Pathways towards policy relevance, operationality and usability of models for *ex ante* impacts assessments

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INTRODUCTION

The existence of a gap between scientific knowledge and its usability in political decisions is now widely recognized (Bradshaw & Borchers, 2000). The gap between science and policy corresponds to the "now-familiar pattern wherein policy lags behind science" (Bradshaw & Borchers, 2000). Researchers are often frustrated to see their work not used by policy-makers, while policy-makers complain about a lack of data, of information on critical topics and about the non-operationality of scientific research. Relevancy is not defined similarly by researchers and policy makers (Cash et al, 2002).

To explain the gap between science and policy, decision mechanisms, the use of knowledge in decision making, institutional and policy processes have been largely investigated (Hall & Taylor, 1996; Lindblom, 1959; Sabatier & Pelkey, 1987; Weiss, 1979). In particular, Regulatory Impact Assessment (RIA) is an interesting venue to analyse science policy interrelations because *"there are few institutional venues in which knowledge, politics, and policy-making are more closely interlinked than in Regulatory Impact Assessment."* (Hertin et al, 2009). Regulatory impact assessment is the part of the process of policy making which consists in identifying the main options to achieve an objective and analyse the potential impacts of these prospective policy options. *"Impact assessment helps structure the process of policy making. It identifies and assesses the problem at stake and the objectives pursued. It identifies the main options for achieving the objective and analyses their likely impacts. It outlines the advantages and disadvantages of each option as well as synergies and trade-offs. Impact Assessment is an aid to political decision, not a substitute for it."*[1] In this article, we do not distinguish between regulatory impact assessment, which has been the main policy appraisal tool in the USA, UK and Canada for instance (Turnpenny et al, 2009), and policy appraisal tools, which covers the family of *ex ante* procedures and techniques.

Even though the *ex ante* impact assessment of prospective policies is an essential tool to support evidence-based policy making, the quality of RIA is multivariate and depends largely on the stakeholders involved (Radaelli, 2004). The integration of evidence, which is *"the capacity to acquire, process and integrate different types of evidence"* across sectors, impacts, stakeholders and evidence is has developed as a new focal point of research (Turnpenny et al., 2008), a evaluation criteria for IA. The integration of evidence obtained from complex tools, understood as *"highly complex computer-based models that seek to establish formal mathematical relationships between different variables (Cabinet Office 2000, p. 8)"* is particularly difficult to achieve (Nilsson et al, 2008); it faces the scepticism of end users (Dilling & Lemos, 2011; Aumann, 2011) regarding their usefulness. Consequently, the use of complex tools is disparate and rather rare in formal IA processes (Nilsson et al, 2008; de Ridder et al, 2007; Jacob et al, 2008). On the contrary, it is more common in informal policy processes (Nilsson et al, 2008) and in specific sectors such as finance, taxation and climate policies. It then enters the category of "policy appraisal tools" (Turnpenny et al, 2009).

However, even though numerous models have been developed in the academic research (Podhora & Helming, 2010), the use of tools is not systematic. Some models have become stars of the projection, others are given the status of "RANAs", French acronym for "Not applicable applied research" (Latour, 1995).

If *"the scientist must communicate somehow with the decision maker"* (Cash et al, 2002) and if science policy iterative processes are essential to stir the use of models (Weichselgartner et Kasperson, 2010; Schößer et al, 2010), the co-production of evidence at the interface between science and policy is a necessary but not sufficient condition (Sieber et al, 2009): despite numerous meetings and interactions, models are not always used by end users (Uthes, S., et al., 2009).

[1] Commission of the European Communities, Internal Guidelines on the new impact assessment procedure developed for the Commission services

To explain the lack of use of complex IA tools in policy processes, research has focused on the policy realm, explaining IA policy processes through "institutional capacities and constraints" (Turnpenny et al, 2008). Turnpenny et al (2008) investigate the role of *micro-level constraints* such as background of the policy-maker, professional experience and networks, accessibility to knowledge, time and money, as well as *meso-level constraints*, legal and organisational traditions, constitution, inter-departmental coordination, "silo mentalities", quality control, perspectives on the assessment. Finally, he looks at *macro-level constraints*, like paradigms such as economic growth, EU level policies or patters of consultation. Similarly, De Ridder et al (2007) analyse the role of time and budgetary constraints, availability and accessibility of and to data and tools and qualification of decision-makers in the use of complex tools. Radaelli (2003; 2004) demonstrates that the success of the transfer of a process like RIA, is highly sensitive to the context through its dimensions. The first dimension is institutional: the bureaucratic context and the integration of the procedure into the rules of procedures and processes, and the dominant legal culture (Radaelli, 2004). The second dimension is territorial: what are the different methods used at the different levels-jurisdictions. The third concerns the theories of the policy process: how does this introduction of mandatory IA concretizes in the policy process? And the last one is legitimacy.

When one analyses the use of complex tools in particular, the factors related to the institutional and policy processes have certainly a role to play. However, scientific variables, related to the modelling process itself, may play a role as much important as the variables related to the policy process. Problem framing (Buttel, 1998), temporal and spatial scales (van Delden et al, 2011), disciplinary approaches (van Delden et al, 2011; Ewert et al, 2011), assumptions (Kloprogge et al, 2011), format of results and presentation of uncertainties (Kropp & Wagner, 2010; Ravetz, 2003) are critical choices in the design of models, on which both researchers and policy-makers may have diverging opinions and which play an important role both for the scientific and the policy objectives. We make the hypothesis that the ability of models to match end users' expectations is an explaining factor to the use of models.

In this article, we investigate to what extend and how stirring policy relevance and operationality of IA models can enhance the integration of the RIA process? We analyse empirical pathways and windows of opportunities to stir the use of *ex ante* IA models through increased policy relevance and operationality.

METHODS & DATA

To address the research question, we adopt an explorative, empirical and qualitative approach. In particular, we focus on the difficulties experienced in the projects to successful build models that are perceived policy relevant by policy makers.

The date collected come from three cases, which are investigates thoroughly. The cases were selected on the following main criteria:

Firstly, all cases involve complex computer-based mathematical models that allow the *ex ante* impact assessment of agro-environmental policy options. The challenge of making complex modelling tools lies in that their complexity generates systematically a form of scepticism and requires a heavy investment in the co-production of the end users.

Secondly, the three cases focus on land use, with a special focus on agriculture. Models for the *ex ante* impact assessment of prospective policies are numerous in the field of *land use and agriculture* (Podhora & Helming, 2010). Agriculture and land use call on numerous disciplines (agronomy, hydrology, economics, environmental sciences etc.) and generates controversial viewpoints, supported by strong contradictory interests. This makes of it a very interesting topic, where the role of science is hotly debated.

Thirdly, all cases are *academic research projects*. Unlike consultants, academic researchers working on policy-relevant IA modelling are submitted to allegiance to two communities of practices: on the one hand the quality criteria of scientific research (among others peer-reviewing, independency) and on the other hand to the policy realm (transparency, rhythm of the policy process, targeted communication etc.). This makes it a particularly interesting case, where the objective is to combine high quality academic research and operationality.

Fourthly, all cases are *showcases for science policy interactions* for co-production of evidence. Numerous interactions between scientists from various disciplines, policy-makers, various stakeholders, and in one case lay citizens took place. The collection and implementation of end user requirements, the participative design of scenarios and visualisation of the results were at the centre of each project. All three cases were financed under the European Framework Programm (6th and 7th), which ensures that the *financial and human resources* are not a restriction to policy-relevancy (organising meetings, interactions…).

Fifthly, all cases are *recent* (2000s). This contributes to ensure that pathways and obstacles for operationality and policy-relevance are described under the current institutional, policy and scientific contexts.

Sixthly, all cases *vary* in the type of end users targeted, the size of the model, degree of integration of disciplines and impact areas. They all have a different way to frame the issue.

Seventhly, data are extensively accessible through the websites and observations.

Finally and more importantly, despite their high investment into the science policy interface, the projects resulted in a mitigated use of the models (Uthes, S. et al, 2009; Sebillote et al, 2008): there is a lot to learn from the experiences covered by these three projects.

The first case is the RIVERSTRAHLER coupled to the MIRO model, with GIS interface Seneque (Passy, 2011a). In particular, we focus on two aspects of its development. The first one is the development under the **European FP7 project AWARE**. The project focuses on "how to achieve sustainable water ecosystems management connecting research, people and policy makers in Europe". It is funded through the 7th Research Framework Programme and started in June 2009. The project focuses on three case studies, the Po river basin, the Seine, Somme and Scheldt river basin and the Gulf of Riga. We take the process for the Seine-Somme-Scheldt as a case study in this paper. After consultations of scientists and policy makers from local to EU level, selected "lay citizens" are in charge of identifying pathways to achieve a good ecologic status of coastal waters. Scenarios are then simulated in order to evaluate *ex ante* the impacts of these identified policy options on the eutrophication of coastal ecosystems at the outlet of the river basin – in which the group of modellers involved in the project is specialized (Passy, 2011b). The outcome of the simulations are then used by the citizens to produce a statement, which is presented to members of the European Economic and Social Committee. In this case, what we will refer later on as end users corresponds to the group of citizens, who designed the scenarios based on their interactions with scientists and policy-makers. The second aspect of its development, which chronologically preceded the AWARE project, is through the PIREN-Seine. The PIREN is a partnership between the same group of modellers and local water management agencies, in charge of the development and implementation of local water policies, which are in this case the (potential) end-users[2] for which the simulations are made.

The second case is the history of development of the **SIAT tool (Sustainability Impact Assessment Tool),** which was developed under the frame of the Integrated Project SENSOR funded by the 6th Framework Programme of the European Commission. The SIAT tool was built to evaluate the impacts of land use policy options on a wide range of indicators related to the agriculture sector as well as the sectors of forestry, tourism, nature conservation, energy and transport (Helming et al., 2008). The SIAT tool is based on an interlinkage of individual models, which allow to represent "each sector relevant for sustainable land use" in great detail (Sieber et al, 2010). The SIAT tool was developed based on a model requirement

[2] Sebillote, M., Larrue, C., Merillot, J-M., Pointet, T., 2008. Evaluation du Programme de Recherche PIREN-Seine. Conseil Scientifique du Comité de Bassin Seine-Normandie.

analysis, which relied on group discussions with potential end users and interviewees (Sieber et al, 2010).

Finally, the third case is the development of the **SEAMLESS-If** (System for Environmental and Agricultural Modelling, Linking Europe Science and Society), If stand for integrated framework. SEAMLESS-If was developed under the seventh framework programme (FP7). SEAMLESS focuses on "land-bound agricultural activities (...) and their interactions with the environment, economy and rural development" (van Ittersum et al, 2008). It was developed to assess the impacts of agricultural and environmental policies, as well as technological innovations on a wide range of economic, social and environmental indicators. SEAMLESS is an integrated framework based on the coupling of several pre-existing sub-modules (Ewert et al, 2005). The infrastructure is relatively flexible and allows to link various components, namely models, databases or indicators. The infrastructure of SEAMLESS results from iterative discussions with potential end-users (van Ittersum et al, 2008).

The data are collected from a wide array of sources of information: observations, interviews with different stakeholders (policy officers, facilitators, modellers), publications, deliverables, evaluation reports etc.

Because these projects are similar by many aspects, we complement the analysis by collecting modellers' experiences on additional IA modelling projects with a strong science policy interface. To do this, complementary interviews are conducted with experts, observations of discussions on policy-relevance, meetings between end users and modellers. In so doing, we aim at augmenting the variance of the sample and confirming the analysis based on the three cases.

RESULTS & ANALYSIS

The research demonstrate that stirring the usability of a tool starts with its co-production but does not end at the post-modelling stage. This is why the results we present in this section concern both the initial co-production of the models as well as their further development and the post-modelling communication around it. The results of this research show three main difficulties to stir the use of evidence from complex tools. The first one concerns laying the foundations for the fixation of common achievable objectives. The second difficulty concerns the integration of end user requirements into the model development. The third one concerns the difficulty to match policy makers' demand for evidence. In the following section, based on these results, we analyse the pathways to stir the policy relevance of IA models, namely laying the foundations to match expectations (1), targeting a venue and satisfying its requirements (2), and seizing windows of opportunities (3).

1. Preliminary steps: laying foundations for the adjustment of expectations

The first main difficulty experienced in the three cases lies in the preliminary step of the research. It consists firstly in setting targets, which leads us to describe the necessity to reinforce the communication of scientific capacities and constraints (1.1). Secondly, it covers the collection of end user requirements, which leads us to conclude on the need to target policy appraisal contexts (1.2).

1.1 Communicating scientific capacities and constraints

One common characteristic of the test cases is the difficulty experienced by the modellers and the end users to match expectations from both sides. Either the targets which are set, end up being too ambitious and have to be reduced by the modellers, or the end product does not correspond to what one or the other end user had expected. For instance, the AWARE project was announced as a project on "sustainable water ecosystems management" and on water quality management. Nevertheless, in the North-Sea case study, the modellers' team engaged in the project was specialized on nitrification and denitrification processes, nitrogen, silica, phosphorus cycles and eutrophication. Therefore, the modeller's team was unable to provide insights on pesticides or on input from ships' emissions, as was requested repeatedly by the participants.

In contrast to cases where the available capacities are obviously limited such as in AWARE, cases which rely on tens of partner institutions, such as SIAT and SEAMLESS-If (about thirty partner institutions each), financial capacities and human resources for the project can be both groups of end users and scientists set ambitious targets. However, these targets proved to be unachievable. If a very high level of details and integration (disciplines, impact areas, etc.) were covered, it was at the cost of a significantly lower robustness of the results, a partially functioning graphic user interface in one case and a reduced transparency and thereby credibility of the results.

The discrepancy between the announced policy targets and engaged scientific competences contributes to the impression of an imbalance of powers, and to the impression that the modellers' team dominates the co-production process.

One explanation is the difficulty experienced by the researchers to communicate on capacities and constraints. The first step to draw clear boundaries around the range of possibilities within the scope of available competences and communicate them. This allows to set achievable targets for the co-development of a model and avoid frustrations. The two main types of scientific capacities and constraints are the given research competences and the financial capacities and human resources available for the project. When a project involving the co-production of evidence is launched, common scientific and policy objectives have to be set considering the limited scientific capacities and constraints.

Furthermore, not only boundaries have to be clarified, but also of estimating the trade-offs and the costs of each important modelling choice, in terms of how they affect the ability to achieve other complementary and important objectives.

1.2 Targeting contexts for the collection of critical end user requirements

The second aspect of the preliminary difficulties is the collection of critical end user requirements. Participative processes have developed as the golden standard of science policy society interface in policy-relevant modelling. Participation is often seen as involving a large audience, the representation of various interests and aims at combining both objectives of enhancing legitimacy and usefulness of the tools (Helming et al, 2011), co-production of evidence and learning process. They are used both for the collection of end user requirements as well as to the design of the scenarios to be assessed. However, the three cases demonstrate that at higher administrative levels, the access to relevant interlocutors is difficult. The first stage of the process, which consists in convincing the end users of the usefulness of the model is particularly difficult through participative processes than during interviews. End users are unstable and researchers struggle to obtain "input" from end users (Sieber et al, 2007). Consequently, the difficulty to collect end user requirements has led to a progressive differentiation between participative processes and the collection of end user requirements, which tend to rely on one-to-one interviews (Sieber et al, 2009) and regular contacts with a core of "key interlocutors".

This tendency which is discernable in all three projects to separate participative processes from the collection of critical end user requirements is a pathway to manage the tensions between credibility, legitimacy and salience, which were underlined by Cash et al (2002). Not only does it shows the tension between salience and legitimacy, but also on the salience itself. As was demonstrated earlier, the quality of RIA is not monolithic and depends on various dimensions of the context (Radaelli, 2004). Collecting information on the context requires time and resources. The integrated IA models aim at providing information on a large array of policy questions, which are treated by different policy makers (policy officers) embedded in different contexts, for which the dimensions of the context vary: for instance the bureaucratic and informal rules of procedures between the different DGs at the EU Commission or different ministries at the Member State level. In consequence, in order for the model to be fully salient, only a limited range of contexts can be targeted and thereby the diversity of the group of end users has to be limited.

2. Targeting a context, a venue, matching their requirements

Once the foundations for a good science policy dialogue have been set, one needs to look at the critical aspects which the model has to fit to be considered salient or policy relevant. These are the requirements bounded to each context or more specifically venue. Co-producing evidence consists essentially in identifying what these requirements are for a certain policy venue in a certain context in order to build the model accordingly.

2.1 Matching the requirements of a venue: major trade-offs for an optimized salience

The territorial dimension of the context (Radaelli, 2004) is the first requirement for a model. They are often non-negotiable and set the spatial coverage a model has to respect: *The major criteria for usability is that it covers 27 EU countries. We are looking for coverage of all countries."* report an expert end user. However, contrary to territorial coverage requirement, some requirements let a large margin of interpretation to the modellers and depend on the priorities set by the end user. An expert end user reports: *"I like the meta-models very much, I like that it is simple but not too simple, but I insist on robustness"*. This statement reflects that the end user favours meta-models for their comprehensiveness but set up a strict limit to comprehensiveness, namely the robustness of the results. On the contrary, in another context, different priorities may be set, such as the rapidity of the simulation time. Once proposals have been amended, a few weeks remain before the proposal is actually voted by the Parliament. In order for the Parliament to be able to proceed to an informed decision, the amended proposal has thus to be assessed very quickly: *"[in this venue], we need to have instruments where alternative policy options can be exercised with not much cost"* report a end user. In this venue, meta-models which require complex adjustments and long simulation time are excluded.

The other venue is the integration of the tool directly into policy departments, the DGs Agriculture or Environment for instance. In this venue, models are used to prepare negotiations at the international level or to build policy proposals. In this case, the requirements are considerably different: the tools can be complex (meta-models for instance) and take longer simulation time. An example for this is the CAPRI model. The CAPRI model is global agricultural sector model with focus on the 27 EU Member States. Before being used as a component in SEAMLESS and SIAT, the CAPRI model was initially developed as an independent model by European Commission Research funds. It has been further developed, through responses to tenders targeting the development of modules and functions. For instance, in 2004 there was a tender for the development of the dynamic and spatial dimensions of CAPRI, which led to the development of an employment module, an indicator for energy use in agriculture and a GIS link.

Both end users and more recently modellers are tempted to flexibilize model frameworks to increase the range of functionality and therefore the range of possible uses. The objectives being on the one side to enlarge the group of potential end users and on the other side to increase the adaptability of the tool to the fast changing policy environment. Nevertheless, this research demonstrates that too much flexibility can be detrimental to policy-relevance. Tendentiously, and especially for coupled models, the more comprehensive, flexible and/or detailed the tools, the lower the robustness of the results and the higher the simulation time. To each venue corresponds specific requirements, defined mainly by the priorities set by the policy process, the in-house available capacities to run the model, the bureaucratic traditions. Some of them are nonnegotiable but easy to grasp such as the spatial coverage. Some others require a subtle blend of priorities, in particular flexibility, comprehensiveness, simulation time and robustness.

2.2 Matching the requirements of a venue: proofs of credibility

Not only salience but also credibility build the usability of a model. One major difficulty experienced by the modellers was over-coming the scepticism of the end users. The data shows that credibility of the models and thereby transparency is one crucial, if not the main requirement to the use of models. In order to overcome the scepticism of the end users, the modellers follow various pathways.

The first requirement for credibility is transparency of the model (product) and its development (process). This means not only opening the access to peer-review of the final product, but also making the development process transparent. The first pathway to transparency consists in making the *source code accessible* either publicly or at least to the end users: *"The weakness is (…) not being able to go back from the published paper to the source code."* (expert end user). However, accessing the source code is not necessarily a sufficient standard of transparency. If the source code has not been written with a special care for readability by an external person, it can remain a mystery to any other person than the developer himself. This is why the model may be accompanied by *model documentations* in the SIAT, SEAMLESS & PIREN-Seine projects. Model documentations describe the structure of a model. Written model documentation can take the form of a book or document, or it can be integrated to the tool itself, such as in the SIAT graphic user interface for quick and easy access. In AWARE, one main type of end users being non-modellers lay citizens, the oral communications, explanations and discussions with confrontation to other scientific colleagues from other research institutions were used as a proof of credibility. The model documentation took the form of an oral communication of the most important aspects. This model documentation may not only describe the structure of the model or model framework, but also *analyse and discuss underlying assumptions* and *uncertainties*. Uncertainties tests and analysis can be undertaken in the light of how policy-makers define important uncertainties, as was the case in SEAMLESS-If (Gabbert et al, 2010).

Impact assessments are predictions of the future state of the environment, an economic sector and/or the society. For the end users to trust the predictions, test cases. It means that the model can be run for a policy case, which results are already known by the end users (a policy recently implemented) and/or for which empirical data is available. In so doing, end users can verify whether the model is able to accurately predict results. The empirical validation of the results can enhance considerably the use of the tool if it resonates with end users' knowledge, especially at local level (AWARE and SENSOR). In particular, once a model has been tested and validated for one case, end users tend to trust more easily ideas that challenge their "previous beliefs" (Sabatier, 1998). One interviewee of the PIREN explains: *"before the partnership, the officers from water agency only considered point-source pollution, since we showed them the results of the simulation of the role of agriculture in water pollution, they began to take diffuse sources of pollution into account"*.

Finally, credibility can be proofed through the availability of a *help desk*. It is the case of the CAPRI model through its capri-users mailing list and the EuroCARE GmbH in Bonn. It was also the case of the SEAMLESS project through the SEAMLESS association. Such institutions allow iterative processes between peer-reviewers and improvement of the model. It offers the possibility to end users to ask questions and to challenge the model continuously. As is reported in the evaluation report of the PIREN-S, the possibility offered to the end users to ask their questions stirs the use of the models. In the case of the PIREN, the existence of a formal partnership initiated the creation of close working relationships, which contributed that end-users obtain answers to their questions rapidly: *"When close relationships exist with researchers, users obtain, without difficulty, answers to their questions. Otherwise, users won't even speak out their questioning, because they don't know how to position themselves regarding the research agenda, and on the other hand whom to ask."*

In SEAMLESS and SIAT, the highest level of transparency was requested by the end users at the EU level, namely open source code, very large model documentation through project deliverables, end user guidelines, integration to the tool of background information (SIAT)[3].

As such, the first element is simply the construction of relationships between the suppliers of information and the users of this information. The importance of trust in informal relationships is underlined by Kropp & Wagner (2010) in the context of scientific policy advice. Cash et al (2002) write that credibility is often judged by proxy, based on the scientific process, the reputation of participants and organisation (expertise and records) for instance. In coupled models, one important element is the extend to which model components are renown, within the academic community and in terms of policy uses. Nevertheless, IA models are increasingly complex. It is often impossible for one person to have a detailed understanding of the highly integrated models. Therefore, the proofs of credibility and transparency required are higher. Consequently, certain pathways to credibility are specific to the modelling process. Overcoming the initial scepticism of the end users requires to open the black box of the models (Latour, 1989).

Modellers do not always have the resources to invest in transparency, which are very poorly rewarding scientifically. However, the requirements for transparency, in not respected, can be a real barrier to the use. This is why a subtle balance need to be found and relevant proofs of credibility need to be targeted.

The data confirms the results of Wardekker (2008) and Guimaraes (2009), whom he quotes, and that a “progressive disclosure of information” is needed. This means that proofs of credibility which allow end users to overcome initial scepticism very quickly are required, as well as an assurance that detailed proofs of validity can be accessed to. In addition, as regards to IA modelling, one can observe three types of proofs of credibility which are required by end users: the first one is a description of the model, accompanied by a critical discussion of the model assumptions and uncertainties. The second type is the empirical validation of the results. The third type of credibility proof is the availability of a help desk.

Our data shows that the level of transparency requested can varies from one venue to the other. Each level of credibility proof needs to be adjusted to the foreseen type of use. For instance, in case the model is planed to be used in-house by policy officers through a graphic user interface, the availability of a help desk is indispensable. If the model targets a “one-shot” simulation, it is not necessary. On the contrary, the requirements can be satisfied in

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[3] Information available on the sensor project and SIAT websites. Sensor project: http://www.sensor-ip.org/ SIAT: http://siat.cgi-systems.nl/SiatGUI/

submitting the model to extended-peer reviewing, oral description of the model and critical debate among a extended peer-review community (Funtowicz & Ravetzt, 1993).

The data shows that each institutional venue for knowledge appraisal brings about its own specific requirements regarding the structure of the models. Complex appraisal tools are only considered relevant and useful if they satisfy these requirements.

3. Seizing windows of opportunities

The independent character of research makes that it does not (and should not) perfectly timely fit the convulsions of the political agendas. The last main difficulty experienced by the modellers is the ability to fit the pace of the policy process and more precisely to match policy-makers' demand for evidence.

3.1 Adjusting the offer and demand on the market of evidence: a thorny task

In the three projects, the initiative came formally initially from the academic side. In the SIAT and SEAMLESS projects, the difficulty was that the project was financed by the DG research and targeted users from the DGs Agriculture and Environment in particular. The scepticism from the DGs Agriculture and Environment was then much higher than expected and the utility of the models had to be marketed: *"the unique selling point of this model is that it covers a wide range of issues, of rural indicators than for instance the CAPRI tool"*. The utility of a model and its up-take by policy makers can also result from hazard. In the AWARE project, when the citizens presented the results at the ECOSOC in front of representatives of the DGs Agriculture and Environment, even though the process and the values and general ideas of the results of the project were understood, solutions were considered not timely or inappropriate.

Changes in the context can suddenly improve the policy relevance of a tool. For instance, attending a session of presentations of models on "Modelling capacities for policy support in Europe" organized by the LIAISE[4] network of Excellence and the Joint Research Centre of the EU, including the SIAT, one other model was pointed out as particularly relevant for the current EU discussions about a strategy on the regulation of cross-country pollution through rivers and suggested the relevance of the model for the strategy: the tool would allow to reinforce data and the evidence-based of the strategy on transnational pollution through the Danube river. The modellers were incited to contact the relevant working group.

[4] http://www.liaise-noe.eu/

3.2 Establish the conditions for seizing windows of opportunities

The windows of opportunities for policy appraisal through complex tools are more and more numerous in certain contexts. *"Desk officers performing IA are regularly reminded that they have to investigate alternative options"* reports an internal informant from the JRC.

However, this trend is not to be observed in any policy area. For complex tools to be taken up by policy makers, their introduction requires to fit policy makers' demand for evidence. However, the independent character of research makes that it does not (and should not) perfectly timely fit the convulsions of policy processes. However, policy making proceeds by incremental changes (Lindblom, 1959). In particular, Sabatier & Pelkey (1987) write that if some factors change rarely or only over decades, some others vary often over the course of a few years or a decade. They can be changes in socio-economic conditions and technology, change in the governing coalitions or policy decisions in other related domains. Thereby, uncontrollable factors related to the policy process can suddenly reinforce the policy-relevance of a model or tool.

This is however only possible if it is brought to the attention of relevant end users. To ensure that opportunities can be seized, the conditions must be reunited that the model gets attention at the right point in time. The visibility of the model can be ensured through communication and model platforms, such as toolboxes. It can also be developed through applications to policy cases. Promoting the active development and up-dating of the model is the second option to promote the use of a model, which mainly applies to coupled models, where both up-dating the model framework and/or some of its components can be promoted. Like the SEAMLESS Association, infrastructure for disseminations can be maintained. They can certify trainings on tools and/consultancy work and propose a help desk to answer questions related to the model and its use.

Conclusion and perspectives

The lack of standard procedures has opened up the process of IA to a wider range of stakeholders and policy-makers (Adelle & al, 2012). This research shows that the academic community is one of them. *Ex ante* impact assessments and policy appraisals have developed as science policy interfaces and as a venue for complex tools to support the *ex ante* assessment of prospective policies.

The analysis of the obstacles encountered to stir the policy relevance of IA models at the science policy interface showed that the integration of evidence from complex models does not only depend on institutional capacities and constraints (Turnpenny et al, 2008). It also depends on the ability of modellers to take advantage of the institutional context. This means either adapting model development to the requirements of a venue or finding a suitable venue for the further-development and use of an already existing tool. Thereby, these results complement previous findings, which consider institutional and policy variables such as legal upper constraints, political leadership, rules of procedure as well as policy maturity, heat of the debate and social beliefs (Jacob & Hertin, 2007; Jacob & al, 2008; Lindblom, 1959; Sabatier & Pelkey, 1987; Turpenny et al, 2008) as the main determinants of the use of scientific knowledge.

Just like Regulatory Impact Assessment cannot be implemented as a best practice into policy making processes (Radaelli, 2004), the more specific integration of evidence from complex tools follows the same rule. The characteristics of a model needs to fit the context of use to be considered policy relevant and thereby used. In particular, the critical steps to stir policy relevance underlie the pre-modelling phase, the collection of critical end user requirements as well as the post-modelling phase.

The first step is to lay the foundations to set common achievable objectives. This means scientific capacities and constraints have to be communicated in order to set boundaries to what is feasible and to shed light on necessary trade-offs. Moreover, requirements vary a lot from one venue to the other. Therefore, venues for knowledge have to be targeted in order to be able to thoroughly collect end user requirements. Each venue brings about its own specific requirements regarding the structure of appraisal tools. They are shaped by policy processes and bureaucratic and path dependencies. In particular, each venue has specific requirements in terms of salience and transparency. These requirements concern three main aspects: firstly the spatial coverage; secondly, major trade-offs between comprehensiveness, flexibility, reusability, robustness and simulation time. This optimal blend results from an adjustment to the priorities bounded to the venue; thirdly the proofs of credibility. Finally, policy relevance cannot only be controlled through adjustment of the structure of a model to the requirements of a venue. Thematic relevance is also influenced by the ability of modellers to seize the windows of opportunities opened by the policy process.

Institutional limitations to operationalization

Even though this research shows that researchers have tackled the operationalization of IA modelling through diverse entry points, some institutional constraints continue to limit policy relevance.

Research is characterized by its innovative character, which is one of the main criteria for scientific quality. However, the requirement of ceaseless innovation is (paradoxically) an obstacle to policy relevance. Some essential elements of policy relevance are not rewarded by the standard criteria of the academic system: writing model guidelines for instance or offering advice on the use of tools. What is more, the fast-changing policy context often requires tools to be adapted quickly. However, the research funding schemes do not usually provide funds for the maintenance of tools on the medium/long term, marginal adaptations nor policy support. This is perceived as a major hindrance to the take-up of the tools: end users fear the unsustainability of the scientific support. Finally, another restriction for policy relevance is the inflexibility inherent to the common funding schemes for academic research. Researchers funds are granted under the condition of the fulfilment of a contract. This contact has to describe precisely what the research project consists in and its milestones. This limits the ability of the modellers to adjust the architecture of models to the requirement of the venue all along the research process.

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Vitae

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