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Readers, users and regimes: integrated assessment models in context *

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Huge and complex models such as the Integrated Assessment Models defy a quick characterisation.[1] Their theoretical assumptions cannot be easily read from their structure, even if this structure is open for inspection. In a recent discussion, one particular model was found to present itself as a "validated" tool for policy [2]. This implied a judgement of this particular model as a "truth-machine", meaning that it purports to give the truth on the predicament of the world if the right numbers are plugged in, and thus is offering much more certainty than sciences and assessments can possibly offer. Many if not most modellers in the IAM community seem to be aware of this difficulty. Attempts to address the "truth machine" accusation have focussed primarily on improving the content of the models, the way they are built.[2] In this article, however, we will take a more contextual approach toward the analysis of IAMs, and investigate some conditions under which IAMs may possibly be put to use as truth machines.

1. The implicit reader of the models

One striking feature of IAMs is that they seem to be models in search of a user. With this characterisation we do not wish to do any injustice to IAMs, and surely do not wish to say something against the successes IAMs have achieved. But when we look at the targeted audiences of IAMs, one can see great diversity.

To elaborate on the subject of audiences, let us use some literary theory. In literary theory, a distinction is made between the so-called implicit reader, and the real reader. The implicit reader is an effect of the text and can be made visible by text analysis. The real reader can only be identified by empirical research, e.g., by citation analysis or by another form of sociological research. We have not conducted such research ourselves but we shall refer below to a preliminary survey conducted by others.

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[1] Paradigmatic examples include IMAGE 1, IMAGE 2, ICAM-2, TARGETS, DICE, and RAINS. See for a recent review [1].

[2] For instance, by aiming at a representation of uncertainties within models, and trying to make cultural perspectives explicit, e.g., [3].

What are the audiences of IAMs? One kind of audience we can exclude at the outset: those in charge of the management of, e.g., rivers, fishing grounds, etc. They find more benefit in a model that is focussed on their concrete situation. An IAM would only be dead weight.

In fact, the enormous scope of IAMs excludes all those who are not active on an integrative level and unwilling to expand their perspectives. The implicit audiences of IAMs therefore are, in the first place, people on the highest policy levels, both nationally and internationally. Indeed, the implicit message of IAMs is that a number of separate policy areas should be linked to one another because of their mutual interactions. IAMs invite to look beyond the boundaries of a given policy level – and thus they appeal to audiences that have the possibility of doing so: higher policy-making officials, the more influential non-governmental organisations, and international committees. To the extent that they point out lacunae in – social or natural – scientific knowledge IAMs will also be relevant to audiences from the domain of science policy. In all, IAMs seem to be particularly suited for agenda setting.

This means that IAMs seem to be models searching for users, and that we can further specify who these implicit users are. This image was verified by a small survey carried out by Clair Gough via Directorate-General XII of the European Commission [4]. In advance, a selection was made of a number of higher policy officials of various European Commission Directorates-General (from the "decision making community") whose position made them likely to be potentially interested in the use of IAMs. A little less than half of them indeed proved to be already cognisant of the IAM phenomenon. Most of them indicated that IAMs could improve the decision-making process. Some of them were concerned that IAMs were probably not sufficiently focussed, and that politicians could still ignore the results of IAMs. They indicated that for this reason politicians, too, should be involved in the development of IAMs.

This suggestion is in line with the practice of several IAM-modellers to indeed involve intended users in – the later stages of – the development of their model. This practice stems from the idea that, ideally, there is a close relationship between an IAM and its intended user, or set of users. Such intended and involved users will become the primary or even the only users of the model, using it in a known and specified situation, such as a setting of international policy

negotiations. In the social studies of science we call such a close relationship between a model and its users a "regime".

Such fixed relationships between model and user are common practice in part of the modelling world; particularly in that part of the model family that is closer to management. Among Dutch examples we can mention the models for the management of estuaries, which are developed at the National Institute for Coastal and Marine Management (RIKZ) for its own use, or the models that are made by the Netherlands Institute for Fisheries Research (RIVO) for a number of buyers who are more or less known. Of course, these are models of a much smaller scope than IAMs and with a topic that is usually more defined. And what is more, we are dealing here with a situation in which the side of users' demand for models is much better articulated, to the extent that a commercial market can develop, even with competitive prices.

We should point out here that IAMs need not function in strict regimes only. Several in fact don't. But if they end up in a regime, the primary user gets certain privileges with regard to the possible range of interpretations of the model.[3] In principle, a strict regime will set the conditions for any IAM to function as a truth machine, regardless of the content of the model or the intentions of its modellers. IAM-modellers have in fact recognised that "tensions" exist between assessment models and assessments (such as they are made with the help of models) [1, p. 313]. But our point is that regime-situations are different from the mere use (and possibly "wrong" use) of a model. No author is able to control his readers and, accordingly, no IAM-team can control its users. We will come back to this point below.

There is another type of user, or "reader" (the word "user" may be ill chosen here) that comes into sight if we look at the context in which certain IAMs are produced and published. This context is more like a free academic setting than like a strict regime. Both of the IMAGE models, for instance, as well as the TARGETS model, were partly developed in the non-earmarked (and therefore "free") part of the budget of the Dutch National Institute of Public Health and the Environment (RIVM), and thus without the restrictions that characterise short-term commissioned research. IMAGE 2 could also draw on research funding from the NOP (Dutch National Research Programme on Global Air Pollution and Climate Change), so that this made up nearly one-third of its total budget. IMAGE 2 is also involved in the International Geosphere–Biosphere Programme (IGBP), and through that science-oriented programme also has a line to the Dutch Science Foundation (NWO). A number of other, primarily American, IAMs are developed at universities. We may note that the University of Maastricht now houses part of the former TARGETS team. In addition, we would like to point out the existence of specialised academic magazines, e.g., *Integrated Assessment*. Such magazines are peer reviewed. All of this indicates the existence of an academic-oriented IAM community, with academic forms of quality control. Such "horizontal integration" of IAMs within a peer community seems to us an important safeguard of any model's critical potential against its possible use as a "truth machine".[4]

Yet, as we have seen above, there is an in-built logic for IAMs to enter into relationships with their users. The case of IMAGE is particularly interesting here also. The team leader of IMAGE 2 took the initiative for the "Delft workshops", consultations with various possible users in the international arena [6]. This initiative can be interpreted in a variety of ways, one of which is as a strategy to diversify its users, to avoid a situation in which IMAGE 2 would be locked up in a particular regime. If so, this could have interesting outcomes, since different users may come up with different "readings" of the same model, stimulating critical discussion.

In the Dutch national context, though, one particular user is a powerful enough player to make it hard to avoid regime-like situations. We would like to point to RIVM's role as Environmental Planning Bureau, a policy advisory institute to the Dutch government. In this capacity, the RIVM is the author of the four-yearly National Environmental Outlooks and the annual Environmental Balances. Especially in the first of the outlooks *Zorgen voor Morgen* in 1988, the first IMAGE model was an important tool in the drafting of this study. We tentatively identify here the relationship between IMAGE 1 and the RIVM's Planning Bureau as a regime-like situation, which existed for some years.

IMAGE 2 is a different case, however, since it is not designed for national Dutch use only, but addresses a variety of international and regional problems and, hence, audiences [7]. No privileged regime-like situation with the RIVM therefore appears to exist, despite the fact that the IMAGE 2 team is housed (literally and figuratively) within RIVM's Planning Bureau.

In an ideal world, to avoid the use of integrated assessment models as truth machines, their context of use would have to be such that exclusive user–model relationships or *regimes* are avoided. Any particular model would ideally have more than one user, and any particular user would ideally make use of more than one model for the same policy problem.

A possible objection against our plea for any model to ideally have more than one user could be that this encourages the lure of universality, causing IAMs to become "too-many-purpose models", against the conventional modellers wisdom which suggests to keep models focussed. We do not think, however, that aiming to open up a model to more than one exclusive user-relationship is necessarily the same as expanding a model to become over-comprehensive. Rather, it becomes possible to spell out background assumptions, which may all too easily remain implicit in stable model–user relationships.

The particular aim of IAMs to provide *integrated* assessment makes it necessary for their modellers to apply a con-

[3] R.S.J. Tol and P. Vellinga hinted at this possibility, see [5].

[4] In this context, we mention also the European Forum of Integrated Environmental Assessment, see [5].

ceptual framework by which the different aspects to be included into the model can indeed be integrated. Such an overarching conceptual framework that enables integration may not be explicit to the users of the model, but it is of prime importance to the layout of the model, to the kind of questions the model will be able to answer, and to the kind of uses and users it will find. To create optimal plurality both of IAMs and their users, one would ideally like IAMs to differ among each other also at this most fundamental level of their underlying unifying conceptual framework. As much as contemporary IAMs may differ among each other however,[5] we suggest that at this most fundamental conceptual level they share the same discourse: a discourse based on substance flows and systems analysis, as is central to the scientific disciplines of economics and (systems) ecology.

2. Shared background assumptions and new audiences

This *ecosystemic* discourse has come to dominate the north-Atlantic perception of environmental issues since the mid-1960s. It has added a number of important dimensions to our contemporary perception of environmental problems. One could even say that the perception of "environmental problems" as such, in the modern, *ecological* sense of the word, is inextricably tied to this ecosystemic approach. The three most important dimensions that resulted from this new ecological perspective, as compared to earlier perceptions of environmental problems, are the following.

First, an up-scaling to higher geographical levels of scale, eventually encompassing the Earth as a whole.[6] Second, and related to this geographical up-scaling, we see a conceptual up-scaling to the level of socio-economic macro-processes. This entails humankind to become perceived as a crucial element in the global cause and effect chain, and not only as a disturber of ecosystems at local scales. Pernicious trends of humankind appear at higher, aggregated levels of scale, e.g., as "industrialisation" or "population growth".

And third, we derive from this ecological perspective much of our present awareness of the intricate interrelationships that span the web of ecosystems, and thus of our environment. Probably most enlightening in this respect has been the introduction of the conceptual difference between the pollution of *flows* in a system, like "water" and "air", and the pollution of *sinks* in a system. The former is understood to be more amenable to management, while the latter phenomenon is much more persistent and difficult to counteract. All the major environmental problems of the 1980s and 1990s: acidification, depletion of the ozone layer, and the greenhouse effect, have been problems of this more difficult class of sinks.

As an analytical and integrative framework the ecosystemic or systems analytic approach has undeniable strength, but it also will introduce – like any analytical framework – a predisposition to "see" certain kinds of problems, and to ignore other kinds of problems or definitions of problems. Systems analysis-derived approaches predispose to predominantly perceive environmental problems as problems that can be expressed in quantifiable *flows* of substances between the different elements or "boxes" of a system. To integrate the various subsystems of any ecosystem to-be-modelled into a dynamic whole, the *output* of one element of that system should typically be able to function as *input* to the next element of that system. Thus, we find a tendency to express the flows between the various elements of the system in the most elementary quantifiable units: such as energy or the basic chemical elements. This will make the essence of environmental problems – as they are perceived and labelled – typically something like "acidification" or "depletion of stratospheric ozone levels" – so problems of chemical unbalance – sooner than, for instance, "loss of biodiversity". More in particular, the ecosystemic perspective causes a tendency to perceive environmental problems as problems that are related to the intensity of human energy consumption. With this, the decrease in intensity of human energy consumption is simultaneously identified as an ideal point of attack for managing whole systems, and with that, for managing global environmental issues all at once.

We could say that the current dominance of a systems analysis-derived framework as the integrative concept behind IAMs makes their implicit readers above all technocrats: those for whom energy and substance flows are amenable to control and management. A challenge for the integrated assessment community could therefore be to consider whether it is possible to conceive other integrative frameworks, which would appeal to different groups of readers/users. A disadvantage of systems analysis-derived integrative frameworks is for instance their tendency to leave the intrinsic value of nature and natural species outside of their calculations, thus making such intrinsic values only an additional bonus that cannot be expressed in the currency of the system. In a typical systemic framework, there is no difference between the carbon consumed by man or a grizzly bear. We may wonder therefore whether certain user groups would not prefer less fully integrated models. The ultimate challenge in this respect might be for an integrated assessment model to be able to also show that in some situations different fields of problems are less connected than one would perhaps think.

[5] As an example of non-trivial differences among IAMs we may think of macro-economic-oriented versus biosphere-climate process-oriented models [1].

[6] A typical example of such up-scaling is the classification of environmental problems into five geographical levels of scale (ranging from global, continental, fluvial and regional to local) as presented in the first National Environmental Outlook for the Netherlands (subtitled "Concern for Tomorrow"), which the RIVM produced in 1988.

References

[1] J. Rotmans and H. Dowlatabadi, Integrated assessment modeling, in: *Human Choice and Climate Change*, eds. S. Rayner and E.L. Malone, Vol. 3 (Battelle Press, 1998) pp. 291–378.

[2] S. Shackley, J. Risby and M. Kandlikar, Science and the contested problem of climate change: A tale of two models, Energy & Environment 9 (1998) 61–82.

[3] J. Rotmans and B. de Vries, *Perspectives on Global Change, The TARGETS Approach* (Cambridge University Press, Cambridge, 1997).

[4] C. Gough, Users' needs and views of integrated environmental assessment, Working paper, Institute for Systems, Information and Safety, Ispra, Italy.

[5] R.S.J. Tol and P. Vellinga, The European Forum on Integrated Environmental Assessment, Environmental Modelling and Assessment 3(3) (1998) 181–191.

[6] E. van Daalen, W. Thissen and M.M. Berk, The Delft Process: experiences with a dialogue between policy makers and modellers, in: *Scenarios of Global Change for the 21th Century – Results of the IMAGE 2.1 Model*, eds. J. Alcamo, R. Leemans and G.J.J. Kreileman (Elsevier Science, Amsterdam, 1998) pp. 267–285.

[7] L. Dresen and C. Kwa, Dutch climate research and its human dimensions: Integrated assessment as culture, in: *Managing the Planet*, eds. C. Miller and P. Edwards (MIT Press, forthcoming).