they produce—the many ways in which *something relevant can be said* about them. Further work indicates that some of the partners continue to reintroduce their particular relations to technology assessments and integrated assessments, while the others have produced evaluations that can be said to be of a rather different nature.[7]

Publishing: the cases as teamwork and leadership as integration work

The first publishing efforts of each case study were a follow-up from the scoping exercises and first working documents. We will not go into the contents of these publications here but we wish to draw attention to matters of choosing topics and the process of bringing these publications together, i.e., as indicative of the kind of teamwork that took shape early on within each study group. They are also indicative of the kind of leadership provided for each of the groups. We articulate issues of teamwork and leadership in depth in a forthcoming publication. We wish to point out here that we observe varying levels of delegation or lack thereof, of freedom and encouragement to take initiative in order to move the studies forward, of approximations and distantiations amongst the

6 E.g.. van der Sluijs (2002), http://www.jvds.nl/reports/EGEC-IA.pdf .

7 See **Appendix II** for a list of associations between Epinet partners, based on methodological complementarity.

partners for reasons of (dis-)interest, belonging and related factors. We also observe different types of leadership or lack thereof—leadership by absence, by facilitation, by dictation and command. The point of making these observations known here is to argue that case study developments in matters of converging views and methods, of integrating assessments and so on, hinge quite intimately on the nature of the teamwork and its leadership, i.e., what can and cannot be achieved. We like to argue in that respect, that successes and failures at this within Epinet are no more or less significant than is reasonable to expect in matters of collaboration across geographical distances and the disciplinary boundaries we have been dealing with. This only goes to show how important it is to pay attention to matters of team-development and leadership for any project holding great expectations of genuine interdisciplinary learning, mutual understandings and the shaping of new and effective frames for identifying and evaluating issues and concerns—as in this case, associated with new-emerging domains of innovation.

Extending the network: embedding work

There are certain characteristics to notice about extending the case study networks, i.e., of the ways in which contributions from invited participants (methods and input) come into play during the embedding events and the impact on the follow-up output in reporting back on these events. For example, the Epinet team leaders each framed the embedding events, by taking on particular topical themes, illustrated by certain terms and notions that were positioned in guiding roles in the discussions, e.g., the use of *social robustness* to frame the discussion on smart grids and the use of *autonomy* to frame the discussion of state-of-the-arts robotics. The events themselves also presented challenges to the unfolding of the cases, with the potential to shift the way in which respective developments are depicted, promoted and understood.

Concepts and models of disciplinary convergence

Our focus on the dynamics of teamwork and leadership opens up new perspectives in the study of interdisciplinarity, in particular, its material manifestations and resources. In this section we introduce two heuristic notions, ‘infra-concept’ and ‘epigram’, that each facilitate closer scrutiny of the *materialities of interdisciplinarity*. In and through our use of these notions, we attempt to shed light upon the epistemic features that are mobilised in collaborative work—in achieving disciplinary approximations and distantiations.

Caring for (infra-)concepts

We observe the emergence of terms we have chosen to call infra-concepts. They are methodological in the sense that they operate like field guides that can help a practice 'speak' and be understood by those outside the immediate disciplinary or practice-bound environment. They are cross-cutting in the sense that many such terms migrate quite effectively across disciplinary boundaries within emerging epistemic networks where they begin to exert an ordering (epistemic) force. Infra-concepts also have a tendency to form clusters of use by virtue of being performative and then clustered together into what we refer to as *epigrams*—world-making depictions with claims upon knowledge and future action.

In referring to ***care for concepts*** we are, among other things, observing the practical settings of the Epinet embedding events. The workshop on *making robotic autonomy through science and law?* was focussed on the different senses made of the concept of *autonomy*, and how to relate to it within the fields of robotics, law and ethics. In the final round of reactions to the embedding event, one of the roboticist remarked having learned a lot and what became very clear to him pertains to the *use and misuse of words, how they work across fields and barriers*, as he put it, and that this is even more problematic when *approaching the public*. There is a great need to involve ethicists and lawyers, he remarked, and he learned a lesson: *we need to be careful about how we use words*.

These remarks attach importance to the value of ***learning***, in this case in relation to the embedding of (ethical and legal) assessments within a (robotics) network of innovation. This *learning*, referred to here, pertains directly to the issue of caring for concepts, for the ways in which concepts are used within disciplines, how they can shift meaning and create confusion when they are used across disciplines—here the key infra-concept is *autonomy*. This participant also flags a concern for *communication of scientific knowledge to the public*. Another example articulating care for concepts comes out of the workshop on *the issue of the future social robustness of smart electricity networks in Europe.* One participant contested the central concept, *smart grids*, used by the case-study team and its leadership to frame the object of assessment and engagement at the event. This participant stated that the assumption at the centre of the framing is that there is such a thing in the world as a smart grid. Instead, he argued, we can assume that there are different technologies, political and economical developments and opportunities to do things differently. The comparisons between those different things *depend on the concept one uses*, as he put it. The question, *do we want the smart grid*?, is actually misleading since *it enhances and fortifies the concept, smart grid*. The issue could be seen to be about guiding a transformation that is taking place in society. For example, the battle of the smart meter depends on the concept used: some technical concept, a function in an organisation, etc. Each formulation will perform very differently, so we have to structure the *framing of what is at issue* the other way around.

- **Epistemic Networks**
- **Issue-focus**
- **Mapping**
- **Embedding & Intervening**
- **Responsibility**
- **Multi & Interdisciplinarity**
- **Social robustness**
- **Integration**
- **Plausibility**
- **Systemic approach**
- **Vision assessment**
- **Assessing Assessments vs Doing Assessments**
- **Mutual Assessment**
- **Experimentation**
- **Bottom-up vs. top down approaches**
- **Technology Exceptionalism *vs.* Technology Generics**
- **Epistemic Checks (and balances)**
- **Quality of knowledge**
- **Risk, Uncertainty, Ignorance**
- **Purpose specification**
- **Legitimacy**
- **Fitness for purpose**
- **Alternatives**
- **Proportionality**
- **Learning**
- **Normativity**
- **Public participation,**
- **Contestability of evidence**
- **Due Process for impact assessments**
- **Ethics by design vs. Ethics in design**

Table 1: A catalogue of infra-concepts

This contestation of the way the assessment was framed, and proposing a counter-frame, becomes a crucial factor here, with bearing on the notion of *mutual assessment* and *intervention*. In this case, care for concepts is itself mobilised as a concern about mutual assessments, about complex political, economical, social and technological developments, thus also contesting the guiding term of *social robustness* as the main indicator of whether or not the innovation is sound.

In this and similar manner, we observe a whole catalogue of infra-concepts emerging, in particular, during the embedding phase of the case studies (Table 1; also APPENDIX I). Each of these notions are performative in approximation, contestation, debate, distancing, just comparing books, and many other features of communication that lead mutual understanding and learning. The fact that we single them out as notable objects of observation and reflexivity is the caring we observe in the articulation of meaning and world-making across disciplinary boundaries, vested interests and points of view.

Epigrams

What we are calling *epigrams* refers to a practical model for ordering items of knowledge and modes of knowledge production into a constellation of relationships. As such, they indicate epistemic power and their identification can serve reflexively the need for installing epistemic checks and balances. An epigram relates to the notion of a cosmogram[8] in that it is a provisional model of a world of one or another description with which one is working. It relates to the notion of a diagram (Foucault, Deleuze)[9] in being a discursive map of relations that have the potential of creating a reality as much as representing it.

Within the case studies, the making and use of epigrams serves us to explore emerging epistemic networks of innovation and assessment, but also how actors situated in or around these networks are reflexively trying to make sense of their epistemic relations. The team leaders (and sometimes assertive team members) came up with their own illustrations, diagrams and other schemas for what the innovation networks are, how to conceptualise them and how to integrate assessment efforts, even unify them. We argue that the making and using of epigrams is a display of epistemic power and the need for explication and confrontation. We take here five examples to address some of their key characteristics and functions in relation to the development of the corresponding cases.

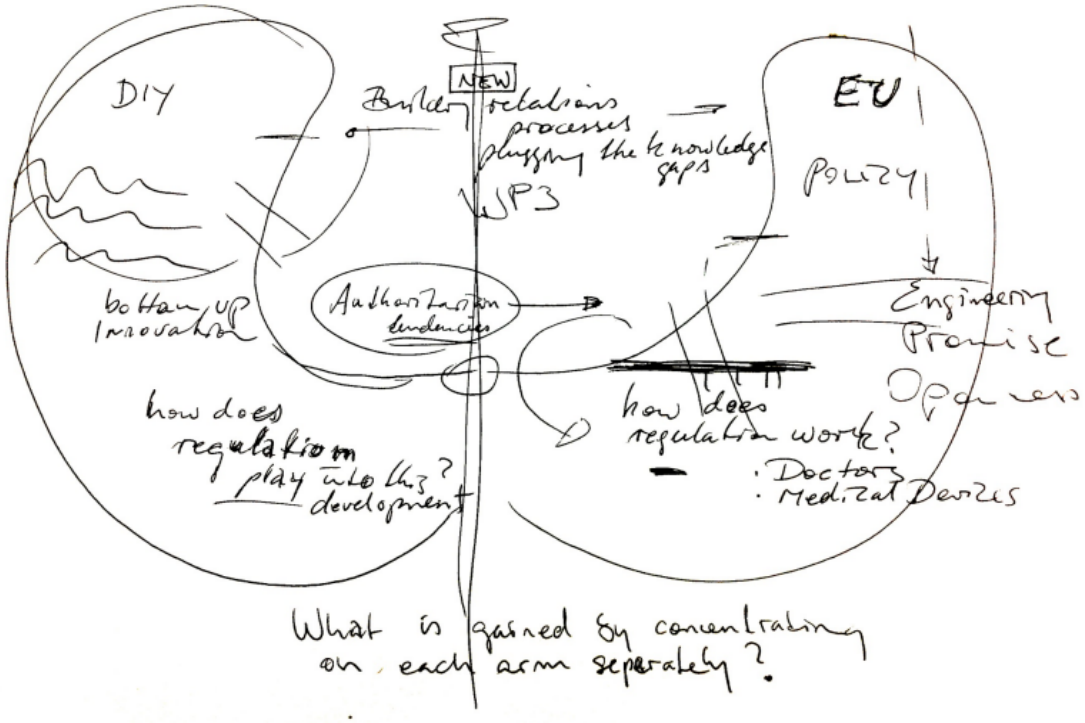
The logo of the Epinet project (**epigram 1**), symbolises the way in which the project is introduced along with explicit framing in terms of, “Epistemic Networks as Point of Departure and Normative Goal for Integration of Assessment Methods”. By that, the stage is set to view epistemic networks as empirical and normative focal points for the integration of different TA methods in connection with the networks of innovation and governance. This epigram provides a mapping and embedding guide which is further associated with central governance concepts like *responsibility*, *social robustness* or any of the policy problems the study teams have identified, i.e., prior to the task of integrating methods, orientations and views.

8 Ohanian, M. and Royoux, J. C. (eds). (2005). *Cosmograms*. NewYork:Lukas and Sternberg; Latour, B. (2005). *Reassembling the Social: An Introduction to Actor-Netork-Theory*. Oxford University Press.

9 Foucault, M. (1991). *Discipline and Punish*. London: Penguin; Deleuze, G. (2006). *Foucault*. London: Continuum.

Epigram 1: The Epinet logo

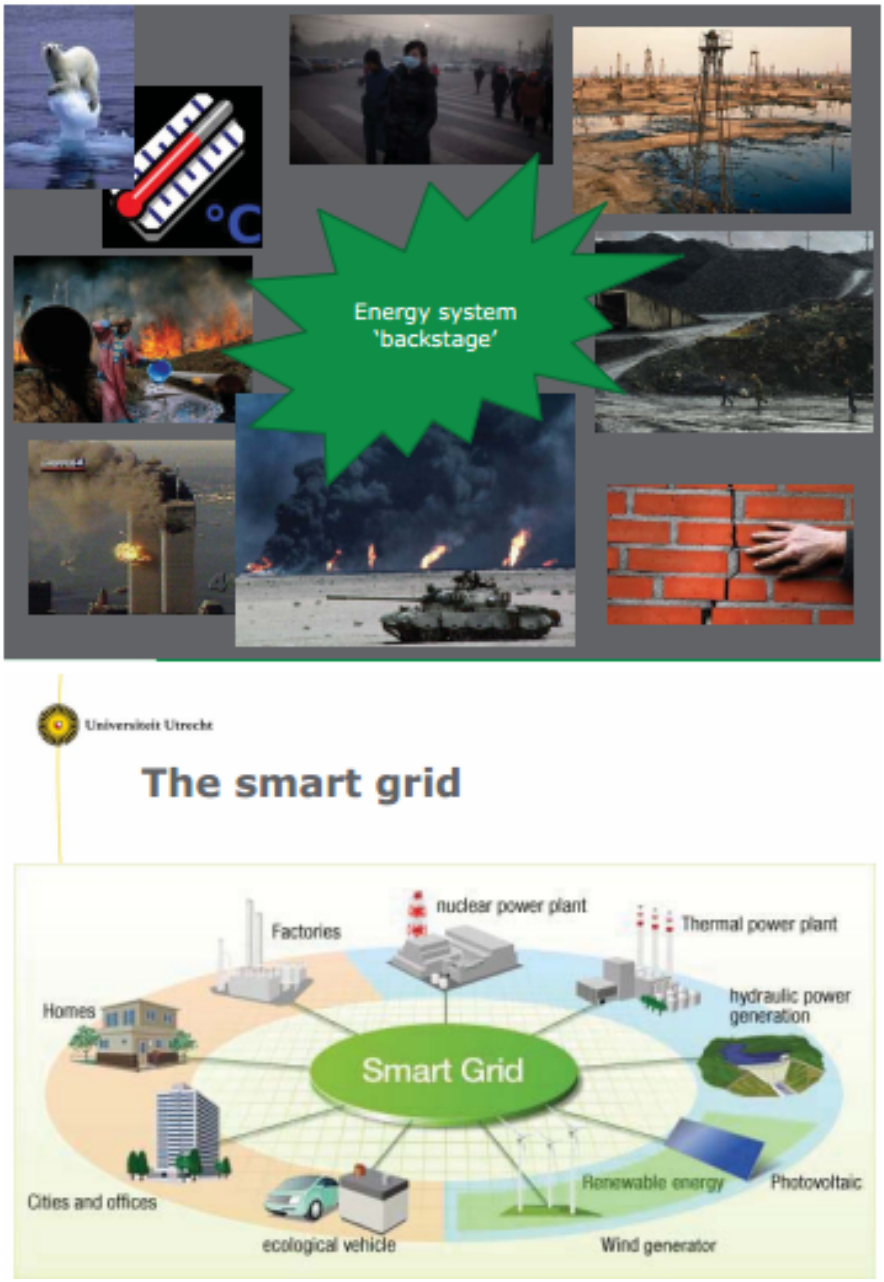
Epigram 2 was presented in a debrief at an Epinet consortium meeting, to elaborate and collectively reflect upon an observed disconnects between grass-roots activities associated with wearable biosensors and top-down thinking in EU policy in matters of healthcare. It was used to clarify the outcome of a networking event with a range of experts, experimenters and activists. It depicts the clustering of epistemic networks, indicating two areas of concern and disciplinary commitment for each assessment methodology available on the study team, one for each *arm* so to speak. But, this depiction of two arms was primarily represented to indicate lack of mutual learning and knowledge exchange, one arm presenting policy initiatives and investments infused with engineering visions of healthcare and a promise of a healthcare revolution, the other arm representing do-it-yourself care and associated grass-roots innovations and activities. It was used to state the need to *plug knowledge gaps* for better understanding of the state of the art and of probable futures of wearable biosensors for health and self care, fitness and well-being.



Epigram 2: Elaborating and reflecting upon an observed disconnect between grass-roots activities and top-down thinking in EU policy. This finding was one of the outcomes of a networking event, involving experts from industry, ELSi scholars, policy-makers, regulators and activist representatives.

Here an epigram is put to use to sort out relations and lack of relations--a sorting instrument to explicate, to lead on what the status is overall with this innovation domain, and to provide suggestions on how to move forward with the case. In doing that, the epigram is also explained in reference to how the members of the study team each take interest in and stock of what is happening on both sides, share observations of normative presuppositions and values, epistemic commitments, relations and gaps.

Epigram 3 was presented to participants in a networking event for the Smart Grid case, involving innovators and a whole range of different experts. It was used to frame the event and set the stage for the interactions. Here a photo collage (on top) illustrates a world of rising heat, war for easy oil out of middle-eastern deserts alongside environmental devastations. This collage is made to

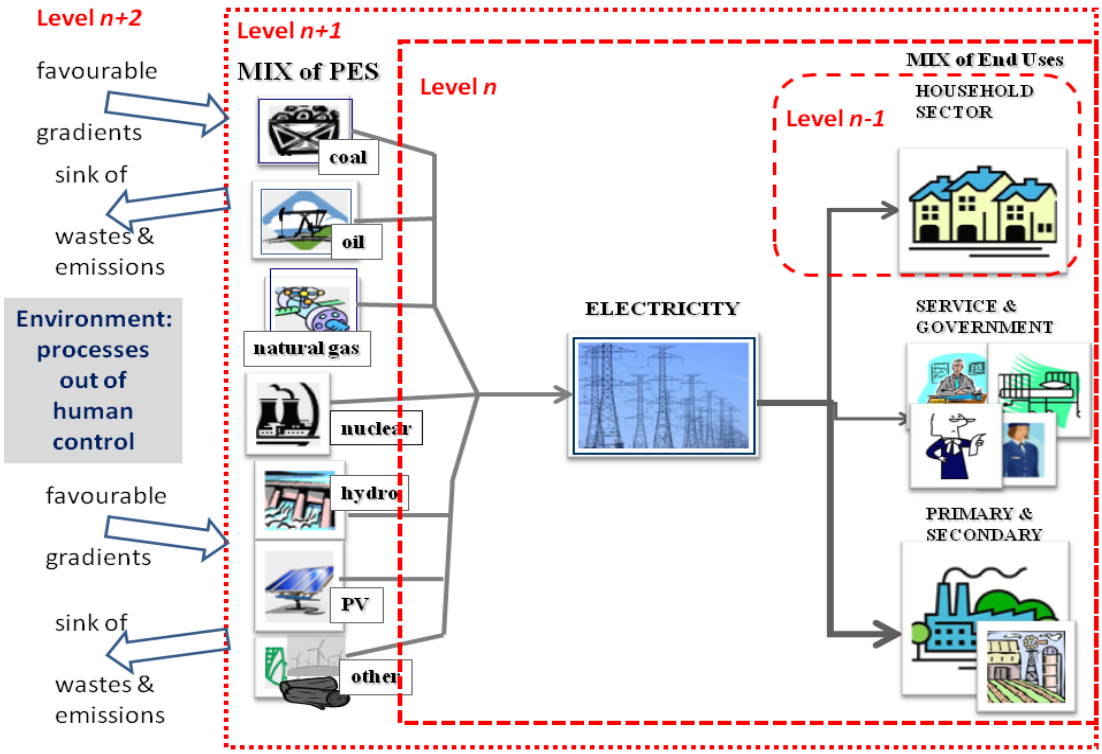


Epigram 3: Setting the stage for a networking event with experts from industry/SMEs, public offices of technology assessments and economic affairs, systems analysis and consumer organisations.

represent the current dominant model or a *flammable* if not *explosive* “energy system 'backstage'” to which a diagram underneath is presented as the projected solution. The smart grid is the 'clean break' so to speak, an idealised model of energy production, distribution and consumption. As the event leaders put it to their guests,

> “in its current state of emergence, smart grid is a set of promises, expectations and visions that shape innovation. These include claims about technological characteristics, societal usability and desirability”. And, to clarify how the meeting would proceed in relating to this vision, the stated objective was to “develop and test a framework for the systematic critical reflection on quality, pedigree, plausibility and social robustness of these claims and promises.”

Here we see an epigram that has the power not only to confront but to provide an event with an epistemic lead. In particular, the diagram depicts a systematic combined vision assessment on the basis of common depictions of what the future smart grid shall be. The epigram frames the technology as the “set of promises, expectations and visions” that constitute the focal points for both a convergence of assessment practices and the method of integrating them. To summarise, this epigram is the key identifier of how the case study became defined by this particular method of representing an ‘*integrated vision assessment*’ to the wider epistemic network as part of developing a “*framework for the systematic critical reflection*” overseen and directed by the leadership of the case study, thus also highlighting central focus on a proactive construction of a *systemic framework* integrating 'causal-chain' assessments as **epigram 4** indicates. In this epigram the smart grid is framed as a *complex adaptive socio-economic system*, operating across different scales and organisational levels. This *societal and ecosystem metabolism* constitutes a focal point for the convergence and integration of different societal and ecological assessments on different scales of this system—a particular method referred to as *multi-scale integrated analysis*. The integration happens through the development of pre-analytic performance criteria and indicators, again



Epigram 4: Proactive construction of a systemic framework, integrating 'causal-chain' assessments

highlighting that the central focus is on active construction of a systemic framework. Although, one could argue that there are some tensions between epigram 3 and 4 as they compete for displays of power, the case-study leadership in this case considers it their role to draw and integrate this and other depictions coming from study partners, into its systems-oriented framework.

Finally, **epigram 5** is a grid of legal concepts that operate as conductors for assessment proceedings, here of Data Protection Impact Assessments (DPIAs) for assessing risk to privacy rights of people (which have been a concern cutting across three of the other cases). The table depicted was the result of exploratory research mapping the different fields with experience in striking a relation between the concepts of risk and rights. The epigram consists in the identification of those fields and disciplines (STS and law) that are currently ignored in developing this assessment methodology and stating that lessons from these disciplines should be taken into account. The epigram especially represents a focus on *due process* considerations for assessment proceedings and on *proportionality* for aligning technology assessment lessons: *purpose specification*, *purpose legitimacy*, *fitness for purpose*, *alternatives* and *proportionality* (narrow). One aim of putting it to use is to chart the importance of checks and balances on knowledge claims produced in proceedings.

Epigrams signify orientations to sorting things out, making claims and leading, which then are indicative each of an emerging trend in the ecology of practices in which they are presented. They draw attention to opportunities (or lack thereof) to compare and combine methods and perspectives. They draw attention to inclusion and omission of approaches to assessment, to a hierarchy of disciplines, and more. It is perhaps most obvious to point to diagrams or other pictorial schematics in this regard, because of the *strength of representation* they possess. But, other ways of creating and sharing epigrams can be found in the development of the cases, for example, in the actual structuring of reports and other documents.

A key lesson to take from the use of epigrams concerns the indication they give of how a study is proceeding, for instance, the depth and scope of integration. They can be evidence of leadership and direction in doing this work, and thereby they are also indicative of various styles of leadership and choice of direction. Taken together, we heuristically distinguish three ways in which epigrams can be characterised in terms of the direction they give. ***System-based*** orientations in epigrams are biased towards pre-set analytic criteria and frameworks. The association is with complex multi-scale, multi-layered systems but also in other system-based orientations, and an explicit concern over how to integrate different assessments of such systems. ***Network-based*** orientations in epigrams lean on issues, actors, practices, performance, mediation and other factors that get taken into account in a cartography of connections and disconnects *in practice*, that also produces novel leads to take forward. These leads can point to the need to establish new relationships and plug knowledge gaps. ***Proceedings-based*** orientations in epigrams seek adequacy and quality in preparing for or reporting on proceedings (invitation, events, legal proceedings). Primary elements are key conceptions, modalities, logics, symbols, expertise and stakeholder identities with emphasis on process relations, purpose-specificity, participation, issue framing and clarity in epistemic quality checks and decision-making. The elements can be preparatory for work (framing) or proceedings (lesson in law) or they can dictate the reporting of proceedings (lesson in an innovation practice).

Risk-Right Logic (*Nature of Relation*)	**Operating Modality** (*Institutional or Societal*)	**Risk Conception**	**Right Conception**	**Aligned Expertise**	**Type of Public**
Right *at* Risk (*Mutual Disentanglement*)	Civic (*Civil Society*)	Uncertainty Qualitative/Normative Perceived Threat	Political Right: Social Valuation, Collective Good	- Social Sciences (PTA, STS, Surveillance Studies) - Computer Science - Law - Politics	Publics in Risk Concerned public of participation
Right *as* Risk (*Factorial Incorporation*)	Organizational (*Business*) ➢ *Current Narrow DPIA Version*	Probability Quantitative	Risk (*to the Organization*)	- Organizational Management - Risk Assessment - Information Security - IT architecture	Public as Risk Public Relations & Perceptions
Risk *vs.* Right (*Balanced Trade-off*)	Governmental (*Government*)	Probability Quantitative	Political Right: Collective Good (*General Mechanically Balanced Weight*)	- Politics - Intelligence Analysis - Risk Assessment - Information Security - IT architecture	Public Interest at Risk (Phantom) public of political representation
Risk *vs.* Right (*Proportional Adjustment*)	Legal (*Court*)	Proportion Contestable Evidence Normative	Individual Legal Right (*Specific Proportionally Mediated Weight*)	- Law - Science at the Bar	Public Interest at Risk &. Publics of Rights: Individual Rightholders
Risk *to a* Right (*Procedural Comprobation*)	Legal (*Court*)	Environment Harm	Individual Legal Right Procedural (Fair Trial)	- Law - Science at the Bar: Impact Assessments	Public of Rights: Individual Rightholders Figure of Affected Public
Risk *to a* Right Mutual Transformations - Proportional - Environmental	DPIA ➢ *Lessons for a Broader Version*	Proportion Contestable Evidence Normative Harm Perceived Threat	Procedural (Fair Trial) Scope: - Individual Legal - Social Value	Ecology of expert practices Include insights from: - Law (speculative jurisprudence) - Social sciences	Who participates? - Affected public - Concerned public

Epigram 5: A grid of legal concepts, operating as conductors for assessment proceedings.

Epigrams evidence the strengths in doing this work as well as the weaknesses of the teams and within them. Instruments like these are important in sorting things out, however, each element, a category, a classification and the types of connections made between them will always silence someone's point of view, while valorizing someone else's. Epigrams are also the one instrument most clearly indicative of thought-styles emerging in the leadership, in trying to bring the study groups together and the material they are working with, i.e., they indicate attempts at *structuring*, *networking* and *processing* in some combination. But we also observe in these uses some of the difficulties in bringing together formal and informal assessments, knowledge claims, diverse experiences and views on the progress of an innovation domain. We observe that the partners on all sides become hard pressed to expand their views to learn and share. The manifestations of this dynamic lie primarily in the emergence of master and servant positions, in what gets included and what gets filtered out but also in considerable efforts to overcome procedural complications and other barriers.

Modes of integration

From what we have learnt to-date, we suggest that each case study is a laboratory of assessment approximations and distantiations, each of which leads to a *mode of integration*, so to speak. Apart from the obvious complications brought on by geographical and disciplinary distances, there is more to be said about the development of teamwork or lack thereof. For example, the first working papers are practically catalogues of input, with each partner contributing materials using their respective tools and approach to study. In the subsequent phases however, the issue of *doing analyses* and bringing them together begin to force connections as well as disconnections which are the results of *teamwork* collaboration or a lack thereof. But, a closer look at the work of integration unravels distinct coordination acts which are performed small-scale within a team, or they are performed by the case study and project leaders and brought forward in and through the embedding of innovation and policy expertise. In the following we roughly summarise key characteristics and modes of integration efforts to date:

WP3– Wearable sensors

Characteristics: bottom-up and dispersed efforts: wild growth of connections between assessment partners and networks of innovators and policy, in mapping state-of-the-art as well as the public spectacle of the technology.

Keywords: bottom-up vs. top-down, disconnect, connecting/networking, mutual learning, experimentation, epistemic checks, responsibility, ethics by design vs. ethics in design.

Mode(s) of integration: network-based (major), system-based (minor) and process-based (minor).

W*P4 – Robotics*

Characteristics: mixed, 'dialogical'. The partners have engaged in mapping the epistemic networks of innovators and technology assessments, and organised their accounts around the (policy) issue of autonomy in robotic systems which is fed back to these networks.

Keywords: mapping, assessing assessments, mutual assessment, epistemic networks, epistemic checks, multi-disciplinarity, responsibility, care for concepts, bottom-up vs. top-down.

Mode(s) of integrations: network-based(major), process-based (minor).

W*P5 – Synthetic meat*

Characteristics: centralised, integration work by WP leadership. The partners have mapped the epistemic networks of innovators as well as the public perceptions and spectacle of the technology, however, only partially organised around the policy question of funding.

Keywords: networking, intervention, experimentation, restructuring, mutual assessment.

Mode of integration: network-based (major), process-based (minor).

W*P6 – Smart grids*

Characteristics: centralised, integration work by WP leadership. Integration through use of epigrams. Integration as topical concern.

Keywords: vision assessment, integrated assessment, multi-layer systems/systemic approach, social robustness, plausibility, quality, responsibility, care for concepts, mutual assessment.

Mode(s) of integrations: system-based (major), network-based (minor).

DPIA

Characteristics: mixed, concentric, dialogical. Exploration and condensation of a broader field by gathering knowledge from relatively unconnected networks, piecing them together around an (policy) issue and feed the questions that arise from this contraction into three of the case studies during embedding events.

Keywords: mapping, learning, purpose specification, fitness for purpose, proportionality, due process for IA, contestability, participation, normativity, uncertainty, experimentation, epistemic checks.

Mode(s) of integrations: process-based (major), network-based (minor).

Looking through the developments within each case study, we can say that the different modes of doing this work hinge in part on technology-specific issues, sector-specific issues, generic issues, and similar factors. For example, ICT-based innovations which essentially are key enablers in most innovation domains nowadays, constantly call for a distinction between technology specific and generic problems. Modes of doing this work also hinge on differences between the epistemic networks in question, for example, the number of actors, their import and influence in the world of innovation, assessment and governance, the complexity of the technology in question, and the amount and nature of pertinent 'hot' issues the innovations engender. We can also say, with hindsight, that the three-phased organisation of the case-study work poses certain limitations, i.e., *mapping*, *embedding* and *integrating*. A lot of effort has been put into extending the case work to

include innovators and policy experts but there are still many disconnects with various practices, relevant expertise, experiences and views, which points to the question who was included or left out during the mapping and embedding phases. And, it goes without saying that matters of inclusion and exclusion hinge on availability of persons and resources on the one hand which can be hard to overcome and, on the other hand, leadership choices and styles, top-down vs. bottom-up approach to study, and so on. That said, the embedding phase was aimed at the widest possible network, given available resources—a network which started from the premise of a small set of assessment methodologies but now can be (experimentally at least) reshaped and restructured through dialogue and mediation. In other words, the work of an Epinet case study is not only *bringing a field together*, situating the actors in a broader picture and performing integration. It is one of *shaping a field* which then will have something to contribute to the ongoing and future work of innovation, assessment and governance.

APPENDIX I

A catalogue of (infra-)concepts

Epistemic Networks

Epistemic networks is perhaps the main organising concept of the Epinet project as becomes apparent in the full project title: *Integrated Assessment of Societal Impacts of Emerging Science and Technology from within Epistemic Networks.* It is also one of the keywords of the project, next to ***integration***, ***responsibility*** and ***social robustness.*** The notion of epistemic networks is the best example of an infra-concept with its intermediary status between theoretical conception and practical aim.[10] The DoW formulates this relation in the following way:

> "[I]n order to serve as an integrating tool for TA the concept of epistemic networks needs to be worked out with regard to its theoretical content, its relation to TA as a number of different but related practices and, finally, with regard to work with the cases, i.e. with respect to epistemic networks as they emerge (and are likely to emerge) in the cases of wearable sensors, cognition for technical systems, smart grids and synthetic meat. Hence, epistemic networks take on the role of a heuristic tool aiming for interdisciplinary integration of methods. […]In terms of theory, we will work out connections between the concept of epistemic communities (Haas 1992) and more recent theories of networks. […] It is important to take note of the practical character of the project: an overly strong theoretical focus on the materialistic aspects of ANT could come at the expense of the task of seeking integration through policy-concepts such as responsibility, sustainability, human rights and good governance. […] As STS would put it, coherence in such networks, including epistemic coherence and identity, is an achievement, not a premise. Hence, theories of networks will be used as heuristic tools for approaching constellations of actors, technologies and institutions forming around societal, technological and political grand challenges, but cannot be made to stand in for the perceptions, experience and imaginaries of actors in the relevant fields."

As a theoretical construct, the notion of epistemic networks is related to the notion of an epistemic community of professionals with recognised expertise and competence in a particular domain, and an authoritative claim to policy relevant knowledge within that domain or issue-area. As a WP1 Memo puts it, this means that we are looking at different communities or networks of knowledge workers, that each draw upon different bodies of knowledge in the pursuit of some common good/a policy project. The notion of epistemic networks places a primary emphasis "on the ideas, values, concepts, imaginations and visions of the actors themselves, and on how they use these to influence and position themselves within the innovation/policy fields in question" (WP1 Memo, p. 9). The concept was worked out in D1.1 and used as a conceptual anchor and introduction to the Epinet approach in many of the embedding events. Given the description above, the concept is closely tied to a methodological three stage division of ***mapping***, ***embedding*** and ***integration*** and to a sectoral division between contexts of innovation, contexts of assessment and governance.

Within Epinet the notion is used in several different ways to the extent that it both relates to contexts of innovation - the knowledge networks of social innovators - and serves as a way of approaching "contexts of assessment where it can also function as a possible resource for assessing and evaluating '*integration'*. In the second sense the concept of epistemic networks takes on a more normative sense to the extent that it is used as both a goal and means for the integration of different assessment practices themselves, thus serving as a guide towards more integrated approaches of TA. Lastly, many of the participants of Epinet who focus on the interactions between science and society can themselves be seen as an epistemic network, with specific expertise on the often poorly understood and articulated zones of interaction between politics, law, society, research, innovation and the environment. In this last sense the concept of epistemic network also relates to that of ***intervention***. That this intervention between assessors and the assessed can be a two-way process,

10 This is of course not strange considering the fact that the notion of network as it figures in Actor-Network Theory is one of the prime concepts of infra-language in the sense in which it is used by Latour.

became clear in the context of the smart grid embedding event. The very notion of an epistemic network itself here became disputed by one of the participants. A consultant on sustainable strategies and energy policy stated that the term *epistemic networks* is too narrow. The issue is not only knowledge, but economic power. Rommetveit (Bergen) responded, that members of epistemic communities have to stick to their knowledge base and that industry workers are not bound to this. This is thus a good example of ***mutual assessment***.

Issue-focus

The methodologies of many Epinet partners converge with regard to a focus on issues. This concept is closely related to those of ***framing***[11], ***mediation*** and ***mapping***. The role of issues is perhaps most prominently described in Bergen's methodological brief, in which they describe their ethical approach as "concerned with matters of concern, and the articulation of issues and 'oughts' in practice". This commitment is related to a distinction between governance of complexity from above in classical ethics versus governance in complexity in which the ethicist *mediates*, fosters and facilitates the articulation of critical issues and matters of concern. One of their central questions is also framed in these terms: What are the relevant and important public and ethical issues in techno-scientific innovation regimes? The notion is also linked to that of *responsibility*. Issues play a central role in ULANC strategically pragmatic approach, which holds "that unrecognised questions or issues, often ones embedded and hidden in technical or scientific standpoints and choices, should be: 1) recognised for what they are, and 2) deliberated in appropriately inclusive, informed and accountable ways, and their implications for techno-scientific work and innovation thus also worked out." Issue-focus is also linked to the concept of *framing* by studying how the issue becomes framed and by whom. Sussex expresses a concern for identifying important issues, anxieties and promises around certain technologies by studying the way they are taken up in media participation. This relates to their methodological concern for assessing the relative weight of different *mediations* of an application across the media spectrum. They also propose the use of the Issue Crawler tool to map such media networks and the use of frame analysis for studying alternative "against *frames*" in the media. VUB also committed itself to what it calls an issue or dispute based approach to law in mapping the ways that legal actors are performing or relating themselves to assessments of technologies. JRC discusses the role of complex issues in what they call the model of framing, relating to situations in which there is an absence of conclusive facts that can solve an issue and thus a focus on *framing* becomes important. JRC describes its approach in such a way that "evaluation of knowledge inputs to policy-related issues by an extended peer community are the knowledge assessment programme", thus linking the concept to that of *public participation*. UU refers to the use of mini-checklist and quickscan questionnaires as guiding instruments in problem framing and project design, by flagging key issues that need further consideration.

Mapping

This concept plays a central role in the description of the Epinet project in relation to that of epistemic networks. It designates the first phase of Epinet research which consists in mapping the epistemic networks (followed by the embedding phase and the integration phase). Apart from this it also plays an important role in the methodologies of some of the partners often also in relation to concepts like ***network*** or ***issue***. The methodological description by ULANC perhaps best brings out

11 This concept is used to look at how actors within certain networks frame an issue in a certain way (ULANC, Sussex). The term frame is however also used in a second sense as a specific proposal by the assessment partners to frame the assessment in a certain way. It is in this sense that it is used by UAB when they describe their central approach in the smart grid case study as "Framing the discussion over the performance of smart grids using the MuSIASEM approach" or when UU argues for an integrated "framework" for the systematic critical reflection of smart grids.

this central role. It describes its methodology for “Mapping innovation domains” in the following way. “What we call 'mapping' or as Latour would suggest, cartography, describes a common STS commitment to depict the key features of activity (substantive, imaginative, suggestive and anticipatory) that emerges in association with scientific and technological development in a specified area. […] The critical-reflexive potential of this approach lies in the view of knowledge production as socially constructed and socio-materially constituted, involving multiple orientations, biases, agendas, materialities and accounts, as well as the moral and socio-economic referencing with which innovation and development takes place.” In the section above we have already seen how Sussex commits itself to a mapping of “media networks” and its actors involved in the production and take up of media materials, both focusing on the dominant and antagonist mediations. VUB, in turn, sets out to map the legal networks of technology assessment by tracing “the legal actors like lawyers, legislators, judges and actants like patents, copyrights, privacy rights, data protection rights ... within these networks and their interrelations, articulations and effects with the rest of the network”.

Since these mapping exercises are not restricted to contexts of innovations, but also extend to contexts of assessment. the concept of mapping has a strong link with the idea of ***assessing assessments*** as opposed to ***doing assessments***.

Embedding & Intervening

The Epinet approach does not limit itself to the ***mapping*** of the epistemic networks, but, as a next step, aims at engaging with emerging epistemic networks within the technological fields being studied. The DoW calls these e*mbedding assessments*, stating that to “another key aim of EPINET is to relate and integrate such developments, as outlined in the previous section, with emerging networks of expertise whose members attend to technological innovations, per our case studies. During this stage in the project, concrete results from assessment case studies (produced by different TA methodologies) will be introduced to participants in the consortium.” The idea of embedding, aims at facilitating dialogue and ***learning*** between these different perspectives.

Whereas this notion of embedding by itself merely connotes the broader reflexive movement of incorporating the assessment results into to the networks assessed, this movement attains a more normative sense through the term *intervention* that was later proposed during the Epinet consortium event. This term signals a more pro-active attitude that aims not merely to observe but also to intervene within the epistemic networks mapped and for instance taking the steps to propose better definitions and policies and to build on Epinet’s expertise as itself an ***epistemic network***, in understanding the implicated problems, technologies and networks. Several examples of such intervention will be worked out in sections below.

Responsibility

One important task set out for EPINET is striking a relation between the assessment approaches and the concept / programme of Responsible Research and Innovation (RRI). The Dow of WP1 states that “this work package should consider the extents to which inherent tensions and inconsistencies in the goals and methods of TA methodologies point beyond 'methodology' and towards the need for *institutional change* to achieve *responsible research and innovation* by governance of emerging technologies.” In its methodological brief, Bergen hooks on to this concept of responsible research and innovation as one of its main three methodological sections and uses it to clarify their ethics. They reformulate this concept as responsiveness, or refer to the notion introduced by VUB in the WP1 draft and the memo as *respons-ability*, which refers to “the capacity to respond to claims and

issues, arising from matters of concern by other actors". This notion is thus crucially related to that of *issues* described above.

In the robotics embedding event, the RRI notion was also taken over by some of the participants which lead to discussion in relation to the role of Private-Public Partnerships (*PPP)* - large projects where 50% is industry funded – in the European research agenda. One roboticist remarked that a completely *multi-disciplinary approach* is needed to get at responsible research and innovation. He stated that Private-Public Partnerships (*PPP)* will change research dynamics. When the European Commission wants RRI to be hard-wired in such projects, reviewers will hold projects to this ideal and there will be a tension. For companies it will be more costly and they will be less willing. Smits (UU) remarked that PPP's could thus serve to make things explicit, when the EC does not sell out on its principles. He thought that future EU PPP projects should only be approved unless they address the RRI framework and engage ethical sustainability. Gunnarsdóttir (ULANC) remarked that RRI however runs the risk of turning into compliance based tick box exercise. Another roboticist, in response to this role of PPP, stated that there is a need to make clear to people what robots are. In the smart grid case study we could observe how this notion also becomes applied or extended to ***visions*****.** Rommetveit (Bergen) here raised the question of who is *responsible* for these visions and how they can be regulated. We could in fact speak of a conception of *Responsible Promises for Innovation*.

Lastly the concept of responsibility can perhaps be linked to the developments analysed in the wearable sensing case study to responsibilise individuals to take control of their own healthcare and well-being.

Multi- & Interdisciplinarity

In the context of responsible research and innovation we have already mentioned the importance of interdisciplinarity or multi-disciplinarity. In the robotics embedding event, this point can even be highlighted as a separate concern or value in itself. A roboticist for instance stated that a completely multi-disciplinary approach is needed to get at responsible research and innovation. He also proposed a specific multi-disciplinary approach program for robotics based on four principles of ethical sustainability. The concepts of ethics, RRI and multi-disciplinarity thus become gradually fused. In concluding remarks to the event, an ethicist further remarked how technology assessment has a role both as a tool for law and in making things more sustainable. TA should be given more relevance with the involvement of experts from different disciplines. A legal scholar confirmed this point in stating that interdisciplinarity is important for lawyers and that this should be a point for additional funding.

Social robustness

Social robustness is one of the crucial anchoring concepts in Epinet. Not only was it already written into the DoW as one of the keywords of the project next to ***integration***, ***responsibility***, but it also played roles in the partner methodologies and in the integration of assessments in the smart grid case study. The DoW states that "The EPINET project will investigate conditions for the development of more integrated technology assessment (TA) methods. It will develop methods and criteria to be used for more socially robust and efficient practices on the interfaces between TA and the world of policy makers and innovators." The concept is described as "sustainable, meaningful and responsible developments" and is tied in with the programme of ***responsible research and innovation***. As such it is also called a *policy goal* together with ***sustainability*** and ***responsibility***.

The concept of robustness surfaces in several of the methodologies of the Epinet partners, especially in the smart grid case study and to a lesser extent also in the DPIA case. It must however be noted that this term does not always refer literally to "social" robustness, instead it relates to the robustness of technologies, knowledge, assessment, policies and decision-making. UU's methodology brief on its systematic reflection on risk and uncertainty for instance, makes a distinction between the robustness of knowledge (through "comparative and independent evaluation of research results aimed at building scientific consensus via multidisciplinary expert panels") and the robustness of policy strategy ("which policy is useful regardless of which of the diverging scientific interpretations of the knowledge is correct", pp. 14-15). VUB refers to the role of "transparency requirements, *countervailing powers or competences*, privacy in public contexts, purpose limitation, the pitfalls of the image of balance, the need for delay and hesitation as well as adversarial argument to achieve robust knowledge and fair decisions". During the DPIA event Pereira (JRC) evoked the concept in reaction against the statement that public engagement in impact assessments is about credibility. She rather related such participation to the quality of the whole process and to assess in a socially robust manner. In its methodological brief UAB aims at increasing the robustness of the analysis through integration of different types of *quality checks*. At this level the concept of social robustness is linked to that of ***epistemic checks***.

In the smart grid case, social robustness gradually became one of the central organising concepts for integrated assessment approaches. In the first working paper, The work package leader linked the concept to that of ***vision assessment***. "The main objective of this working paper is to broaden the scope of societal debates and political decision making on the future of smart grids by providing recommendations informed by a range of TA methodologies, in order to guarantee a more socially robust and sustainable development of technology in conjoining with society and social values."(p.2) "We aim to elicit the conditions that need to be met for a smart electricity grid to be a socially robust and socially acceptable technology" (p. 4).

In the embedding event the concept was used as the central conceptual anchoring point for the event as becomes apparent in its title: *Workshop on the issue of the future social robustness of smart electricity networks in Europe.* In this workshop, one of the main questions to the participants was, "[w]hat should a socially robust smart electricity grid look like? What social values should be served in a future smart grid?" This lead to a kind of process dynamics in which each of the participants took up the notion in their own way, appropriated the concept so to say. In a sense these proceedings offer an interesting case study of an infra-concept in action. In his introductory talk van der Sluijs (UU) introduced socially robust knowledge in the three senses in which it was introduced by Nowotny (2001),[12] i.e., to "1. validate models and scenarios *outside of expert circles*; 2. involve an *extended group of actors in the production of knowledge*; 3. repeatedly test, expand and modify knowledge claims and preliminary assumptions. In this way we can produce a set of *knowledge gaps* and a set of steps for innovation governance." This notion was then taken up in a variety of ways, which we can summarise as economical, environmental, procedural/participatory and systematic.

- A researcher in electrical energy & computer architectures replied to the question of what is the most socially robust by saying that the *cheap price* of electricity, this is still the burning of coal. Socially robust is *not* always *environmentally friendly*.
- A platform manager of electric energy systems stated that the smart grid is socially robust when: 1. it supports our lifestyle: we want energy. This is not so much a human right, but is related to *wealth*. 2. it reduces our carbon footprint. Unlike the

12 Nowotny, A. H., Scott, P. and Gibbons, M. (2001). *Re-Thinking Science. Knowledge and the Public in an Age of Uncertainty*. Polity Press.

previous researcher who opposed an economical and environmental sense of socially robust smart grids, he juxtaposes the two senses.

- A technology assessor of systemic risks in energy infrastructures thought the take-up of the notion is more in line with the procedural and participatory sense given to it in Nowotny's definition. He stated that in smart grids there are many trade-offs with privacy, accountability and prediction. It is *difficult* to say which of these *values* are more important. We have to step back and *set the political procedure right*. The outcome of smart grid development will have to be more *socially robust*. Which procedures are there right now? 1. those who are impacted will have to be involved, 2. the information necessary will have to be made available in a neutral way, 3. the gap between the outcome of participation exercises and the actual political decisions has to be narrowed. Here the procedural quality of the process of decision-making is important.
- The position of a public affairs advocate at a consumer organisation was also in line with this participatory perspective. One has to start from the role of the consumer for there is a tendency to start from *technology*, looking at the *outcomes* you want to get. We need to look at the *beginning*, i.e., what the issues are *upfront* for different audiences. Are there new consumer issues?
- A researcher at the European Commission Institute for Energy and Transport stated that socially robust smart grids are developed within a ***systems view*** with all the layers and stakeholders included." This position is thus both systematic and participatory
- The response of a consultant on sustainable strategies and energy policy coincided with the systems approach, stating the interpretation of social robustness as a kind of biological resilience on multiple levels. There are *systemic principles* that apply here: diversity, subsidiarity, networking, participation. These are good measures for *societal resilience*. In concluding remarks to the event however, the consultant added that there is a question about the instruments of analysis. The concept of social robustness is not so clear, there are big differences in different countries so we need precise terms for analysis.

This last point is interesting, since it contests the ***framing*** of the issue in the integration of assessment as provided by Epinet. This point is strongly related to the notion of ***mutual assessment*** in which the participants from the networks being assessed also assess the (Epinet) assessors. We could perhaps also speak here of ***mutual intervention.***

Integration

Integration is the main stated goal of the Epinet project with its full title of *Integrated Assessment of Societal Impacts of Emerging Science and Technology from within Epistemic Networks.* Integration is thus a crucial concept, at least in the formal sense, and is listed as one of the keywords of the project, next to ***epistemic networks***, ***responsibility*** and ***social robustness.*** As such a formal goal it is what we could call a requirement for the different assessment practices participating in Epinet, especially for the leaders of the case studies in a practical sense, for WP1 to work out its theoretical construct and for WP2 to understand how integration is achieved in practice. Just like social robustness it is a good example of an infra-concept that, within the scope of being requirement, leads to different uptakes of the notion and of what/how to integrate. That discussion is closely related to the use of ***epigrams*** introduced in this document.

As the title of the project makes clear the notion of ***epistemic networks*** play a crucial role in the conception of integration, written into the project design. In the discussion of this concept we have already seen that it also has a normative sense in serving as a guide and means for more integrated approaches of TAs. The DoW states that "epistemic networks take on the role of a heuristic tool aiming for interdisciplinary integration of methods. It is important to notice that such integration can only succeed where goals, values and methods are compatible"

At the same time however, the notion is also used to achieve a second, more extended sense of integration. The notion of integration does not merely relate to the integration of TA methods, but also to the integration of TA into the innovation domains being studied. This conception of integration is closely related to the notion of ***embedding***.

In its third most extended sense, integration also relates to governance and policy. As the DoW states it:

> "It is the potential for tighter integration between these three main fields of practice, i.e. contexts of innovation, governance and contexts of assessment, which serves as the analytic point of departure as well as the critical (regulative and normative) goal for EPINET." (p. 5).

This extended sense of the notion of integration both refers to greater influence of certain values like ***social robustness***, ***responsibility*** and *sustainability* into policy and innovation, as well as to the ***framing*** of problems and who should be invited to ***participate***: a greater inclusion of concerned groups, lay perspectives and more generally a greater role for democracy. During a consortium event a comment was added that innovation, governance and assessment should not always be integrated in all circumstances. When the lines between these circles are in fact too close, they have to sometimes be distanced from each other (This point also ties in the concept of ***epistemic checks*** and balances).

Work package 2 has studied these levels of integration within the practices of the case studies, with a special focus on the first sense of integration between the different TA partners. At the Epinet Kick-off event Gunnarsdóttir (ULANC) stated that WP2 will focus on enablers and constraints with reference to the methodological commitments each partner brings to the consortium, and the potentials therein for *complementarity*, *expansion*, *enlargement*, *amplification*, *modularity*, *convergence, harmonisation* and *integration*. The case studies are thus taken as a point of departure to investigate the coming together of different orientations and methodological commitments. Integration is here thus taken as different forms of ***coming together***, or what came to be called ***approximations and distantiations***. It is doing so by studying indicators of *disciplinary convergences and divergences*, possible new forms of *collaboration*, *complementarity* in different approaches and in the work of *coordination*.

The terms *integration* or *integrated assessment* were however contested. They are invested with different meaning already from the start of the project, is., at the kick-off event. We can illustrate this by the following excerpt of the discussions taking place:

> Giampietro (UAB) *felt that what was missing was a* ***semantic definition*** *of the meanings of Technology Assessment.*
>
> van der Sluijs (UU) claimed to have *10 years back attempted to provide a* ***definition of integrated Assessment****. Quote:*
>
> > "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."

Then he argued that we might have to change this definition according to the case studies which unlike climate change are about new-emerging technologies. Also, the cases might not be informing policy but rather encouraging a dialogue between policy and society.

[…]

Rommetveit (Bergen) *agreed that the consortium had* ***not defined*** *what we are looking at. Integrated assessment belongs to a certain historical state of our socio-politics. We might be stepping beyond that and then we can come up with a new concept. In WP1 we can productively use our conflicts of value to reflect upon the different approaches.*

[…]

Funtowicz (JRC/Bergen) *argued that language is open-textured. That is why it is* ***useless to provide precise definitions of terms****. In that sense, he said he preferred Humpty Dumpty over Alice. The meanings are always embedded in a certain power structure. The interventions of Giampietro and van der Sluijs show the historicity of Integrated Assessments, but building the concept loosely into project is a reason to step beyond that.*[13]

Giampietro (UAB) *explained that the term integration was used to handle different* ***quantitative values*** *for different dimensions of analysis instead of only measuring things in* ***monetary values****. It thus had a different meaning from political integration of immigrants. Later the term was used in a more* ***broad sense for different narratives and cultures****.*

Rommetveit (Bergen) *suggested that the use of the term within Epinet will move beyond these historical meanings. We will have to* ***experiment*** *with the term and the approaches.*

Strand (Bergen) *pointed to the importance of asking what the object of investigation is. Giampietro mentioned a difference between technique (flying) and technology (balloon, plane, and helicopter). Referring to the notion of epistemic network, we can* ***start*** *with other objects entirely, say, to investigate the* ***actors' side****. What* ***knowledges*** *do the actors have? What does the consortium (of robotics) do and promise? How does what they do interrelate with* ***policy questions****?*

Giampietro (UAB) *further insisted here that the analysis of technique is qualitative, the analysis of technology is quantitative, as an example of distinctions we need before we can start.*

Strand (Bergen) *argued back that such a* ***distinction is not necessarily crucial to start the analysis with****. It could however pop up in the* ***concrete cases****.*

We can thus see different approaches to the idea of integration, for example, one that does not start from definitions and conceptual distinctions, but from the actors and the cases, the knowledge and

13 It is interesting to observe that JRC's previous methodology brief already started by distancing its knowledge assessment approach from the field of integrated assessments: "In the early 2000s and following some disenchantment with the notion of Integrated Assessment in particular, we have set at the Joint Research Centre a group called Knowledge Assessment Methodologies which expressed both awareness and commitment to change a certain 'state of affairs'"(p. 17).

the policy problems being addressed. This approach puts the emphasis on experimentation within networks in which new meanings can emerge. Another option would be to start from definitions that tie into existing approaches that self-identify as integrated assessments within the field of environmental studies. Here the goal is an integration between quantitative and qualitative approaches, among other things, according to a certain pre-articulated framework of semantic definitions and conceptual distinctions (like technique and technology). We could say that here we can already find the prototype of the network and system-based ***epigrams*** we discuss in the main text of this document.

This sense of system-based integration has come to guide the work in the smart grid case study, both with regard to contributions from UAB and the coordination work done by UU. In the working paper (D6.1), UAB introduces a model for integrated assessment called Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (MuSIASEM). This approach frames the assessed technologies (smart grid) as complex adaptive systems that operate at different scales and levels of organisation.[14] Solutions should not be reduced to one of these levels. There are different identities of the system at different scales. What is good on one scale, is not necessarily so on another. Therefore, adopting quantitative indicators for the assessment of performance relies on integrated assessment of plural dimensions and scales. This requires developing complex analytical tools to integrate various semantic messages of non-equivalent narratives about performance. This approach calls itself a performance assessment for the assessing the performance of smart grids on different scales in future scenarios. It is based on "insights from hierarchy theory (the branch of complexity theory dealing with the epistemological predicament of multiple-scales)".[15] Hierarchy theory focuses on levels of organisation and issues of scale within a more general framework of systems theory including social, biological and ecological systems. This performance assessment requires a pre-set pf analytic choice and criteria as indicators of performance.[16] Integrated assessment refers to different criteria of performance and scales of analysis: multiple scales and dimensions. It looks at performance in different ways - for user, economic, technical, for environment – and on different scales: micro, meso, macro. There are different performances at different levels. Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (MuSIASEM): Methodology that addresses the implications of pre-analytical choices when selecting narratives about smart grid and quality of choice of narrative (quality checks: on the descriptive side of control on the quality of

14 "Complex adaptive systems are open systems operating across different scales and levels of organization. This implies that it is impossible for an analyst to define a clear cut boundary when analyzing a given functional or structural part. Depending on the scale of observation and the dimension considered as relevant we will see different "identities" for the very same system." (Working paper 6.1, p. 28).

15 The following description is given (by a previous co-author of Giampietro): "The Hierarchy theory is a dialect of general systems theory. It has emerged as part of a movement toward a general science of complexity. […] Hierarchies occur in social systems, biological structures, and in the biological taxonomies. […] Hierarchy theory uses a relatively small set of principles to keep track of the complex structure and a behavior of systems with multiple levels." http://www.isss.org/hierarchy.htm .

16 This approach "uses insights from hierarchy theory (the branch of complexity theory dealing with the epistemological predicament of multiple-scales) to discuss the problematic definition of the term "smart grid" and the consequent challenge faced when assessing the performance of "smart grids" in future scenarios. In fact, an integrated assessment of the improvements that "smart grids" requires a pre-analytical choice of a set of criteria and indicators of performance about electrical grids. This integrates assessment should refer to their feasibility (compatibility with ecological conditions), viability (in technical and economic terms) and desirability (social acceptability and convenience of end use)." (Working paper 6.1, pp. 16-17).

representation and on the normative side of control on the quality of decision-making).[17] This approach is inherently related to the notions of ***systemic approach*** and ***multi-layer systems.***

UU as the leader of the smart grid case study, also comes up with an account of integration in the introductory document for the smart grid embedding event: "The EPINET integrated approach to vision assessment starts from the notion that in its current state of emergence, smart grid is a set of promises, expectations and visions that shape innovation." Integration is linked to the deployment of a ***vision assessment.*** The document adds that this integration will take place through the development of "*systematic critical reflection* on ***quality, pedigree, plausibility*** and ***social robustness*** of these claims and promises." Apart for these other infra-concepts, integration is here also linked to ***systemic approach*** which will be further discussed in the section on coordination as integration work.

Plausibility

The ***systemic approach*** brings us to the criteria around which the integration of methodologies is to take place. The criteria that UAB mentions are *ecological feasibility, technical and economical viability and social desirability*. In the working paper on smart grids, UAB states that integrated assessment of smart grid technologies should refer to "feasibility (compatibility with ecological conditions), viability (in technical and economic terms) and desirability (social acceptability and convenience of end use) (UAB, D6.1, p. 16). These criteria seem closely related to those proposed by UU in their document introducing the smart grid embedding event. There, the assessment focus is placed on claims about the technological characteristics, societal/economic/usability and the societal desirability of smart grid technologies. The use of these criteria however differs in the two uses, since in the first case they are criteria for the assessment itself, whereas in the second case they are the topics to be assessed in claims made by others according to different criteria. In short, the evaluation of these claims and integration of assessment methodologies is anchored around the criteria of ***quality***, *plausibility* and ***social robustness***. The first and third term are separately covered in this catalogue. In this entry we point to the term *plausibility* as an umbrella term to encompass the notions of ecological feasibility, technical and economical viability.[18]

Systemic approach

In the entry on ***integration***, especially in the work of UAB, we could see the crucial role of the notion of *multi-layered systems* in the environmental field of integrated assessments, to the extent of being symbiotically intertwined as system-based integration (as opposed to network-based integration for instance). This link also became apparent in the way UU framed smart grids technologies for the embedding event assessment. They stated that "[s]mart grids have the character of an *emerging hybrid large technical system* aligning technical and non-technical elements into one

17 "The approach of Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism has been developed with the goal of improving the quality of quantitative analysis in sustainability science. In particular this method explicitly addresses the epistemological predicament of dealing simultaneously with multiple-scales and different dimensions of analysis. To achieve this goal, the method adopts innovative concepts developed in the field of Complexity Theory (the use of grammars rather than models, mosaic effect for multi-scale quantitative analysis, impredicative loop analysis, and the systemic framework of bioeconomics proposed by Georgescu-Roegen) and in the field of Science for Governance (quality assurance based on Participatory Integrated Assessment, procedures of societal multicriteria evaluation). The ultimate goal of the MuSIASEM approach is to make it possible the generation and the utilization of quantitative information within informed processes of deliberation over the desirability and feasibility of future scenarios in relation to the implementation of alternative policies or technical solutions."

18 This assumes that social desirability is at least covered by the term social robustness. In its entry, we have seen however that, depending on how broadly social robustness has been interpreted, it sometimes also includes economical, environmental, procedural/participatory and systematic dimensions.

unified, functional whole" of which the social impacts have to be studied in a "*systematic and integrated form*".

We can further flesh out this systematic approach by turning to the embedding events in the case studies of smart grids and robotics. In the smart grid event the contributions of two participants were particularly relevant, linking the concept of multi-layered systems to those of ***social robustness*** and ***integrated assessments***. One participant stated that ***socially robust*** smart grids are developed within a ***systems view*** so all the layers and stakeholders will have to be included. The smart grid is here also framed as a complex system consisting of several layers on the one hand ranging from the macro level of the supergrid extending to North Africa, to the microgrid of development of local communities, and on the other hand relating to the technological, economical and social layers of the system. The participant further states that there will have to be a shift in focus to more layers in the system, especially the social layer, and ***integrated assessments*** of all layers will have to be performed. Here, integrated assessments are again integral to this multi-layer systems framing, and tools from complexity science are proposed to perform such a modelling of these different layers. Specific focus will need to be on the inclusion of the social layer (linked to the concept of *social robustness*) within these assessments, which also can be relate to a notion of a *just grid*. This puts emphasis on values like universal accessibility to electricity, equitable social-economic development, protection of vulnerable consumer and decentralised control. A consultant on sustainable strategies and energy policy also argued for a systemic approach to study the issue. Interestingly however, contesting the central term *smart grid* used by Epinet as a way of framing the object of assessment. Here, the smart grid is not observed as a useful concept if it is used for very different things, for old stable things against a transformation taking place which will be conflictive, unstable and multi-level. There are several lines of transformation taking place at different levels that do not have one stabilised object, but rather conflictive positions between different powers. The organisation of these developments is key. For this purpose we could focus on *multilevel cellular structures*, which are based on *negotiation, diversity* and ***learning***. Such multi-level systems are more stable than centralised systems, a notion of stability taken from biology or ecology and related to the notion of biological resilience or the capacity of an ecological or biological system to respond to a perturbation or disturbance by resisting damage and recovering quickly. This is also how the concept of ***social robustness*** can be interpreted, i.e., as a kind of biological resilience on multiple levels. However, there are *systemic principles* that apply here*: diversity, subsidiarity*[19]*, networking, participation*, which can be considered good measures for *societal resilience.*

During the embedding event of the wearable sensor case study, similar arguments were made with regard to a systemic approach, although in reference to a very different socio-technological field. One argument reacted to the understanding of Epinet's approach to wearables as primarily a device perspective. The counter-argument is to say that a device is the wrong place to start and that we should rather look at the *system.* ***Public policy*** is key, not some *technological fix for problems* and approaching the devices as solutions to those problems. A ***systems approach*** looks at the *organisational* side. You might have a good device with all the functionalities and all the appeal, including privacy by design or default and there is no lack of regulation. But if the *system* is not *receptive* there will be a crash, and it will just be a gadget which may or may not come into wide use. A discussant in the field of social science, health & medicine also stated that we have to adopt a ***systemic approach***, not one focused on the *technology*, referring to an under-researched blurring of boundaries between the clinic and the outside/society and to a research focus on *social interoperability*, not just technicalities, to explain what these devices mean to patients. This is the first step before addressing *technical interoperability*. In these reactions we see that a systemic

19 This principle of subsidiarity is formulated as follows: "do well at the local level what you can do well there, if not do it on a different level".

approach is evoked against a narrowly technology-centred perspective. Just as in the smart grid case, we also observe a difference in focus among participants on the issues of which focus such a systemic approach allows. On the one hand there is a focus on the *political* and *organisational* side of the innovation, relating to public policies. On the other hand, there is a focus on the *social* side of the issue whicht has to be taken into account, framed in the concept of *social interoperability*. In response to this, Gunnarsdóttir pointed the attention to the role of shifting markets for health and wellbeing. Later during a consortium event Gunnarsdóttir also made a distinction between (key) *enabling technologies* that can be put together to make different functional ensembles and the *social enablers* related to multiple use scenarios with technologies that have a huge potential for service distribution and knowledge-creation.

Vision assessment

We have already mentioned that the focus on visions of innovation has gradually grown in importance throughout the Epinet project, which went hand in hand with an increasing importance of a methodology of vision assessment both as a common approach, or within the methodologies of different partners. Intrinsic to recent developments in vision assessment, we not merely assess downstream the products, we also assess the policy goals and their relationship with the innovation visions/products. Looking at the partner methodologies, Bergen spotted "tensions between the overarching socio-technical imaginaries set out by entrepreneurs and politicians, and the realities experienced by day-to-day practising scientists and engineers" and they saw these kinds of tensions between vision and practice as entry points to contestation. ULANC pointed attention to what they called the democratic problem, which "addresses the democratic deficit in future envisioning work and the development of strategic innovation agendas and policies, and it asks who is or should be invited to design our collective futures." Sussex summarised the role of its media analysis "to provide an account of the mediation of a spectrum of imagined and practised applications, or epistemic range". UU in the first working papers, also proposed the use of vision assessment, seen as a form of constructive technology assessment (CTA), as the main methodology for their lines of research in smart grids and robotics. This related to their claim that "the smart grid is not an identifiable object but a set of promises and visions that shape innovation". In the context of the first working paper on smart grids they already describe vision assessment as the 'overarching approach'. As a way of description they state that in a context of broad uncertainty about the future of a certain technology "most people - scientists, engineers, energy company CEO's, politicians and policy makers included- are inclined to simplify the puzzle by making stories, images and narratives that give meaning to the unknown. […] These stories and images however have a performative role; and they will influence the dynamics of the development, for example by stimulating large investments in R&D, or by polarisation of the debate, protest and non-acceptance of users. So it is important to reflect on the quality of the images and story lines and to reflect on the normative assumptions that go with it, often in disguise." (p. 9). This quote also highlights the strong link (or perhaps even sameness) with what we can call ***narrative assessment*** that plays an important role in the methodologies of JRC and UAB. The UAB describes its central methodology of Multi-Scale Integrated Analysis of Societal and Ecosystem Metabolism (MuSIASEM) that they use to assess the performance of smart grids as a way to address "the implications of the pre-analytical choices made when selecting narratives about 'smart-grids'." (Ibid. p. 16). JRC also describes its methodology in such narrative assessment terms: "we would be looking at public narrations coming both from the policy sphere and promoters of a specific technology … in order to assess the state of quality of such claims. In this first step we shall be looking through a matrix of criteria to the quality of information that is implied in the framings, factual or imagined argumentation, justifications, promises, motivations, appeals to the public and other narrative elements of the stories told in those public narrations." For the further development of this vision assessment in WP6 and its role as an anchoring approach for integration, see the section in the main text here on "leadership as

integration work". It has strong links with *integrated assessment* and with an extended sense of *responsible research and innovation*. We have seen how during the embedding event Rommetveit (Bergen) asked the question of who is *responsible* for these visions and how they can be regulated. A participant added that there is an obligation to *deliver what was promised* and that we have to know what the *conditions of success* are for this. One has to set clear criteria, an impetus to really delivering on promises. We could here speak of a conception of *Responsible Promises for Innovation*.[20]

The vision assessment approach also took hold, although in a different form, within the WP 4 case study on robotics. Its central role becomes clear in the abstract of the first publication,[21] which sets out to explore "the entanglement of visions, politics and innovation policy development with recent developments in robotics. […] We explore the orientations to purpose and direction with which innovations in robotics are encouraged. We explore the discrepancies between machines as reality and machines as fiction, in particular the vision of robot autonomy as fundamental to future developments with the particular aim to help solve Europe's societal problems. We argue that these complex entanglements are riddled with contradictions and 'gaps' to be minded, i.e., between industry and academic research, between technologists, ELS scholarship, policy and society at large and, last but not least, between machines of today and tomorrow." Within WP 3 the role of visions also received some attention with regard to the new-emerging roles for wearable sensors and the ways in which they are situated in visions of the future of healthcare and self-care.

Epistemic Checks (and balances)

One important theme within Epinet that seems to flow from some of the methodological concerns of the partners, as well sometimes surging in formal and informal discussions, is the idea of checks (and perhaps also balances) on knowledge claims. At the end of the first robotics workshop in Utrecht, Strand (Bergen) formulated this idea of introducing balances of power between knowledges as a potential goal for Epinet. Furthermore, in its methodological statement, the VUB observed affinities between law and other TA methodologies and saw added value in the particular sensitivity that lawyers develop for countervailing powers or competences and the pitfalls of the image of *balance*.[22]

This issue of epistemic checks and balances is perhaps best illustrated with regard to the role that Bergen at that time played in the Robot Companion for Citizen (RCC) flagship proposal and the conceived role of Epinet in relation to this consortium. When the RCC consortium would have received funding, Epinet would have partially focused on the ontologies and world views that would feed into the development of software and hardware for future robots. Certain conceptions of agency and subjectivity were pushed throughout the RCC project, to be built into these machines, which were nevertheless philosophically out-dated, and problematic in terms of engineering if we were to take seriously the phenomenology in the works of Hubert Dreyfus and Lucy Suchman in their critiques of artificial reason and human-computer communication respectively. In this way these networks are performatively constructing agencies and Epinet can itself be seen as an epistemic counterbalance, performatively putting checks into place in these networks of knowledge

20 It is noteworthy in this respect that no one is held to account for innovation promise. Rather the terminology changes over time to shift the attention to new research and innovation agendas. Personalised medicine became stratified medicine; ambient intelligence became synergetic prosperity, so on and so forth. One reason why this happens is that innovation networks are, at a closer scrutiny, focussed on key-enabling technologies which have the potential to deliver disruptive innovation—the mode of progress no one can foresee.

21 Rommetveit, K., Gunnarsdóttir, K., Dijk, N. van. and Smits, M. (2013, discussion paper). Mind the gaps! EU and the makings of robot autonomy (Based on EPINET working paper, D8.4, Oct 2012). http://neicts.lancs.ac.uk/pdf/Minding-Gaps.pdf (Dec 2014).

22 See, also Hildebrandt & Gutwirth on this point.

(and method) production by engaging with the robotics network. Methodologically, this points beyond a method of *mapping* and description of networks, towards the point of *embedding* and *intervention*, which will be discussed later.

Checks can be put into place in a variety of ways: by trying to tie knowledge practitioners who represent their respective disciplines to the constraints of their background practice (if they have one) when they engage in negotiations in a certain network[23], by introducing different kinds of checks on knowledge claims, by highlighting alternative knowledges not taken into account, etc. More specifically, we could distinguish two kinds of checks that are introduced in the approaches of Epinet partners, perhaps most clearly in the smart grid case: *quality* checks (JRC, UAB) and reality checks (UU, ULANC). The JRC methodology of knowledge assessment constitutes an elaborative way to check the quality of modes of knowledge production and knowledge products. In its methodological brief UAB also introduces descriptive and normative checks on the quality of representation and of decision-making. ULANC's methodology concerns the analysis of the scientific and technological problem domains in question, hence, a check on the soundness of promise, and the introductory text by UU of the smart grid embedding event states that: "Preliminary findings at this stage of the project are that these promises are at least partly speculative. Hence, there is an urgent need for extending the epistemic networks and fostering a reality check of the various claims and promises".

Quality of knowledge

The focus on quality of knowledge is at the very core of knowledge assessment methodology as practised by JRC. Their methodology focuses on practices of quality control and assurance of processes of knowledge creation and knowledge products, partly through extended peer communities.[24] Important parts of this methodological framework also seem to provide the background for UU's systematic reflection approach. The importance of quality checks is also emphasised by the UAB partner. They urge for specification of criteria to check the choices to define a technology and its performance.

In the DPIA embedding event the issue of quality came up in reference to *public participation* in impact assessments. A privacy consultant stated that the consulting and engaging of stakeholders, and the people affected, is a question of credibility and that it provides new ideas and legitimacy. Pereira (JRC) doubted whether credibility really is the issue here, but that it rather is about the quality of the whole process and of assessing in a socially robust manner.

23 This was a point made in the D2.1 Working Paper, *Disciplinarity and value commitments*, observing a difference when practitioners work inside and outside the bounds of their practice. See:
Gunnarsdóttir, K., van Dijk, N. (2013, discussion paper). *Disciplinarity and value commitments: Interdisciplinary approach to knowledge and innovation assessment*. (Based on EPINET working paper, Deliverable D2.1, Dec 2012). http://neicts.lancs.ac.uk/pdf/Disciplinarity-and-Value-Commitment.pdf (Feb 2013).
*"*In doing their assessment of the issues at stake each assessor is bound to the obligations and requirements of his or her own home practice. Within the task of integration however, practitioners have left the bounds of their practices and have all become diplomats in a project that they have committed to share. There is a double bind at play here: on the one hand the different practitioners-representatives are mutually constrained by the project in which they are working towards a common goal ("have you fulfilled the terms and objectives of the project contract and arrived at some kind of integration?"), on the other hand they will be bound by the constraints that their peers will pose when they return with results ("what space have you created for us in the integration you have agreed to?").

24 It should be noted that during the course of work in the wearable sensing case study, this concept of ***information pedigree*** became itself extended from science for policy to experiential and lay knowledge making, through its application to users blogs conceived as extended peer communities.

Risk & Uncertainty

The differentiation of risk and uncertainty is at the core of some of the Epinet partner methodologies. UU presents its approach as "a systematic reflection on uncertainty and risk" and distinguishes three different ways of understanding uncertainty, referring to Funtowicz & Ravetz distinction of the key dimensions of uncertainty: inexactness, unreliability and ignorance. In the knowledge assessment methodology of JRC, uncertainty is mentioned as one of the main qualities of knowledge that informs policy-making (next to complexity and values). They use knowledge assessment methodology to express and communicate uncertainty in science for policy. Other partners like Bergen and ULANC referred to the concepts on several occasions, during the project.

Especially during the data protection impact assessment embedding event, the term was topically discussed by Wynne (ULANC) distinguished between risk and uncertainty (and ignorance, indeterminacy and ambiguity) in impact assessments where the object is unclear and poorly defined. He stated that *relationality* is an essential part of risk, which makes one get to *social relations* and concept of solidarity at the heart of managing risk.[**see normativity**]. VUB mentioned the possibility of a ***proportional*** turn to risks in the confrontation with rights, when in a ***fair trial*** in court, the concept of risk loses its 'objectivist halo' and become a form of *contestable* evidence that has to be weighed against individual rights and public values.

Purpose specification[25]

This requirement of purpose specification can be seen as a precondition for questions of the legitimacy of purpose and of fitness for purposes (which will be dealt with below). This is a point that came back on several occasions during the DPIA event. Hildebrandt (VUB) referred to purpose limitation and use limitation as a crucial aspect of data protection with its emphasis on transparency and modulated flows of data and information, whereas in privacy with its emphasis on consent, opacity and non-infringement.[26] The principle constrains the data controllers by making them specifying in advance what they will do. Wynne (ULANC) took up this point stating that purpose specification requires *justification* and *use limitation* and that this relates the technology back to the benefits that it was purported to serve and provide, instead of merely taking these benefits for granted.[27] Within the robotics event Gunnarsdóttir (ULANC) stressed the importance of purpose specification in tying certain solutions to the specific social domain in question, instead of coming up with general solutions. Lastly in the smart grid event Rommetveit (Bergen) pointed at the difficulty of specifying purposes when the technologies themselves are *vague objects of innovation* and nothing more than promissory tales.

Legitimacy

This concept plays a role both with regard to knowledge for stated purpose. In the knowledge assessment methodology by the JRC, reliability of knowledge is one of the main categories of knowledge quality. This refers both to the *sources of information* that support knowledge claims and sources of legitimacy for such claims. The focal lens is the observation of the strategies used to legitimise the information that is offered by someone. During the DPIA event, this point was made

25 In the language of the 4 stage proportionality test in human rights law, this would be an intermediary step between the fitness for purpose or suitability test and the legitimate purpose test, which we don't have in Epinet, since this is probably too politically contentious.

26 Article 6 of the European Data Protection Directive states that: 1. Member States shall provide that personal data must be: […] (b) collected for specified, explicit and legitimate purposes and not further processed in a way incompatible with those purposes.

27 In this sense purpose specification is linked to one of the twelve lessons from early warnings, namely to systematically scrutinise the claimed justifications and benefits alongside the potential risks.

in the broader context of democracy, regulation and impact assessments. Against the technocratic perspective, there is a co-production of knowledge and normativity alongside a learning process. The regulator is learning how to regulate and such learning can also take place through impact assessments. In this way, the knowledge being produced becomes simultaneously a source of legitimacy, blurring the boundaries between the descriptive and the prescriptive. Lastly, the VUB partner noted that checking the *legitimacy of purpose* is the first step in the broader proportionality test used by the courts in determining whether a restriction of human rights is to be permitted. This test was mentioned in different wording in VUB contributions to the first working paper on smart grids.

The concept of legitimacy is closely related with a concern for the concept of ***reference***: it leads to the checking of references to sources. This concern for checking can be seen in JRC's knowledge assessment methodology (including its focus on self-reference), and also in Sussex's media analysis. Interesting as a side-observation is how a concern with the referential links of knowledge claims can be seen in one of the first formulations of the concept of *epistemic networks*, a concept more quantitative than the one used as a reference point for the Epinet project.[28]

Fitness for purpose

This concept serves as a point of convergence between different partners. In the knowledge assessment methodology of JRC, fitness for purpose is the most important category of knowledge quality. It is even called "the core of knowledge assessment activities" in their methodology brief. Fitness for purpose deals with questions like the adequacy, relevance, accuracy and comprehensiveness of information.[29] It is used to look at the strategies used to ensure that the information provided fits with the intended objectives of the relevant discourse. The VUB partner pointed out that a fitness for purpose criterion is the second step in the broad proportionality test of the courts. a court must here ask whether a measure that would restrict the human right in question is suitable to attaining the identified purpose as specified. This can be called the *suitability* test. In the WP1 Memo this was mentioned as an example of one of the main policy problems, i.e., fitness for purpose in addressing societal challenges.

Alternatives

The search for alternatives seems a major point of convergence in many of the methodology briefs of many of the Epinet partners, although the kinds of alternatives are interpreted in a variety of ways over a whole spectrum ranging from: visions, narratives, technologies, measures, policies to institutional arrangements. In the ULANC methodology it is related to what is called the *institutional problem*, which "demands that *institutional arrangements* for innovation, for investment, for governance, are examined critically and alternatives envisaged collectively, and explored practically. As Wynne noted in 1997, in fields of innovation and technology, including risk-governance, methodological elaboration is often in practice a systematic evasion of institutional innovation.[30] In the methodology of the UAB this search for alternatives figures as a quality check

28 Loet Leydensdorff's epistemic networks

29 Interestingly, these criteria also seem to concur with certain data protection criteria. Article 6 of the data protection directive further states that: "Member States shall provide that personal data must be: […] (c) *adequate, relevant* and not excessive in relation to the purposes for which they are collected and/or further processed; (d) *accurate* and, where necessary, kept up to date; every reasonable step must be taken to ensure that data which are inaccurate or *incomplete*, having regard to the purposes for which they were collected or for which they are further processed, are erased or rectified".

30 The search for alternatives is another of the twelve lessons: Evaluate a range of alternative options for meeting needs alongside the option under appraisal, and promote more robust, diverse and adaptable technologies so as to minimise the costs of surprises and maximise the benefits of innovation.

in two ways. First, it figures as a search for *alternative narratives* to the main story-line chosen, secondly, by looking for *alternative technologies*. They state that "a quality check on the proposed technology can also be obtained by looking at the existence of alternative technologies available for expressing the same technique." It is here thus related to a conceptual differentiation between *technique and technology.* In JRC's methodology *social multi-criteria evaluation* is considered an important ingredient "as a formal method to establish preferences over different *alternative policies* or projects using different types of information." Within UU's vision assessment approach, the search for *alternative visions* to the dominant visions of innovation in a certain technological field is also of particular importance. For the VUB the search for alternatives is part of the *necessity test* that constitutes the third step in the broad proportionality test of the courts. The court must here ask whether the restricting measure is necessary for the attainment of the purpose, or whether there are *alternative measures* that are less restricting of the human right.

Proportionality

Whereas the broad proportionality test applied by courts to judge human right restrictions includes the previously mentioned stages of a legitimacy of purpose test, a fitness for purpose suitability test and an alternative-based necessity test, the fourth step involves a proportionality test in the narrow sense.[31] The court must establish whether the restricting measure of proportionally mediates between the purpose and the individuals' rights in question. As both the VUB partner and a human right lawyer remarked during the DPIA event, this concept goes beyond mere mechanical balancing, but rather deals with qualified weights and mediations of interests, rights and other values.

Learning

In discussions during the DPIA event the issue of learning came up in different relations to the issue of performing impact assessments. In the introduction to the event and the later publication the Epinet research team had critically observed the current operationalisation of the data protection impact assessment according to a risk management scheme. This framing excluded both valuable lessons from environmental governance on the nature of risk (in relation to *uncertainty* and the *normative commitments* and values of the *publics* affected) and lessons from legal practice on the nature of rights and *due process*. Below we will come back to these separate points. What concerns us here is their character as *lessons to be learnt from other practices*. This point of *heritage* was picked out by Pereira (JRC), who stressed the importance of learning from previous attempts. Others noted the learning potential of performing impact assessments themselves. A political scientist remarked that business will learn about privacy issues through doing privacy or data protection impact assessments.[32] We also hear how regulators are partially learning how to regulate through doing impact assessments themselves, thus fitting a democratic learning process into a wider co-production of knowledge and normativity.

Normativity

This relation between knowledge and normativity deserves to be highlighted as a separate concept. During the DPIA event Wynne (ULANC) stated that normativities are intrinsically built into

31 "[M]ost rigorously applied, proportionality requires a multi-stage analysis. First, the court must ask whether the purpose of any rights restriction is *legitimate*. Second, the court must then ask whether the measure in question is *suitable* to attaining the identified purpose. Third, the court must ask whether the measure is *necessary* for the attainment of the purpose. Finally, the court must establish whether the measure is *proportionate* in the strict sense, namely whether it strikes a proper balance between the purpose and the individuals' rights in question."

32 In this sense it coincides with the fourth of the twelve lessons for technological innovation and regulation, which is to identify and reduce interdisciplinary obstacles to learning.

scientific knowledge and that public participation thus becomes important.[33] Van Dijk added to this that in the discourse on privacy, risks it is not only about the normative commitments that are purged in the expert based processes of objective assessment, but the very topic of analysis is a normative commitment, i.e.,, privacy.

The assessment of such normative and epistemic commitments is an important part of the ULANC methodology, both with regard to contexts of innovation and contexts of assessment. ULANC wants to study both normative presuppositions and tacit knowledges in fields of innovation.[34] Bergen also considers its type of ethics to deal especially with the normativity inherent in different spheres of meaning and within TA practices themselves.

Public participation

The issue of public participation in impact assessments was one of the main issues of the DPIA event. It relates closely to the other concepts of *disconnect* and *normativity*. The point of disconnect will be treated separately, here we will discuss more the in debt exigencies of public participation in impact assessments. As was already mentioned above, a privacy consultant stated that consultation and stakeholder participation is a question of credibility in providing new ideas and legitimacy, whereas Pereira (JRC) stated that it rather pertained to the *quality* of the assessment process and its *social robustness*. The concept of public participation was also explicit in JRC's knowledge assessment methodology and is linked to their concept of *extended peer communities*. The privacy consultant also observed a *consultation fatigue* and thus noted that we do not only need provisions but also *stimulation* for consultation. Wynne (ULANC) stated that *normativity is* built into scientific knowledge which only makes effective public participation all the more important.[35] VUB distinguished between the participation of two different figures of publics that play a role in law: the broad notion of the concerned public in environmental law that allows for a collective legal action, and the narrow notion of the affected public of human rights law as those individuals who have been affected by a technology, e.g., in their individual right to privacy.

Due Process for impact assessments

In the DPIA event, VUB proposed to apply the concepts and requirements of due process to the organisation of the assessments of risks to privacy and data protection rights. This would for instance imply that ***risks*** will have to be tested as *contestable* legal evidence in a court of law and mediated with legal rights according to a *fair trial*. This perspective relates strongly to the concept of ***procedure***. In human rights law for instance, there has been what is called a *procedural turn*: a shift of focus from the substance of privacy to the ***quality*** of the process of decision-making and the rights of the public in impact assessments. A similar point was made by a technology assessor of systemic risks in energy infrastructures in the smart grid event, stating that it is difficult to say which of these values are more important. We have to step back and set the political procedure right. The outcome of smart grid development will have to be more socially robust. Which procedures are in place right now? 1. those who are impacted will have to be involved, 2. the information necessary will have to be made available in a neutral way, 3. the gap between the outcome of participation exercises and the actual political decisions that are taken has to be narrowed.[36]

33 This coincides with the ninth of the twelve lessons for technological innovation and regulation, which is to take full account of the assumptions and values of different social groups.

34 This methodology finds resonance in the third of the twelve lessons for technological innovation and regulation, which is to identify and work to reduce 'blind spots' and gaps in scientific knowledge.

35 This corresponds to the eighth of the twelve lessons for technological innovation and regulation, which is to ensure the use of 'lay' and local knowledge, as well as relevant specialist expertise in the appraisal.

36 Reminding of Rip and Callon et al on proceduralism in STS.

Assessing Assessments vs **Doing Assessments**

One of the main goals of Epinet is to contribute to the public understanding and articulation of crucial policy and innovation issues in relation to specific techno-scientific domains. A WP1 Memo however, observes an ambiguity about this goal from the very beginning, relating to a distinction between doing assessments and mapping and assessing other assessments: “on the one hand we set out to map and assess assessments already done in the respective fields. On the other hand we ourselves are carrying out assessments, and so making judgements (“assessments”) about the innovation/policy practices in question.” There is thus a play between different levels – mapping vs. assessing, description vs. judgement - that are themselves not that clearly distinguishable, but rather have to align. The WP1 Memo proposes to explain this ambiguity by the vague hybrid often promissory character of the technological objects that are to be assessed. Furthermore, another clue can perhaps be found in statements among Epinet participants, on the blurring between the descriptive and prescriptive once the focus is displaced and becomes the question of the quality of knowledge, which includes the question of values and normativity. Moreover, differences in partner approaches also play an important role here [See the distinction of network-based, system-based, and process-based orientations in the section on epigrams]

Mutual Assessment

This concept is related with the role of sociological (re-)*structuring* of technologies by interrogating the versatility & possibilities of (re-)shaping through societal assessment. The notion is extracted from a remark by Wynne (ULANC) made in the context of the in vitro meat case study who stated that, there are already assessments going on: they observe the outside world, assessing them from the outside and looking in as it were. The people whose work was assessed in the embedding event were assessing the Epinet assessors and the other way around. It thus points to a mutual relation between assessors assessing assessed, but the assessed also assessing the assessors. The concept is also closely related to the discussion on the difference between *observation* and *intervention* of the role of Epinet in the networks the project is studying, i.e., as a ***social experiment***.

Experimentation

Experimentation is a concept has surfaced on several quite different occasions during the Epinet project, although it was used in a variety of different senses. Firstly, it referred to the social experiments referred to above through mutual assessment between assessors and assessed and aim at socio-technological restructuring. Secondly, there were the collaborative experiments in self-hacking, self-awareness & autonomy as presented by a representative of the Quantified Self movement during the wearable sensing event, presenting models of personal data infrastructures that were both based on user-centred computing and on collaborative practices. The audience remarked that this model is interesting for a co-operation between different parties and actors focused on *autonomy*, but through doing things together. In a third very different sense the term was used in the DPIA event both by a privacy consultant and a data protection regulator who referred to collective public experiments in the marketplace of privacy in order to ”try out and see what happens” (as opposed to anticipatory assessments). It also refers experiments of consumer participation in knowledge production about health and fitness through blogging, studied by the JRC & Sussex partners.

Bottom-up vs. **top down** approaches

Related to this concept of *experimentation* is a distinction between bottom-up and top-down approaches. Relating to the wearable sensor embedding event and the perspective of collaborative experimentation, a distinction is made between three different layers. There is the *bottom-up*, DIY-

like innovation field, in large parts driven by markets but also other kinds of private and civic initiatives, such as the quantified self-movement and patient groups. There there are state/EU-driven *top-down* efforts to reform public health care and to *responsibilise* individuals. Increasingly these initiatives are not purely public, however, but rather promoted through large public-private partnerships. Then (in between as it were) there is the *perspective of regulation*: At the WP3 workshop, one of the most grateful participants was a regulator in the field of medicines and health products), who strongly expressed gratitude for the opportunity to have a greater variety of inputs from a greater variety of actors. A strong disconnect was observed between the bottom-up approaches and the top-down approaches, both in the wearables case study, but also in the robotics embedding event. In relation to experimentation with technology, a robo-ethicist observed that Europe is not the best *test-bed* for bottom-up approaches. There is too much top-down control in Europe and a need to unleash younger people [We will come back to this point in the section on *disconnects*]."

Technology Exceptionalism vs. **Technology Generics**

In analysing and juxtaposing the different technological case-studies it becomes clear that there are certain policy issues that are particular to a certain technology, whereas other policy issues are common to two or more cases [see the section on Visions and Policy Problems]. These common issues were cross-cutting and perhaps generic to the use of ICT technologies This issue became a point of topical discussion during the robotics workshop in the light of the question whether technology-specific fields like *robolaw* and *roboethics* are desirable. Here is a fragment from the discussions:

> Strand (Bergen): I was impressed to discover that there is a field called *roboethics*. Just like with nanoethics, the question is what are the *specific questions important to the technology*? Why no *generic approach*?
>
> Ethicist: we wanted to identify the *issues specific to robotics*. You can identify for instance privacy, equity, discrimination, etc. The cameras on the robots, etc.
>
> Roboticist: even if robots are not very intelligent, autonomous, etc.: there are still significant ethical issues. Addressing these issues is to avoid that particular association "robots– ethics = bad".
>
> Gunnarsdóttir (ULANC): there is *specificity* to the data collected by the care robots.
>
> Strand (Bergen): one ends up asking what are the *peculiar issues* in this case. But what are the *important issues*? *The analysis of issues specific to certain technologies can blind to the more general issues common with other technologies that are often more important*.

Thus we here have an important tweaking for assessment that has to find a balance between *technology-exceptionalism and technology generics*. This requires fostering a double-edged assessment sensitivity. On the one hand, assessment has to dig into the particularities of a certain technology or technological field and see whether there are specific issues that these give rise to. On the other hand, such a specific focus should not lead the assessor to lose sight of more generic problems that also rise in other technologies. These issues are only already important due to the very fact that they arise in all these technological case-studies. One way to keep these issues in sight is analysing the generic enabling technologies out of which the specific technological objects are composed, since the generic and enabling is also used in many other technologies.

This point of finding a balance between technology generics vs exceptionalism does not only pertain to the *(policy) issues* technologies give rise to, but also to the very assessment

methodologies. Here we get to the point of a *generic assessment methodology* applied to different technological sectors (a point that is also related to the issue of *heritage* and ***learning*** from other fields) *vs.* a *technological sector-specific methodology*. [See the section on situating models of Integration].

Ethics by design vs. **Ethics in design**

In the wearable sensing case there was a debate on the idea of ethics by design. The event report mentions the following about this: “The drive to engineer ethics into systems (ethics and privacy by design) also came up during the day. This is seen by some as more pro-active and constructive than conventional ethics assessments and consent protocols. The VUB partner stressed an issue for further discussion and debate on this matter. It concerns the difference between ethics 'by' design, a co-production between ethicists and engineers as presented by the Guardian Angels project, and so-called ethics 'in' design which starts from an architecture (like open source) flexible enough to allow users to make their own choices. This contrast has many similarities and points of interest for the discussion on privacy and data protection by design which follows from methodological considerations pertaining to privacy impact assessments (PIA) and data protection impact assessments (DPIA).

Within the robotics case study this discussion about ethics by design also surged in the context of building moral codes and laws of robotics in these technologies. Important concepts mentioned in this respect were: non-lethal, dignity, laws, freedoms, rights, privacy and personal space.

APPENDIX II

Methodological complementarity amongst Epinet partners

- **Bergen-ULANC**: [*method*].
  Converge on the approach to *accountability* and *responsibility* and apply such assessments to induce reflexive accountability among the actors. Seek ethical-moral relevance with them (ULANC). Responsiveness as the capacity to respond to claims and issues, arising from matters of concern by other actors (Bergen), notion of repons-ability (VUB).
  Empirical descriptions of actors against. the making of theoretical constructs.
  Focus on normative commitments of actors but without taking the normative stance about what should be done by (ULANC)
- **Bergen-ULANC-VUB-Sussex-JRC-UU**: *issue-based*
- **ULANC-Sussex-VUB-Bergen** *mapping networks*
- **ULANC-UAB-Sussex**: Attention to *framing*. Homogeneous networks of expertise with defined problem and shared frame of meaning vs heterogeneous diffused networks (ULANC).
- **JRC vs. UAB (& UU?)**: Knowledge assessment is introduced as starting from a "disenchantment with the notion of Integrated Assessment", which disantiates this position from UAB who embrace the integrated assessment approach.[37]
- **JRC vs. ULANC**: JRC's matrix of criteria as a "preliminary set of categories of quality" seems to place this approach in opposition to some other partner's approaches, like the ULANC one in which such a frame is rejected.
- **Bergen vs. UAB**: No definition, no discipline, no synthesis, but *fields* vs. concern for *semantic definition* and *taxonomy* of technology and that a "pre-analytical choice of a set of criteria is needed about criteria and indicators of performance" [*smart grid working paper 6.1*].

*These 2 previous points can be broadened into divergence, with **Bergen-ULANC** on the one side and **UAB-UU-JRC** on the other.*

- **Bergen-VUB**: It is interesting that both the legal and ethical partners have already provided such full-blown analysis at this stage which may have something to do with the *temporality of analysis* of these approaches.
- **Bergen-UAB**: Who takes decisions? Which criteria are used for assessing quality of choice?
- **ULANC-UAB-JRC**: Institutional context-Narrative-Definition of problem. Choice of narrative (UAB), framing of problems in issues, institutional contexts and interests (JRC), also relate to the point of framing.
- **JRC-Bergen**: Assess ontological commitments of groups
- **ULANC-JRC**: Public participation, citizen juries [**VUB**]
- **UAB-ULANC**: Looking for alternatives
- **Bergen-ULANC-UAB-Sussex** and later **UU**: Vision assessments, looking at imaginaries, promises
- **JRC-UU [***method***]**: Fishing in the same pond *qua* methodology: *uncertainty, quality, post-normal science, science-policy interface*

37 It is interesting to observe that JRC's previous methodology brief already started by distancing its knowledge assessment approach from the field of integrated assessments: "In the early 2000s and following some disenchantment with the notion of Integrated Assessment in particular, we have set at the Joint Research Centre a group called Knowledge Assessment Methodologies which expressed both awareness and commitment to change a certain 'state of affairs'" (p. 17).