SCIENTIFIC SUPPORT PLAN FOR A SUSTAINABLE DEVELOPMENT POLICY

SPSD II

FEASIBILITY OF A PARTICIPATORY MODELLING PROCESS FOR PESTICIDES RISK ASSESSMENT – PEPAM

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SUPPORTING ACTIONS

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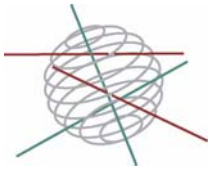
(SPSD II)



Part 3
Supporting actions – "Clusters"

FINAL REPORT

PEPAM

Feasibility of a participatory modelling process for pesticides risk assessment

OA/27

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1. INTRODUCTION

1.1. OBJECTIVES OF THE PEPAM PROJECT

In the area of pesticides risk assessment, a large number of models and Risk Indicator Sets are used for support of political decisions, for pesticides registration, for farm-level pesticides management, etc, and at various levels (see, e.g., Wyss, 2002). None of these models were or are currently developed in a participatory way.

In the field of pesticides risk, a number of uncertainties remain: how to take into account the cumulated risk of various active substances on the same organism? Are particular populations (e.g. children) more sensitive, and in which way? Moreover, when a synthetic view of many risks must be given (for a whole region/country or the entire EU, or for various species considered together) a number of choices must be done: which are the weights of a given species with respect to others? Does every body agree about giving weights? Those choices are culturally determined. It is particularly in such a context, and also when uncertainties are largely present, that choices made must be participatory, not only to ensure social acceptability of the risk but also to take various kinds of knowledge and points of view not considered in classical scientific risk assessments into account.

In this context, the objectives of this proposal are:

- to define the most appropriate participatory methodology to obtain a useful input from citizens into the modelling of pesticides risk assessment
- to test the methodology, and define its feasibility
- to initiate contacts with interested participants and potential organising institutions.

In our PEPAM project, the particular model that is the object of the test is PRIBEL. PRIBEL is a successor of POCER. POCER is a risk indicator system. The POCER-1 model has been developed by UG (Gent University, W. Steurbaut *et al.*). POCER-1 is presently used in Flanders in the framework of integrated crop management for the production of fruits and vegetables. POCER-2 has been developed as an improvement of POCER-1 (new compartments up to a total of 14, a scoring and aggregation procedure) by a team from UG (W.Steurbaut *et al.*), UCL (Université catholique de Louvain, Maraite *et al.*) and CERVA (Vincent Van Bol, Luc Pussemier, Philippe Debongnie). In order to answer the Belgian federal request for a Risk Indicator Set (RIS), a simplified version of POCER - 2 was proposed. It was named PRIBEL. This RIS assesses the risks of pesticide use in seven compartments; those for which data are available at the country level. The definition of the aggregation method in PRIBEL is the subject of an ongoing project financed by the Federal Government (this project is done by CERVA - Peter Harcz, Juan Piñeros, Vincent Van Bol, Luc Pussemier - and UG). While aggregation was mainly viewed as a sum of risk scores in POCER-1, it is evolving to statistics derived from statistical distributions of risk events in POCER-2 and PRIBEL.

The initial hypothesis is that making the choices explicit that are made during the building of a tool for decision making (in this case, the modelling practices leading to PRIBEL) - at destination of a citizen panel – is feasible. Hence, the aims of our present research is twofold : a) evaluate the capacities of citizens to appropriate political and technical matters where the construction of an innovation is in stage and to give advices or opinions that can be of some relevance for experts and decision makers; b) symmetrically, assess the capacities of the scientists (the modellers) to learn from this participatory process both in terms of content

(improvement of their model), but also in terms of their positions and responsibilities in the broader context of their practices.

The end results of the PEPAM project have to be evaluated in light of the increasing necessity for expertise to meet the democratic and precautionary principles that guide its support to regulators in any decision making process. This project has been rendered possible due to the clustering of experiences provided by previous projects on different aspects of pesticides regulation and risk management and funded by BELSPO[1].

1.2. LITERATURE REVIEW

The experiment that was carried out thanks to support from BELSPO and from the King Baudouin Foundation (KBF) – as evidenced by this report – is in line with the continuity of research into the conditions of public involvement in new technologies and more precisely those concerning environmental science and management. This field of research is a prolific one – especially in English-speaking circles – and is characterised by the necessary cross-fertilisation of skills, but also of interests derived from both natural sciences and human and social sciences. This field therefore nurtures reflection into the development of public environmental risk management policies and its impacts on the practice of deliberative democracy (Weber 1999).

It is commonly admitted that these new approaches go hand in hand with recent changes in our technical relationships with nature. Changes that would apparently mark a transition from an *industrial society* to a *risk society* (Beck 2001) characterised by increasing uncertainty expressed in scientific, economic and political arenas about the added values of new technologies. We would seem to have moved from a situation where risks were confined in time and in space and managed by an ad hoc insurance-related system associated with the industrial practices of industrial society to diffuse risks, difficult to control and calculate, spreading over respective size scales in such a way that they disrupt the functioning of the traditional frameworks of management and decision making, whether they are political or scientific. Such uncertainties inherent in the definition and management of these new risks place scientific actors and political actors in a relationship of dependency, but also of tensions. The environmental implications of technological development combined with a market logic have increasingly direct repercussions (even if, for some risks, they are less and less perceptible by our senses alone) on the population, so transforming the latter into a public more and more concerned with their quality of life and their well-being.

In addition to this increased sensitivity to the environmental dimension of the issues related to industrial developments, the knowledge obtained by local populations, acquired through their everyday or professional experiences, have become for some researchers, but also for some administrations and industries (Murdock, Wiessner and Sexton 2005), a source of expertise for understanding the environmental phenomena in question; a source considered complementary – or even more extensive (Eden 1996) – compared with that of scientific experts (Fiorino 1990; Wynne 1999).

Faced with the crucial question of the production of new knowledge and new management practices, the public (whether directly concerned or not) sees its status both as mere consumers and mere citizens (in the sense that citizens willingly delegate their actions to their political representatives) evolve towards a position of full-fledged actor in environmental controversies (Fischer 2000).

[1] CP/33: Développement d'outils de sensibilisation pour un usage durable des pesticides ; HL/DD/05: Instruments politiques du développement durable et rôle de la population ; OA/001: Wetenschap en voorzorg in een interactief beleid van technologische risico's

However, we were very quick to realise that "the public" in its role as an actor is very far from appearing in a homogeneous, monolithic and stable form. This so-called actor status should be imagined more as a *posture*, which can take highly varied forms; forms which cannot be dissociated from the means implemented to solicit and involve the public. For instance, many consultation *dispositifs*[2] were set up in the late seventies so as to keep pace with technological change (technology assessment). The variety and the wealth of them measure up to the issues that they raise (Steyaert and Lisoir 2005). Recapitulating the most comprehensive and most recent summary made by Rowe & Frewer (Rowe and Frewer 2005), it is possible to aggregate these different participatory approaches and the *dispositif*s that each involve in 3 key concepts: a) *Public Consultation*, b) *Public Communication* and c) *Public Participation*. These differentiations are mostly due to the nature of the information circulating between the organisers of such *dispositif*s and the participants, to the statuses and competencies for which the latter are acknowledged and to their positioning in relation to the stated issue and its definition. It emerges from the summary of the advantages and drawbacks of each of the main approaches to public engagement (Hisschemöller and Midden 1999) that their choice and implementation require clarification of the place that the initiators reserve, on the one hand, for the public concerned and, on the other hand, the former's more or less marked ability or willingness to allow themselves to be questioned (Stengers 1999), or even to question their own definition of the issue (especially when it involves the implementation of participatory *dispositif*s in Rowe & Frewer's meaning of the concept). It appears that one of the keys to success of a participatory process lies not only (and typically) in the capacity of the *dispositif* to reflect the public's perceptions, but also for describing, documenting and confronting that perception with the perception that the initiators may (often implicitly) hold about the public in question, whether the initiators are political, scientific or industrial. This reflexive approach requires the circularity of perceptions and representations and makes their interdependence intelligible and productive[3]. It is the focus of the recent concerns of researchers working in the area of the relationship between stakeholders and citizens (Marris, Wynne, Simmons, and Weldon 2001) and more precisely the relation between scientists and citizens (Cook, Pieri, and Robbins 2004). Finally, it is the concern motivating this research regarding the feasibility of a participatory modelling process for pesticides risk assessment (PEPAM).

Our *dispositif* is situated in the typology of participatory approaches (Rowe and Frewer 2005), and its starting point is two strong hypotheses. One is that citizens can contribute added value to the decision-making process. The other involves hoping that a participatory *dispositif* can aim at something more than just a panel of citizens learning the sometimes complex dimensions of the impact of a technology on the environment and expressing a considered opinion about the matter in hand. A participatory *dispositif* should, also and above all, incite the initiators (in this case, modellers who are members of a public research institution) to engage in reflexive dynamics that question both their modelling practices and their perceptions of the wider issue of which they form part.

The first hypothesis is based on the observation drawn from a wide variety of case studies, which shows that lay persons have real aptitudes and skills, but different from those of scientific experts, in posing problems and envisaging solutions (Fiorino 1990; Fischer 2000; Funtowics and Ravetz 1991; Wynne 1999). The aptitudes that were pinpointed show, among other things, that "ordinary" citizens place the problem in a wider setting than experts, because they are not hemmed in by disciplinary boundaries. They also show that a citizens' panel makes it possible to mobilise a broader spectrum of expertise upstream from decision making. They show, further,

[2] We've made the choice to keep the french word "*dispositif*" all along this report in order to characterize what presents itself as both an organizational setting and a technical device. We didn't find any adequate word in the English language in order to make a pertinent translation.

[3] This reflexive attitude placed at the centre of the construction of the participatory mechanism is based on the hypothesis (still to be tested) that the definition of the problem and of these actors in the way that it is postulated by the initiator of the mechanism is actually an integral part of the problem.

that citizens' participatory involvement provides an opportunity to put the limits of the models of experts to the test. As regards solutions, citizens are more inclined to identify alternatives than experts are; citizens are more suited to institutionalise regrets, to put up with uncertainty and to consider possibilities of errors in decisions; their opinions lead to greater sensitivity to values and to common sense. Concerning the latter skill, it may be noticed that it enables them to be attentive to a question that often proves to be crucial for decision making, namely the question of trust and the reliable nature of the behaviours adopted by the various stakeholders involved in the issue (Alsop 1999). This aptitude is precisely what makes it possible for them to link dimensions of the problem that are often considered to be separate.

It is nonetheless important to point out that, unlike an idealised view of the benefits of public participation in the social validation of new technologies or public environmental risk management policies, the involvement of the public in a *dispositif*, whatever it may be, (and especially a participatory one) is not an easy matter. The reasons for that are many and varied and should be sought not only on the "social" side with the disillusioned, critical or cynical perception that citizens may have concerning their role in the consultation or decision-making process (Garland 1999), but also in the concrete technical procedures employed to implement the actual *dispositif*s and, above all, in the difficulty involved in assessing them (Mormont and Mélard 2003; Rowe and Frewer 2000; Rowe, Horlick-Jones, Walls and Pidgeon 2005; Rowe, Marsh and Frewer 2004).

The second hypothesis that could be termed cross-learning between a public and, in this case, scientists, is based on the possibility of implementing methods of collaboration giving priority to the co-production of knowledge (Callon 1998; Epstein 1995) which acquires a hybrid status, but it is hoped that they will serve to reinforce and legitimize the process. Even though these methods of collaboration are diversely accepted within political or administrative institutions, industry or the scientific community (Murdock, Wiessner, and Sexton 2005; Pearson 2001; Weber 1999) – each having constructed ways to be distinguishable from the citizen, consumer or lay person respectively –, their experimentation is still promising both in cognitive terms and in terms of collective action. This second hypothesis is all the more interesting to be used as a basis for our experimentation since it concerns the question of the role of models in the science and management of environmental issues. The use of modelling as an environmental risk management practice is flourishing (studies of the dispersal of pollutants, noise, smells, floods, etc.). It, however, needs to be appropriated with considerable technical expertise (a good command of IT and mathematical tools). This way of appropriating is, unfortunately, at odds with civil society's – politicians' or citizens' - way. As a corollary, the model as a (scientific and political) management and decision-making tool has been the subject of very little research into its social and public accountability (Yearley 1999).

How can models, when they are used to assess and even manage local, national or international environmental problems, be actually appropriated by the public or a citizens' panel? This question is both a cognitive and political one considering the implicit and explicit choices that prevailed in the very construction of the said models. According to Yearley, the difficulty involved in the public assessment of expert models and more precisely the difficulty arising from the choices made are not alien to the very format of the knowledge being manipulated and to the IT architecture, where choices are based on hypotheses made by the modellers, be they political or industrial representatives, concerning the state of the social world (i.e. the behaviour of agents, their preferences, etc.). The format and architecture do indeed pose real problems of physical and intellectual accessibility when a participatory *dispositif* is being developed. What could be the advantage of public participation in the assessment of the relevance of the modelling tool and its results? The advantage is derived from the twofold nature of the model: on the one hand, the fact that it represents a necessary reduction of reality and of its complexity and, on the other hand, its persuasiveness that consists of convincing people that the results of modelling actually correspond to the reality of the studied phenomena; at least,

scaled down to the dimensions that were considered pertinent to be taken into account[4]. This interest in getting involved in public participation can also be shared by the modellers themselves, but, in actual fact, that is seldom the case. That is the crux of the matter and consequently the whole originality of this research. The works of Yearley concerning the study of a predictive model for atmospheric pollution in an urban environment (Yearley 1999) attempt to inquire the issue of the appropriation of a modelling tool by citizens when citizens have difficulty in perceiving the reality of pollution through their own senses. The purpose of the study in question concerns citizens' interpretation and understanding of the process of constructing knowledge about the issue of air pollution and the use and relevance of the alert *dispositif*. According to the author, three types of factors intervene in citizens' assessment of the relevance of the model and its findings: a) their evaluation of the trust they should put in the municipal authorities (system operator) and the public body's real intentions; b) the trust that they put in their own command of technical knowledge about the model and c) their evaluation of the social conditions/hypotheses underlying the construction and the operation of the model. The conclusion drawn from the study is interesting in relation to the approach that we adopt in our own study since it consists of affirming that: "*to build robust and legitimate models, public bodies will need to devise methods of consultation and participation not only when the model is running, but also in setting out the objectives and parameters of the model in its earliest stages*" (Yearley 1999).

Finally, this literature review could not be complete if it did not take into account the assessment, or even the evaluation, of the contribution that a social-scientific approach can make to the management of environmental risk issues. What may be the prerequisites for valid and pertinent knowledge produced from participatory decision-making *dispositif*s? The approach prioritised by the social study of scientific and technological research activity is commonly characterised by name of social constructivism. The current of STS (Science & Technology Studies) arising in the seventies made the social study of science and technology its priority object of study. It spent its time trying to understand as close to the ground as possible (firstly, through the use of methodologies such as ethnography or participant observation) how scientific and technical facts are really created, i.e. by not using epistemology or hagiographic forms of discourses as resources of explanation. However, almost all the research that was carried out from this point of view merely described as accurately and objectively as possible how things happen, refraining from taking position or giving opinions about the quality, and pertinence of the patiently deconstructed findings (this task being left at best to philosophers of science). The growing interest of STS in the issue of public participation in the construction and assessment of new scientific and technological products especially with reference to decision making (Foltz 1999) has led some researchers to put trust in their expertise and leave the comfortable position of neutral observer. In affinity with action-research or management approaches, some research projects attempt to show that it is possible and desirable to get involved in a process of social deconstruction of an expertise by taking into account both the social dimensions of the choices that governed that expertise, but also by taking into consideration the "natural" constraints involved (thereby making the result a hybrid result, but one that is closer to reality). It should also and above all result in opinions about the pertinence of experts' judgements in making a useful contribution to public risk management policy (Hisschemöller and Midden 1999). For instance, in their research where the object was close to our own, van Zwanenberg and Millstone maintain that the added value of the work of social deconstruction of the process of expertise underlying regulations on the use of pesticides (comparative study United Kingdom/United States) does not only lie in the objectivity of that "clarification", but also in its usefulness in assessing its pertinence in relation to the decision-making and, hence, regulatory process (van Zwanenberg and Millstone 2000). Questions such as "What is research of high

[4] Which brings the scientific model, as the result of scientific (but also political) activity (perhaps even more than for other scientific products), into conflict with the public clarification of the choices involved in its construction.

quality?" or even "What research makes it possible to offer useful data for decision makers?" come within their fields of reflection and action and require a process of reflexivity as previously described. Indeed, what the authors endeavour to demonstrate through their case studies is that the pertinence, or even the legitimacy of the process of expertise is not only in the hands of the experts themselves, but in a tuning of the reciprocal interests of the different actors or beneficiaries of such expertises conducted through an appropriate constructivist approach.

2. METHODOLOGY

2.1. PRACTICAL ORGANISATION

In order to organise the participatory exercise, we had to decide on the focus, the objectives, the geographical level and location of the participatory exercise, its potential participants, and its structure.

2.1.1. FOCUS: THE BEE-INDICATOR

During internal meetings of the research consortium a lot of time is spent to the definition of the substantial focus of the participatory exercise. That this definition aspect was so time consuming is partly due to the ambiguous political context of which the research project itself is a part.

In the beginning the research project was understood as a project that was born out of an interest of members of CERVA to know whether the PRIBEL indicator set could be reconstructed in a participatory way so that the indicator set became technically better and socially more robust.

At a certain moment in time the research team received signs of interest from the cabinet of the minister who is responsible for the Belgian Pesticide Reduction Plan. In the context of this reduction plan, the cabinet installed 14 technical working groups structured around several cultivations (cereals, maize, beet, fruit, ...) and one working group that functions as a stakeholder platform (not all stakeholders are represented in the technical working groups). The idea of the cabinet was to integrate the research project into a 16th working group with the aim of discussing transversal topics. The test that is the object of the PEPAM project was considered at the same time a test case for stakeholder consultation.

Moreover, the cabinet suggested focusing the test on the problem of the bees, because this problem is not really dealt with in the 14 technical working groups. The problem of the bees is prominent in the Walloon region and conflicts regarding this problem are heavy and very emotional. The problem is perceived as such in France, Spain, Italy and so on (countries where agricultural crops are cultivated on very large surfaces), but not in the northern European countries (where surfaces are much smaller). According to some persons, the problem is linked to culture. Others consider the problem to be a conflict between bee-keepers, who are no professionals, and scientists. Bee-keepers blame particular pesticides for having a negative effect on the behaviour of the bees at very low concentration. Amongst scientists a lot of controversy exists whether this really is the case. Bee mortality can, according to them, be induced by a lot of risk factors of which pesticide use is but one. Other factors can, for instance, be the bee-keepers themselves who experiment with introducing new queens that are not safe and that induce new diseases.

The research team considers the cabinet's interest in the research project both as a challenge and a risk. On the one hand, the cabinet's interest throws light on the political relevance of the indicator set and of the participatory exercise. On the other hand, the controversial nature of the bee-topic adds an extra dimension to the test: can we organise the participatory exercise in such a way that we do not get stuck into the controversy?

We finally decided to accept the challenge and to refocus the participatory exercise as follows. Since the PRIBEL indicator set consists of 7 risk indicators of which the risk indicator for

bees is one, we decide to restrict the test of the indicator set to a test of this latter risk indicator. In addition to PRIBEL government will use what is called an 'aggregation method', i.e., a method for presenting a synthetic view of the results of the indicator calculations by using statistics. This aggregation method, that CERVA was developing while the research project was running, was also brought under discussion during the participatory exercise.

In a later phase of the research project, it was not so clear any more to the research group whether the cabinet's interest in the research project's role in the development and implementation of a pesticide reduction plan remained. This evolution did, however, not change our substantial focus, also because some research members had already done a lot of preparatory work and time constraints did not allow for reorienting this work.

To conclude, not only the PRIBEL indicator set, but also the research project itself exists within a particular policy context. Understanding this context is relevant in order to define the substantial focus of the participatory exercise. Focussing is, however, not easy, in case the policy context changes too rapidly and the status and mandate of the research project remain, hence, not sufficiently clear.

2.1.2. OBJECTIVES

The participatory exercise aims, according to the research team, at the same time at testing a) the PRIBEL indicator set and b) the participatory exercise. Testing can mean, however, many things (see Annex 1). Hereafter, we reformulate and regroup these objectives.

a. Objectives regarding the PRIBEL indicator set

a.i. Can the indicator set be made accessible as a social construction to persons at a local level?

a.ii. Is the indicator set able to monitor the risks of pesticides use within all types of agricultural practices?

a.iii. Is the indicator set socially robust, i.e. do citizens accept its technical functioning, its objective – namely monitoring the risks of pesticides use in function of a pesticide reduction plan - and its use in the present policy context?

b. Objectives regarding the participatory exercise

b.i. Does the workshop provide insights that help scientists to make the bee-indicator more socially robust?

b.ii. Does the workshop provide insights that help scientists to decide on a socially robust way of aggregating various indicators?

b.iii. Does the workshop provide insights that help public authorities and stakeholders to make a scientifically founded and socially robust use of the indicator set?

b.iv. Does the workshop provide insights that help public authorities and stakeholders to find other scientifically founded and socially robust ways to reduce the risks of pesticide use?

2.1.3. LEVEL AND LOCATION

We chose to organise the participatory exercise on a local level since we started from the supposition that risks depend on the characteristics of a specific region and on the particular way farmers use pesticides. We chose to organise this local exercise in the Dijle region (around Ottignies), because the research team had already a lot of information regarding the data and

contacts that are relevant for our participatory exercise. We finally found a location at Court St Etienne.

2.1.4. PARTICIPANTS

The choice of the participants is dependent on the objectives of the project. Due to the political context and the experimental character of our participatory exercise, we first distinguished between four groups of candidates besides the organisers themselves:

- Users of pesticides, for instance,
  - Farmers (organic and conventional)
  - Agricultural labourers
  - Agricultural contractors
  - Other professional users (both independent people and people in employment of local authorities – municipality - or enterprises – railway company)
  - Amateur gardeners
- Producers and retailers of pesticides
- Representatives of public authorities, for instance,
  - Federal level (administrative authorities in charge of the reduction plan)
  - Regional level (regional environmental authorities)
  - Local level (eco-counsellor, mayor, ...)
- Indirect stakeholders, for instance,
  - Medical doctors
  - Representatives of environmental organisations, bird-lovers, bee-keepers, fishers, ...
  - Representatives of water producers
  - Representatives of agricultural organisations
  - River contracts representatives
- Inhabitants

Once the focus, objectives and structure of the participatory exercise became clearer we distinguished between

- Organisers of the exercise (social and natural scientists)
- Persons involved in the use of the indicator set (representatives of federal authorities -the cabinet of the Minister of Public Health, representatives of responsible administrations)
- Stakeholders (representatives of industry, representatives of environmental organisations, of farmer organisations, of bee-keeper organisations)
- Citizens, both citizens with a direct (farmers, bee-keepers) and with an indirect (consumers, gardeners) interest in the topic.

Finally (and due to thorough campaigning efforts on the local market and a lot of phone calls, among other things), the workshop consisted of 20 participants, next to 5 members of the research team and 1 facilitator. These 20 persons are 4 consumers, 1 conventional farmer, 1 organic farmer, 1 IPMF (Integrated Pest Management Farmer), 3 bee-keepers, 2 amateur gardeners, 2 representatives of CERVA – i.e. the institution that developed the indicator set -, 1 representative of the cabinet of the Minister of Public Health, 1 representative of a farmer organisation, 1 representative of a bee-keeper organisation, 1 scientist with expertise regarding bees, 1 representative of the pesticides industry, 1 representative of an environmental NGO.

2.1.5. STRUCTURE OF THE PARTICIPATORY EXERCISE

Details of the final structure and the objectives of each item of the participatory exercise are presented in Annex 2. The original idea was that, to start with, the scientists involved in developing and the persons involved in using the PRIBEL indicator set would present this indicator set to the participants so that they can start with forming their own opinion. Secondly (in time), we invite stakeholders to comment and criticize the indicator set, so that citizens can reconsider their first opinion. The third part of the test is mainly devoted to deliberation between the citizens themselves so that they can test and adjust their opinion via a confrontation with the opinions of other citizens. The goal of this third item is not to reach consensus, but to make the various opinions and underlying arguments more explicit. This three functional parts were organized as following during the workshop:

1. Welcome, General Presentation, 9:30 – 10:00
2. The policy goals and the functioning of the simplified indicator set, 10:00 – 13:00
3. Stakeholders' perspectives, 14:00 – 16:50
4. Citizens' perspectives, 9:30 – 11.30
5. Evaluation of the test, 11.30 – 12.30

2.1.6. COMMUNICATION TOOLS

Various persons developed different presentations to communicate about the indicator set. Communication started well before the workshop itself.

To start with, one scientist involved in the development of the PRIBEL indicator set presented the POCER and PRIBEL indicator set to the PEPAM research consortium (see www.ua.ac.be/PEPAM). As argued above, this first presentation aimed at explaining the indicator set to and understanding the indicator set by the members of the research team.

In the course of the research project, another scientist developed two more presentations. The first of these two was created in response to questions for more background information from the invited stakeholders. These invited persons had a need for clear instructions regarding what the research consortium expected them to do during the participatory exercise. A precondition for providing them with these instructions was to inform them on the explanation the research team would offer to the citizens regarding the indicator set. In order to realise this precondition, this scientist developed a presentation (see www.ua.ac.be/PEPAM). Consequently, he invited the stakeholders to a separate meeting – before the participatory test - where he used this PowerPoint presentation to inform the stakeholders regarding their task in the participatory exercise and, between the lines, to receive some of their comments on the PRIBEL indicator set.

After this meeting, however, the designer of this latter presentation concluded that his presentation was still too difficult to be appropriate to use as a communication tool during the participatory exercise. He developed, hence, a third presentation (see Www.ua.ac.be/PEPAM) and tested it with a small group of relatives (no scientists).

This third presentation was modified once more in response to reactions of the designer's relatives and of one of his colleagues who is familiar with graphical presentations of information. This final presentation was, then, used during the second part ('The policy goals and the functioning of the simplified indicator set', see Annex 2) of the participatory exercise.

For this second part of the workshop, three more presentations were developed (see www.ua.ac.be/PEPAM)

- One by a representative of the administrative authorities in charge of the PRP in order to present the legal context of the PRIBEL indicator set
- One by a representative of the cabinet of the Minister of Public Health in order to present the policy context and the political perspective
- One by a representative of CERVA to present the functioning of the bee-indicator and a short history of its coming into existence.

Some of the stakeholders that were invited to participate at the test during the third part ('Stakeholders' perspectives') also prepared a presentation: the representative of industry, of an environmental organisation, of a bee-keepers organisation, and a scientist (see www.ua.ac.be/PEPAM).

An evaluation of these various presentations and of the location, the selection of participants and of the structure will be offered in section 4 (Discussion).

2.2. BUDGET

The present test counted approximately for 12 man-months in the initial budget, from which one third went to the institution involved in the design of the PRIBEL indicator set, and 2/3 to the other two research institutions. This time was too short, and we spent an additional 3 man months. 2 days of work were also necessary for the facilitator. This was not enough time to prepare her to the task, and to be sure that she and the research team agreed on the objectives and methodology. As proposed by her, 1 day of preparation is necessary for each day of dialogue.

For the practical organisation of the participatory event the budget was, roughly:

	Euros
Hotel	380
Coffee, drinks + 1 meal for 25 persons	570
Meeting room	150
Citizens compensation	480
Audio recording and transcription	750

Hotel accommodation for the research team was essential because the event took a weekend and the research team made a preliminary analysis and prepared Sunday's discussions on Saturday night. The meeting room could have been more comfortable for citizens, but we did not have the necessary budget. Audio recording and transcription proved to be essential. It gave us the opportunity to re-think many times what citizens said. Food and drinks added the necessary conviviality to the event. The citizens' compensation was calculated to be 40 euros taxes included. This means that the citizens can end with around 20 euros, which is not enough. It would be better if citizens receive 40 euros net.

Globally we believe our budget was very limited.

3. RESULTS

There are different ways of analysing such a participatory exercise. In a toolkit perspective, we suggest that this participatory experience should be analysed as a *dispositif* (Foucault, 1994). According to Foucault, a *dispositif* has to be apprehended as the result not of an *intentional* action but of a *strategic* action, namely an action that, in order to face a problematic situation, will combine heterogeneous elements: actors, institutions, natural objects, knowledges, values, norms and techniques. In this way, it is essential to analyse the effectiveness of the participative *dispositif* - the effects that it produces - rather than its efficiency - the correspondence between the produced results and the expected results -. In other words this approach invites us to pay attention to what the '*dispositif* fait faire' or not to the different actors involved (what it urges to do or not). It is why, in this section, we will firstly propose a reflexive analysis of our own work in order to show to what extent the *dispositif* brought our research team to develop some skills, formulate other questions, explain and understand new elements. Secondly, we will show what the *dispositif* brought the citizens to do (which kind of discussions, on which elements, which approach and positions they adopted). Thirdly we will analyse the results from the point of view of the scientist involved in the development of the PRIBEL indicator set in order to see what the *dispositif* obliged him to do (for preparing the workshop, explaining the indicator set, ...).

3.1. THE PROCESS OF DEVELOPING A PARTICIPATORY EXERCISE

We argue that developing a toolkit for a participatory exercise aiming at a test of an indicator set implies to make an evaluation of what the research consortium did and how we did it in order to point out things important to do (or not to do) in a future case and to which to be attentive in our own practices.

In order to perform this project, the research consortium had to fulfil three main tasks:

1. Explaining the indicator set that is the object of the participatory exercise to the various members of the research group itself/understanding the indicator set
2. Developing a test, i.e. looking for a suitable participatory exercise in order to open this indicator set to the participants and to allow them to discuss it
3. Formulating suggestions to perform a real scale participatory exercise

In the following sections we will describe and evaluate the ways in which the first task mentioned before has been dealt with during the research process.

3.1.1. EXPLAINING AND UNDERSTANDING THE INDICATOR SET WITHIN THE RESEARCH CONSORTIUM

The PEPAM research project is an interdisciplinary research project. The members of the research consortium have scientific expertise regarding Technology Assessment, the construction of scientific knowledge, the organisation, role and possible impacts of participatory exercises, the meaning and implications of a precautionary approach, the POCER and PRIBEL indicator set.

Since the researchers have different disciplinary backgrounds, a first step to be taken during the research process is to create a common understanding of the indicator set that is intended to be the object of the participatory exercise. Therefore, the first meeting of the PEPAM consortium was mainly devoted to a presentation of and discussion about the POCER and PRIBEL indicator

sets. Two persons involved in the construction of the POCER and PRIBEL indicator set – of whom one person is member of the research consortium - introduced these indicator sets (see the PowerPoint presentations in Www.ua.ac.be/PEPAM). It is important to underline that part of the researchers from the consortium had at the beginning few knowledge regarding the PRIBEL indicator set. So at that time, they are like the 'citizens' who will attend the participatory exercise. This is why it is helpful to analyse the difficulties that these researchers had to understand (and the indicator set expert to explain) the indicator set.

A. Explaining the technical construction of the indicator set

Topics that are dealt with during the introductory meeting of the research consortium are a) the objective of the indicator set and b) the reduction problem c) the aggregation problem.

To start with, the indicator sets - POCER and PRIBEL - are described as 'pesticide control tools', 'risk indicators systems', 'risk assessment systems'.

Second, the main problem that the POCER and PRIBEL experts had to solve while constructing these indicator sets is how to reduce an enormous amount of empirical and scientific data in order to be left with a workable indicator set. To start with, the ideally required database for risk assessment is enormous and many of these data are missing or not available. Hence, the experts have to reduce the data needed and to select, for instance, the compartments considered (which flora, fauna, ecosystems?) and the damages (e.g. lethality, carcinogenicity) taken into consideration. Secondly, the experts have to define Pesticide Risk Indicators (PRI). Among other possible formulas, the experts chose for the formula PRI = Exposure/Toxicity. These PRI's do not assess risk itself, they only provide an indication of the risk. They are, hence, proxies for risks that are based on simplifications and extrapolations. Moreover, after calculation, the risk indicators are transformed into a risk score. There is various risk scoring functions in POCER. One purpose is to be able to express risk in a common scale when working with various compartments. In this participatory exercise, only one compartment was chosen (bees), so no scoring was needed. This topic was not discussed with citizens, although it was briefly presented.

A third choice to make regards the way to aggregate risk indicators, since POCER is typically used to estimate risks on a large set of situations (e.g. locations) at the same time. Aggregation can be seen as a method to give a synthetic view of an ensemble of risks following a management question. Aggregation can happen spatially, temporally, with regard to a specific compartment or for several compartments, with regard to a specific active substance or for several active substances.

B. Understanding the indicator set

An important result of our own learning process while developing a participatory exercise is that we experienced and became conscious that 'understanding' an indicator set can mean different things. We can understand an indicator set at different levels, depending on the objectives towards which the effort of understanding is oriented. We experience that understanding the indicator set on a technical level, i.e. understanding the functioning of the formulas used, is not sufficient or satisfactory. In order to gain a more complete insight into the indicator set, we also need sufficient insight a) into the (policy) context in and for which the indicator set is developed and – linked with this aspect – b) into the reasons for and the meaning and impacts of the reductions and choices made within the indicator set. It is interesting to note that, during the participatory exercise, citizens expressed the same observation.

The technical functioning of the indicator set

Though the formulas in the POCER and PRIBEL indicator sets are not that complex, this does not imply that the indicator sets are easy to understand. We experience, to start with, that the research project was too short to reach a sufficient understanding – by the social researchers themselves - of the technical functioning of the PRIBEL indicator set. In order to gain a fuller understanding we need several concrete illustrations of how the indicator set functions. How does, for instance, a risk indicator change when using different pesticides? Which different results are obtained when applying the different risk indicators for the different compartments to the same pesticide? What are the results of various types of aggregation of risk indicators, for instance, for one compartment for various active substances within a particular region? Or for one compartment for one active substance and on a national level? Or for several compartments for one active substance? Which databases are used to feed the indicator sets? How are these databases constructed? And so on. In order to understand the technical functioning of the indicator set, working with it in an interactive way seems recommended. These three points (time, concrete illustrations of how the indicator set functions and necessity of interactions with the indicator set) will have to be taken into account for a future exercise.

The policy context and the stakes of the citizens participation

The research project provided an indication of the elements within the policy context that merit further analysis. These elements are:

- The PRIBEL indicator set and its role in a more comprehensive national pesticides reduction plan.
- The national pesticides reduction plan as a Belgian interpretation of the European 'Thematic strategy on the sustainable use of pesticides'[5] and this 'Thematic strategy' as part of wider, international policy endeavours to reduce the risks of pesticide use.
- The national pesticides reduction plan as one possible interpretation of the European 'Thematic strategy' amongst others: monitoring risks (Belgium, …) versus reducing the use of pesticides (Denmark, …).
- The national pesticides reduction plan as a reflection of power relationships between various stakeholders.

A more extensive, preparatory analysis of the policy context will help the research team to define better the substantial input that is needed for the participatory exercise and to give more precise instructions to the various persons (experts of the indicator set, members of administrations, responsible politicians, …) regarding the topics they should reflect on, present and discuss with the citizens during the participatory exercise. Moreover, a more extensive, preparatory analysis of the policy context will help the research team to define (and to explain to the citizens) more precisely what are the stakes of the participation of the citizens (which kind of impacts their participation can have on which elements). In other words, it will help to clarify the mandate of our research project.

Making implicit choices explicit

Due to the process of developing a participatory exercise some of the choices that are implicit in the PRIBEL indicator set became explicit.

From the beginning of the research project, we were convinced that, in order to discuss the PRIBEL indicator set with citizens, we first had to make explicit for ourselves the choices that are

[5] (COM(2002)349 final; see http://europa.eu.int/scadplus/printversion/en/lvb/l21288.htm, consulted November 4, 2005)

made within the indicator set as much as possible. Therefore the indicator set expert within the research group started with making an inventory of choices he was himself aware of (see Annex3). According to this expert, participation in the research project helped him to question new elements of the indicator set, allowing him to find new choices.

Initially, we also planned a meeting with various stakeholders in order to repeat the exercise with them and to discuss with them the choices they consider to be implicit in the indicator set. It is worth noting that this type of meeting questions various elements, like for instance the classical forms of consultation of these stakeholders, their interests to participate by presenting their point of view to the expert and to the citizens, by listening to what is discussed, and more generally their own learning process.

This plan was not performed in a systematic way for reasons of time limits. However, stakeholders we invited to present their perspective during the participative meeting asked themselves for a preparatory meeting with the research team in order to get more clarity regarding their role and the researchers' expectations towards them. The discussions that took place during this meeting confirmed the relevance of our original plan: it is worth the effort to discuss the indicator set with various stakeholders in order to receive a fuller picture of the choices that are implicit in the indicator set (and of the reasons for these choices). Therefore, we conclude that in a future, more extended research project, a separate meeting with stakeholders that focuses in a systematic and well-structured way on their perspectives on (reasons for) choices is a useful step to prepare a participatory exercise with citizens. The *Guidance* developed by RIVM provides useful guidelines to organise such a systematic quest for choices and uncertainties (van der Sluijs 2003). We even suggest to split such meeting up into two separate meetings: one for stakeholders - i.e. experts from environmental organisations, consumer organisations, industry, competent authorities, farmer organisations, and so on - that represent a national level and one for stakeholders that represent the local level where the participatory exercise will take place. The latter allows the research team to organise the participatory exercise itself with 'real citizens', i.e. persons who are interested in the topic but who have no direct concern.

The feeling of a complete understanding of the indicator set is linked to the objectives of the participation

As it becomes clear in the course of the research project difficulties to understand the indicator set arise partly because of the big gap between (the simplicity of) the indicator set and (the complexity of) reality. This observation makes us conclude that it does not suffice to know the inherent choices and uncertainties, but that we also need to know the reasons for these choices and uncertainties and their possible impacts. Why does the lack of insight social researchers experience regarding reasons and impacts of inherent choices gives them the impression that their understanding of the indicator set is incomplete? We suppose that the reason has something to do with the fact that the type of understanding we are looking for is related to a particular objective. The aim of our endeavour to understand the indicator set is being able to evaluate it and, consequently, to formulate possible ameliorations of the indicator set. In order to be able to evaluate, we first need the mentioned insight into the impacts of the present, inherent choices. This type of understanding is not purely cognitive or rational, it is also pragmatic. To evaluate the appropriateness of a simplification, many criteria can be used. An expert can, for instance, compare, based on a number of standards, the simplifications used in a particular indicator set with simplifications used in other indicator sets (see, for instance, De Smet, 1995). For stakeholders and citizens appropriateness depends on the acceptability of its results.

The impacts we are looking for in this research project are impacts of using this particular indicator set in a particular way in a particular policy context and on a particular geographical

level. This acceptability depends, hence, on the context in which and the objectives for which the indicator set will be used. In the period that the research project was running, this context and these objectives remained vague. This was partly because responsible policy makers still had to take several decisions in this respect (and discussions between stakeholders and policy makers were still going on). It was also partly because researchers' consciousness of the crucial importance, not only of the (policy) context in which PRIBEL came into existence but also of the (socio-geographical) context in which it will be used, was one of the results of the research project (and not a theoretical starting point).

Public scrutiny and the economy of an indicator set

Even though the use of (economic, agronomical, ecological, statistical,…) models into policy-making decisions is common, their trajectory is not so well-known. Where do those models come from? How are they born? How are they adapted to their new political objectives?

Models are not supposed to be confronted with citizens, nor are they supposed to interact directly with them. The unusual confrontation of a model with democratic procedures (as is the case in the present experimental participative device – *dispositif* -) reveals unusual dimensions of expert practices with regard to the social appropriation of technical innovations. Both the team that organised this experiment (which is made up of social scientists and modelers) and the citizen panel needed a kind of information about models (as indicator sets) that they felt necessary to engage themselves for a kind of social evaluation; a kind of information modellers were not usually prepared to give, not because they are specially reluctant to share it with outsiders but because they do not care about it in their normal practices.

For anyone who is a perfect stranger to modelling practices, the PRIBEL model seems to be a kind of "*naked model*". A model – as an indicator set – is lacking something that is essential to understand both its role and its adequacy in playing its part in policy-making decisions: its *history*. It appears to the team that understanding the trajectory of the indicator set from its laboratory to the politico-administrative scene is essential to fully assess to what extent the model allows to evaluate the risks linked to pesticide uses. Indeed, PRIBEL is a *naked model* in the sense that it lacks the descriptions of the modalities of its uses in the politico-administrative arena. The intelligibility of the technical functionalities of PRIBEL is inseparable of the intelligibility of the technical and social reasons that explain its link to a pesticides reduction plan. It appears to the team that ignoring the very origin of the construction of POCER and PRIBEL is a shortcoming for the evaluation of the social capabilities of the indicator set to assess risks associated with pesticides uses. It appears that the indicator set has to be adapted to fulfil the requirements to use it as a policy-making tool (in the PRIBEL case by setting up and implementing mathematical aggregation techniques, and by selecting indicators compatible with the national scale data).

As the economy of modelling is at first an economy of intersubjective relations between individuals (modelling specialists: owners and users), where models pass essentially from hand-to-hand, the social and technical history is rarely shared with future users. In our case, no operating instructions exist that accompany what presents itself as a bunch of (excel or visualbasic) files. This opacity makes it difficult to trace the different transformations that the model has undergone before its arrival to the present situation. This is common for scientists who are principally confronted with the mathematical dimension of the model (as an indicator set): the mathematical architecture and language replace the absence of an explicit genealogy of the model. An effort is required from the scientist to 'read' and identify the precise role and capabilities of the model he/she received. Once this model becomes the focus of attention of a panel of citizens who question its reliability and adequacy given its relation to both a political reduction plan and specific agricultural practices, it has to be, in some sense, equipped with a kind of social traceability. This is what is at stake when we speak of the "social construction" of

the model, that is to say, to render visible all the causes and consequences that have conducted the model to be what it is technically and politically. This 'new equipment' is precisely what is researched by our team and more precisely by the experts of the PRIBEL model. The need expressed by experts to expand the range of questions that may be addressed to the model regarding its construction by enrolment of citizens, aims at strengthening its social and technical robustness (see the chapter about the learning process of a modelling specialist).

C. Conclusion: the indicator set as a social construction implies its deconstruction

The research team itself did learn from its own efforts to explain and understand the PRIBEL indicator set. The analysis we presented in the previous paragraphs tells us that, in order to understand an indicator set, it does not suffice to know how the indicator set functions in a technical way (what are the formulas and the databases used, what are the results). In order to 'understand' the indicator set on a deeper level, it helps to interpret the indicator set as a social construction. This means that we understand the indicator set as a result of many decisions, which cannot be justified purely on theoretical arguments but that stem from a variety of social elements. This interpretation allows us to start with the deconstruction of the indicator set. **Deconstructing the indicator set implies a) investigating the policy context in and for which the indicator set is made, b) making the choices that are inherent in the indicator set explicit, and c) linking these choices to the policy context.**

The type of understanding the indicator set we are looking for during the participatory exercise is of a pragmatic kind: understanding the indicator set is a precondition for 'testing' the indicator set, i.e. for evaluating it and for formulating suggestions for possible ameliorations. **Consequently, a deconstruction of the indicator set in the previously mentioned sense is not yet enough. We also need an insight into the impacts of the choices made within the indicator set.** This insight is a matter of pragmatism (linking the functioning of the indicator set to its use in a particular socio-political and geographical space), not simply of rationality.

3.1.2. ANALYSIS OF THE RESEARCH PROCESS

In order to discuss preliminary research results the research consortium constructed a website (www.ua.ac.be/PEPAM) and organised several (daylong) meetings.

A. Research meetings

The meetings were intended to state the research progress, to discuss decisions to be taken and to assign tasks to the various research members.

The meetings were rather time consuming (we had at least twice as much meetings as planned in the research proposal). They were, however, very important to exchange the various research perspectives and experiences and to create a common ground within the research group.

The research coordinator prepared and reported on these meetings. The agenda was put on the research website beforehand so that the other members of the research team had the opportunity to comment on it and to suggest amendments at the beginning of the meeting. Also the minutes were put on the research website with an invitation to the whole research team to propose corrections and additions if needed.

The research coordinator also chaired these meetings. In retrospect, the combination of chairing and reporting was not optimal. It would be better to share these tasks and, probably, to rotate them.

B. The research website

During the research process itself the website is mainly conceived as an internal communication instrument. Only the members of the research consortium have access to the 'Work in development' part in order to consult and comment on meeting agendas, minutes, working papers, presentations, references.

This research website proved to be a very convenient communication tool, because all the relevant research information brought in by the various research members is put together on one place that is at any moment accessible. In order to use this communication tool in an optimal way, however, the research team should – better than we did in this short research project - discuss its opportunities and express expectations regarding the use of this tool, for instance, to prepare meetings, to check appointments, to provide (back ground) information, to present discussion papers, and so on.

3.2. ANALYSIS OF CITIZEN DISCUSSIONS AND POSITIONS (A SOCIOLOGICAL POINT OF VIEW)

3.2.1. REFLECTION ON ASSESSMENT CRITERIA

The objectives determine the type of analysis and assessment that we propose for this participatory experiment, analysis and assessment on the basis of which a proposal for an experiment on a larger scale will then be suggested. The citizen conference had a dual objective.

On the one hand, the aim was to test the societal acceptability of a scientific pesticides risk assessment model and the different socio-technical choices (data, calculations, etc.) which governed its construction. The initial aim was therefore neither to focus the discussions on the final objective of the model nor on the context in which it is integrated. Indeed, the social and technical choices incorporated into such a model are aspects that are interesting to question insofar as, generally speaking, they are seldom questioned in participatory procedures. One of the reasons put forward is notably that models are too technical or much too complex to be understood –and therefore discussed- by anyone other than specialists.

On the other hand, and for reasons not unrelated, it involves assessing this experiment in order to issue, subsequently, a proposal for a real-scale participatory procedure, which should be organised in such a way that citizens are able to appropriate and discuss the socio-technical topics.

A. Reframing

Considering the first objective of presenting the model for discussion, the way in which the citizens of the panel discussed the model and, hence, their own specific way of defining the problem will be shown hereafter. In fact, what is very interesting is that they did not merely reflect on the strengths and weaknesses of the model in the strict sense, or on the acceptability of the simplifications set out by the modeller. The subject of their discussions also goes beyond. The main way in which they "reframed" the matter was the fact that they did not want to dissociate the discussion about the model and its technical production from the discussion about its use and the current and future social, political, economic and environmental stakes. Consequently, it may already be emphasised that, in their opinion, it is meaningless to discuss technical data without discussing the stakes involved. That reflects the pragmatic outlook, which the method of reflexive analysis, applied to the research process, also highlighted. That urges us from the very outset to ask several questions concerning the type of assessment to be carried out.

What type of assessment of citizens' way of reframing and of commenting on technical aspects?

1. *How to define what, in citizens' discussions, are useful/useless results for the modeller?*

Our hypothesis is that the relevance of the discussions should not be assessed only against the yardstick of what the modeller can or cannot change in his model. Indeed, the opinions expressed outside this contextual framework are also interesting insofar as they allow for assessing other factors, such as the social acceptability of the model, the different apprehensions and ways of risk management, but also what the *dispositif* gets the different actors involved to do: citizens (behaviours at stake, interactions and changing perceptions), scientists, stakeholders (type of presentation, positioning, translation of the issues). Since the modeller of the research team is also an anthropologist, he provided his own categories. It is interesting to underline that he also differentiated those that concern the elements directly relating to the model, from those that concern other elements (reframing)[6]. Furthermore, taking this reframing into account seems important insofar as it prevents that this participatory *dispositif* is reduced to an instrument, i.e. a way of focusing citizens on a problem that has been chosen for them without leaving them the possibility of defining the problem in their own way and of, thus, providing researchers with unexpected results (Ferrando, 2005).

→ The usefulness and the pertinence of the data that emerged can be judged through the chosen type of analysis, which should at least be twofold. On the one hand, it should be multidisciplinary –which means submitting the analysis to debate, to question and challenge our interpretations and our own considerations-. That requires arranging time, after the organisation of the workshop, for analysis and for discussion of this analysis within the research consortium. In this case, the fact that the modeller was also an anthropologist strengthened this multidisciplinary exercise. In a longer process, that can also be done by requesting one or more feedbacks on the analysis from participants. On the other hand, it should be multidimensional, i.e. an analysis that neither restricts *a priori* nor *a posteriori* the elements addressed by citizens - and the different dimensions to which they refer- to be taken into account. Multidimensional also in its capacity for questioning the way in which the *dispositif* fixes citizens' position or, on the contrary, in which the *dispositif* leaves citizens the possibility of transforming it (Hajek, 2005).

2. *How should citizens' capacity or lack of capacity for discussing pertinently and appropriating technical issues be evaluated?*

Reframing, in view of the interesting results that it produces, should not, however, conceal the difficulties that citizens experienced in understanding the model and discussing it. In this respect, it is difficult to distinguish, in what the citizens expressed, between what reveals their misunderstanding (and which may also be connected with the presentations made) and what reveals their priorities, their views of the world, the elements that interest them and which they want to debate.

 The ensuing proposal is not to underestimate the time that citizens need to understand the topic as well as the time that the organisers need to explain, repeat and recapitulate both the technical aspects of the model and the issues surrounding it and those surrounding citizens' participation. Furthermore, more interactions with the modeller would make it possible to get a quicker and more thorough understanding of the model, provided however that those interactions are geared in the mode of explanation and not of justification. The objective is not for the modeller to justify the limits of his model in such a way that the citizens accept it but to explain them so that citizens, on that basis, can position themselves in relation to their acceptability.

[6] <*EnjeuxGeneraux*>: when people speak about the driving forces, about what is at stake, the economics, etc. / <*StrategieGenerale*>: when people talked about general politics, socially alternative ways of managing risks, 'what we should do', etc. / <*JugementSurScientifique*> <*StrategieScientifiques*>: when they talked about what scientists are doing, 'what scientists should do'. See annex 7

Stakes in the participatory process for citizens and scientists

One of the latest discussions of the citizen conference, which seemed to be particularly crucial to citizens, considered understanding the aim of their participation. That had already been announced to them right at the beginning of the weekend (at the introductory stage), but also during one of the first interventions placing the PRIBEL model in its institutional and political context, namely the Federal Pesticides Reduction Plan. It was however necessary to repeat this at the end of the weekend, as if it was especially at that stage that they were able to understand it and that they wanted to grasp it in detail. This indicates another dissociation that citizens did not want, i.e. they did not want to separate their participation from its concrete stakes (especially the institutional and political ones). The concrete implications are, for the future, the need to define clearly what will become of what citizens express or, in other words, the mandate assigned to the participatory experiment (who -scientists, politicians- is asking what exactly and what are they going to do with it?). The path already covered by the model and the path ahead of it, so as to identify where there is some room for manoeuvre, shall therefore be clearly mapped out and explained to participants, and if necessary, this will be repeated several times.

Type of participation

It further leads us to make clear that citizens' participation in this project was determined by the two-tier impacts that it was likely to have, corresponding to a two-tier involvement. On the one hand, the involvement of citizens at a "technical and scientific" level corresponds to our hope to modify the model by adding other elements to be taken into account. On the other hand, citizens' participation at a more "political" level aims at getting them really involved and letting them express, as citizens, on issues that are seldom open to them.

We hypothesise that this double level is related to the heterogeneous composition of the group, composed both of field actors such as farmers and bee-keepers - people directly concerned with the type of risk assessment model and with the use that will be made of it - and ordinary citizens. Different interests emerged from the latter's point of view. Even though they often combined these different interests, it may be said that some citizens in the panel were more concerned - or even worried - about the environmental issues. That places their participation in a perspective of change, action, and reaction with regard to environmental and quality of life issues in general (civil participation). While others were present more as private users of pesticides.

> *A: I'm here as a consumer. People can't make head nor tail of consumption and that made me think when I realised that if people don't give their opinions, things are not going to move. It's very difficult because people are submerged in information and when they look for information, they don't always find what they need […] We like to live in the country, we have a big garden, a vegetable patch … we use lots of pesticides, no, not lots, but we do use them! Then we realise that some of them are eliminated that did the job well and that new ones are added. And I want to stay in the know to see …*

What is interesting to emphasise is the way in which these two (political and technical) levels joined up. Indeed, as discussions gradually progressed, citizens seemed to become aware of the political, economic, environmental and social dimensions or consequences of science and technology. If this social construction of scientific activity is well known to sociology of science from a general point of view, it is interesting to see how that construction is at work in a particular case such as the PRIBEL one and how the type of *dispositif* involved made it possible for citizens to clarify the social constructions in the model and could subsequently enable democratisation of socio-technical choices. This clarification of the social constructions in the

model took place progressively during the discussions among citizens, as is shown by their different perceptions of science, of what it is and what it should be. This aspect is the one that will be addressed in the final point concerning the model as such, since, once again, citizens did not want to separate the discussion about the model from the discussion about the working conditions of scientific activity.

What type of assessment of scientific activity?

This suggests that a question should be added concerning the assessment to be made of this participatory experiment. Two wishes can be identified at the basis of the proposal for public discussion of the model and the choices that governed its construction. On the one hand, there is the desire to break the myth of neutral and objective science, as a simple representation of reality. On the other hand, there is the wish to attend to the problem of science's reductionist approach to reality by putting its shortcomings and their solutions at the centre of a public discussion so that other possible considerations can emerge, but, above all, responsibility can be shared or even democratised.

What the assessment of such an experiment should or could take into consideration is at least threefold:

1. to identify whether or not citizens manage to "understand" scientific activity (and how), both with regard to its effectiveness and its limits

2. through the opinions that citizens express, to grasp whether or not they suggest leads (and which leads) concerning the way in which scientific activity operates and should address the issues that it fails to take into consideration

3. to decide what such a participatory experiment allows to conclude or invent concerning the possible relations between science and society, especially by assessing what discussing scientific activity gets the different actors involved, other than citizens, to do. We think, for example, about the changes that the public discussion involved for the modeller's work (re-questioning a number of choices and hypotheses at the basis of the model) but also for the stakeholders'. Most of the latter's reports testify of the effort they made to define a clear and well-argued position in relation to the model.

In a more pragmatic way, what are the objectives that should be set for the real-scale exercise: is it to derive results concerning PRIBEL or rather concerning scientific modelling in general (and, hence, concerning the relationships between science and power, science and democracy, science and other forms of knowledge) and what such a participatory exercise gets the different actors involved to do and offers as means of democratisation?

Choice of the bee-indicator: a controversial one or not?

It is important, at this stage, to share a concern regarding the choice of the indicator that was referred to the wisdom of the citizens' panel. Indeed, among the seven indicators that constitute the PRIBEL model, only one was taken to initiate the clarification of the way it operates.

The choice of the bee-indicator was anything but an obvious one. It did, moreover, pose a few problems within the organising team and obliged it to clarify (or to complicate) the initial project. In reality, the bee-indicator echoed an actual controversy concerning the causes of mortality among bees in Walloon hives[7]. The connection between that controversy and the

[7] Lefebvre M., Bruneau E., Inventory of the phenomena of damage in hives in the Walloon Region; House of Representatives of Belgium, Complete report of the afternoon session on Tuesday 11-01-2005 of the Commission for Public health, environment and renewal of society, CRIV 51 COM 454; Walloon Parliament, Analytical account of the public session of the Commission for Environment, Natural Resources, Agriculture and Rurality on Thursday 18 March 2004, No. 46.

choice of the indicator was initiated by the department of the Ministry of Health. There were many reasons for choosing the bee–indicator: it parallels an actual topic, it meets a legitimate demand and it is a good case for applying risk assessment. There was however other reasons that made the assessment of a risk management model itself risky. The subject is an extremely sensitive one and polarises some key players up to an atmosphere of conflict. Moreover, there is some scientific uncertainty about the relationship between this mortality and the pesticides incriminated. Above all, there was the risk that the actual controversy might spread to the panel to the extent that the panel would reflect that controversy and miss the initial objective, which was to take a position, as citizens, about pesticides management policy and, more particularly, about the modelling work associated with it.

That risk was all the greater since the panel was composed in part of bee-keepers and farmers and one of the speakers responsible for presenting the pesticides management policy and the PRIBEL model was a political actor who is member of the department of the Ministry of Health. Since the focus on the bee-indicator could echo the bee controversy, the composition of the panel (3 consumers, 3 bee-keepers, 3 farmers and 2 members of horticultural circles) potentially became problematic since it mixed persons concerned for different reasons with the problem of the mortality of bees. In fact, we supposed that bee-keepers and farmers were directly concerned with this problem while the others were indirectly concerned (consumers and amateur horticulturists), with the risk that the former might behave like stakeholders and the others like 'citizens'. We are going to come back to this differentiation.

This tension was tangible during discussions in the panel, more particularly on account of the attitude of two of the three bee-keepers who were more concerned to assert the position of bee-keepers condemning the use of some pesticides and inclined to reproduce the controversy within the panel. If there were tensions, they did not lead to any questioning of the *dispositif*: the bee-keeping protagonists did not speak with one voice thanks to the presence of one bee-keeper who proposed another point of view, and who was more prepared to discuss and even to reflexive questioning (more particularly, practices of bee-keepers in the face of a changing agricultural and epidemiological context).

The other reason for doubting the pertinence of the choice for the bee-indicator was the difficulty to determine some variables for scientific reasons. The toxicity of some pesticides and their relationship with bee-mortality is not sufficiently known. Consequently, we run the risk that the capacity and the usefulness of the model in dealing with this set of issues and, hence, its relevance for our participatory test could be questioned. However, as one of the modellers associated with the development of PRIBEL very rightly pointed out, there are no indicators for which there is not a potential source of uncertainty in their mathematical characterisation and the same may apply just as much to the indicator for assessing groundwater pollution risks, health hazards for farm workers, consumers or even birds. The same fate is therefore shared by all indicators, i.e. the risk that the choices made or the reduction methods they involve become challenged. Specific for the bee–indicator is, however, that its uncertainties are the subject of public and political debate.

Composition of the citizens' panel: homogeneous or heterogeneous?

The choice of inviting consumers, amateur horticulturists, bee-keepers and farmers responds to the wish to bring together a variety of positions that seemed to exist on the subject. The panel was, therefore, heterogeneous, with participants feeling concerned for various reasons. Concerning the analysis, the objective is not to issue value judgements about the "degree of interest" of the different actors (to define who feel directly or indirectly concerned according to the discussions that took place) but to qualify what differentiates these four categories. We propose making this differentiation by profession. In this way, we suggest that "citizens directly concerned" should be understood as those whose profession is linked to the problem of

pesticides and the mortality of bees (bee-keepers and farmers), whereas those participants whose profession is not directly linked to the problem are classified in the category "ordinary citizens or indirectly concerned"[8] (consumers or gardening enthusiasts). This qualification makes it possible to point to the risk that these "directly concerned professionals" position themselves as holders of a previously defined interest – related to their profession -, and that positioning has more in common with the role that we expect of stakeholders, and not citizens, for this participatory exercise. That is what happened for two of the three bee-keepers present who kept firmly to their predefined position from the beginning to the end of the weekend and revealed to us that they had learned nothing in consequence. Now citizens' readiness to learn is clearly an element that differentiates them from experts, stakeholders or resource persons.

> *E: so, as far as I am concerned, I learned nothing new as far as I know, because I read a lot on the matter in question … here, I learned nothing, apart from the fact that there is perhaps another study that is going to be carried out, so I'd say that it is positive in itself, but it's one among others*

The participation of these citizens "directly concerned by their profession" may be termed instrumental insofar as they did actually use this citizen conference as in instrument in relation to their predefined objective, connected with the controversy which we wanted to avoid spreading to the panel, which was scientific recognition of the relationship between pesticides and bee losses.

However, unlike the latter, the "indirectly concerned" citizens expressed the feeling that they had learnt a lot during this citizen conference, not only from outside contributors but also from one another within the group. That means that the opinions expressed by "directly concerned" citizens together with their experience was enriching. On this basis, we think that in the future, maintaining the heterogeneity of the group – and, consequently, the presence of special individuals that are holders of collective interests, in this case, related to a profession -, is interesting provided that the possible use of the debate as an instrument can be avoided. In order to do so, we propose imagining their participation differently, by inviting them –the bee-keepers - to speak in their capacity as 'witnesses' who come to talk about their experience, in a group of "ordinary" citizens. These 'witnesses' are differentiated from stakeholders insofar as they do not refer to the interest of a group but to the practical experience of individuals. As a matter of fact, what seemed to interest "ordinary" citizens in the experience of "directly concerned" citizens was precisely that they made the work of those who use pesticides or who consider themselves as their victims just as understandable as their own findings and questions (especially concerning the purpose for which the model was going to be used).

B. Citizen posture: analysis of the collective mechanism, of what it produces and what it means for democracy

Comparison with other participatory experiments carried out on the problematic issue of pesticides with consumers makes it possible to highlight one of the specificities of the citizen perspective. The project in question consisted of setting up a participatory approach where a group of ordinary consumers was asked to assess the pesticide approaches of different fruit and vegetables labels and, to do so, they could invite certified producers and label promoters. The process was relatively similar to the one with which we are dealing in this case, apart from the fact that the topic was different and therefore concerned participants differently. If, as a matter of fact, consumers are regularly faced with food labels (without giving an opinion, for all that, on

[8] That does not therefore mean that a consumer placed in the "indirectly concerned" category cannot *feel directly concerned* by the issue or that every farmer *feels directly concerned* by the problem but that we choose to classify the different degrees of interest in relation to the profession and not in relation to our personal judgements about the feeling of participants to feel concerned. It is all the more important to point out that all individuals, regardless of their profession, are consumers.

the extent everyone feels or not concerned with this issue), that is not the case for the modelling of pesticide-related risks. The specificity observed in this case is the acceptance by the individuals in the panel to take an interest in topics that do not concern them 'directly' (contrary to consumption). However, beyond their type of interest, in both projects, the issue at stake seems to be citizens' capacity for giving opinions concerning such topics, and in order to do so, for mobilising different 'ordinary' resources ('ordinary' findings and knowledge, feelings derived from real-life experiences, personal interpretations concerning a whole series of things, ranging from environmental issues and their causes, to alternatives, including consumer behaviours, the working of science and decision-making processes, lobbying, etc.). In this way, they provide their view of the world but, above all, their aptitude for broadening the horizon as a result of the interactions aroused by the type of collective *dispositif* set up. In this case, their individual perceptions are therefore of less interest than the overall mosaic that emerges, one that is complex, interrelated, localised and globalised and involving the sharing of responsibilities, at one and the same time. It provides an overview of the different points that interest the participants in the panel, those that pose a problem for them and their capacity for expressing proposals, the specificity of which is to include different, sometimes contradictory, aspects.

In fact, the experience of a heterogeneous group ('ordinary' citizens and previously defined 'directly concerned' citizens) also made it possible to pinpoint another citizen specificity, namely not a posture that aims to defend a position, to impose a point of view, to negotiate with a view to settling a question – that was the position of 'directly concerned' citizens, which has more in common with the attitude expected of politicians -. If anything, what seems to be at work in the citizen posture is of a quite different nature, aiming more to explore an issue, to exchange with its subject to broaden its outlook and thereby search for convergences, even between contradictory elements. We could go further by identifying as follows the threefold approach underlying the citizen position initiated in the panel that we observed. Firstly, take an interest for oneself (and question one's own practices) and take an interest in others (without condemning any practice as such). Secondly, position oneself as a group able to take all interests into account. Thirdly, ecologise practices, i.e. place them through a series of judgements in a complex pattern, namely, where an effort is made to succeed in holding contradictory viewpoints together. The identification of this citizen posture makes it possible to draw attention to misunderstandings to be avoided at the time of analysis concerning, on the one hand, the power to be given to what they say and, on the other hand, the status of what they say. In this way, citizens' remarks should be less considered as - or directly translated into - political actions to be taken than as a multi-faceted and specific light thrown on the issue and thereby providing a political contribution. In other words, it lights the way to action and does not actually define the action itself!

Methodologically speaking, that means that the unit of analysis (but also the social unit) is the panel. It should be considered as such both in the organisation of the *dispositif* and in the meaning to be given to the discussions that took place in it: especially the feeling of belonging to a group in which there may be diverging opinions. That is why the analysis should not concern individual but collective perceptions, i.e. it should concern the overall image produced by the juxtaposition of individual elements. The importance (minority or majority) of the opinions expressed is therefore less relevant than their diversity and the way in which the citizens manage to make such differences co-exist. This approach is perfectly suited for the exploration phase in which the project is integrated.

The second comparison that we make with other participatory experiments makes it possible to identify a point shared by participants. This is the generalisation of the experience that they live as participants. In fact, they often wonder about the unique nature of the experience in which they participated, so indicating their interest in seeing it multiplied, so that, on the one hand, the results carry more weight and, on the other hand, as a way to raise awareness among other citizens. This second objective reveals the reflexivity of the participants with regard to the

learning that they themselves derived from the experiment that they went through. It also reveals that they became aware that the participatory exercise has changed them compared with consumers or ordinary citizens.

> *E: here, people are interested, more or less, but a summary [would be needed] from other persons who generally shop in hypermarkets, to buy apples, sweets, anything, [who generally go shopping] without realising where the problem lies …*

What seems interesting in this desire for generalisation is that they imagine it not from the traditional mode of normalisation or representativeness but from the mode of reproduction and multiplication of this experience[9].

3.2.2. THEMATIC ANALYSIS

A. Construction of the material and grid of reading

The material derived from this citizen conference is extensive since it involves all the discussions that took place between the citizens following the different information they received at the Saturday session[10] (See Annex 5 and www.ua.ac.be/PEPAM). This information was presented in various ways, namely, either in the form of questions that the participants asked themselves, asked other participants or other speakers, or the opinions and proposals that they expressed, whether they did so orally or in writing. In order to allow citizens to be as productive as they possibly could in such a short time, the researchers attempted, on Saturday evening, to classify everything that had been mentioned by the participants during Saturday's daytime session, in order to decide how to go more deeply into it with them on Sunday morning. It is worth remembering that this period of analysis between these two days' sessions is very important.

Saturday evening, the research team therefore worked on the classification of all the elements put forward by the citizens during the day. The elements could then be grouped into three main categories or questions[11].

Can we do without pesticides? *How should risks and / or pesticides be managed?* *What about the model, its strengths and weaknesses and in what way can it be helpful?*

These questions are those that were used to relaunch the participants the following day in sub-groups. The elements put forward by the different sub-groups were directly recorded in a document (see Annex 5)[12]. In the following pages, the analysis that we propose is mainly based on this table but it should be noted that we also took into consideration the discussions that surrounded it and those expressed on Saturday relating to it.

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[9] It should however be pointed out that, in this case, some participants expressed their wish to continue the approach to go more deeply into the matter.

[10] We should mention that everything that was said (presentations by the different speakers and discussions with and among citizens) was recorded. On this basis, only the questions of the citizens who were following the different interventions, on the one hand and the discussions among citizens, on the other hand, were retranscribed literally. Those retranscriptions proved indispensable for a rigorous work of analysis based on what was actually said and not on interpretation as researchers unavoidably do (such interpretations are already at work when researchers take notes, note impressions and memories that they keep –and do so selectively- of the citizen conference, etc.).

[11] This classification was done in two stages. For the first version, see Annex 4.

[12] It should be noted that the discussions in sub-groups could not be retranscribed (time and budget limits) insofar as they increased discussion times. Now, it should be remembered that the exchanges in sub-groups were the privileged place for interactions between the participants and the modeller and the researchers, arousing interesting elements.

The chosen analysis is a thematic one since it involves taking up all the topics addressed by the citizens. It is also argumentative insofar that, if the citizens dealt with the issues, they also took position and based their positions on arguments. The analysis grid, on the other hand, was initiated in the boxes which precede and which determine, even in an interrogative way, what we decided to question through the discussions expressed. As a reminder, it is a matter of the reframing made by the citizens. They did not talk only about the model in the strict sense but also about a whole series of issues that surround it and that they do not want to dissociate. Second, citizens also discussed the scientific work involved and proposed to improve it specifically. Finally, we also consider what produced the interactive dynamics or what we previously called the citizen posture to search for convergences. However, it should be pointed out that the interactive dynamics could not be encouraged as much as we would have liked because of the tight schedule and the way in which the participants in the panel were invited to speak, namely closer to the method of a roundtable talk than a discussion. Surprisingly, it turned out that even during the roundtables, the citizens attempted to interact, positioning themselves very often in relation to what the others had said. This is shown by a whole series of expressions that can be found in the discussions:

J: Regarding what Mr … just said … J-N: I confirm what Mr … said …

B. 1st main classification: A pesticides risk assessment model at the service of which of society's objectives and priorities?

This question is an important one inasmuch as it indicates the first way in which the participants reframed the issue. Indeed, this question makes it possible to regroup all the elements that the citizens dealt with that do unintentionally not directly concern the model construction, since they question more the model with regard to its objectives. In addition to what the different elements put forward indicate in particular (cf. hereafter), generally, they show that it was not pertinent for the citizens to discuss only about the construction of the model since it was just as essential, for them, to discuss the issue of pesticides and the relevant political (and scientific) objectives: do we want to reduce pesticides? can we reduce them? what will be the consequences? what is our current dependence on them? etc. Considering the reflections expressed by the panel on Saturday (following the different presentations), it could be summarised by reformulating what happened in our own terms, in this way: "O.K., you present a pesticides risk assessment tool to us but we firstly want to talk to you about pesticides and what we think of them, and especially about the Federal pesticides reduction plan which you presented to us". In other words, they reframed the issue that they were asked to discuss by indicating that it is not pertinent, for them, to discuss the internal elements of the model without firstly putting that model in perspective, without placing it in its context and questioning the pertinence of the objectives in relation to which it is designed. They thus decided to discuss the pertinence of the model (or of the tool) in relation to what they consider to be problematic in the case of pesticides, thereby pinpointing where they situate the issues, their priorities and whether or not they consider that the model can respond to them. In doing so, they broadened the question, by not agreeing to dissociate the technical aspects of the construction of the model from the more general issues.

Before analysing the table produced on Sunday morning where this question "can we do without pesticides" is split into three types of answers (yes, yes in the long run, no), some general elements that citizens reflect are worth pointing out.

- First of all, the objectives of the Federal pesticides reduction plan of 25% by 2010 were questioned: "*why 25% and not 50, 75 or 100%?*". In doing so, they indirectly question the problem definition underlying the target. They further show us their difficulty to understand the need - or the sense - of reducing risks when they are considered acceptable at the time of product approval. Basically, it's a very important aspect because there is

hardly an explanation for that: how do we explain that we want to reduce the risks related to products authorised after risk assessment? The issue is, thus, not the individual impact of each pesticide. It is situated elsewhere, either in the effects of synergy, or in the methods of use. These aspects are precisely the ones that the model does not take into account.

- They also asked the question: "*what will happen after 2010?*". That already reveals to us that, for the participants, the pertinence of a model requires assessing the **pertinence of its objective**, which means taking into consideration **both its administrative, political and scientific timeframe**. In our terms, it seems that their questioning could be summarised in this way: "is there any sense in assessing risks in such a way now, if it is possible that the method or, worse, the target will be changed within 10 years? To which problems does the plan, hence, respond? Why does it respond to them like it does today? Does it take tomorrow into account?"

- Next, the fact that the plan aims at a reduction of pesticide risks and not of pesticide use was questioned. This brought the question of alternatives to pesticide use (and/or traditional farming) on the table. In this way, various elements emerged concerning the possibility and the readiness to do without pesticides, and we classified them into 3 categories "yes, yes in the long run, no"". The citizens were asked to divide themselves into sub-groups according to these 3 categories. It should be pointed out that the panel did not express any objection regarding working in these sub-groups. The participants could choose theirs and accepted the coexistence of the three, yet very different groups. That, therefore, confirms that they felt at ease in the classification that was made of their positions on Saturday. That also confirms what was previously emphasised concerning the specificity of the citizen posture – for those who played the game -: citizens are prepared to explore the question, to make different perspectives converge in order to gain a more complex understanding. Citizens do not want merely to assert one point of view at any cost, to settle the matter or arbitrate conflicting positions.

Can we do without pesticides? Yes!

The fact that this assertion 'we must do without pesticides and it is possible' was able to emerge within the group is an important one. It stands alongside the model. It indicates that some participants have other priorities than risk reduction, since it involves eliminating risks by eliminating the use of pesticides. This path is certainly a radical one and puts several salient elements on the table.

For these participants, supporters of the 'yes without pesticides', nature is seriously threatened by pesticides, it is therefore urgent to react. The causes of the problem have been identified: systematically resorting to synthetic pesticides, connected with the industrialisation of agriculture (not viable in the long run) and with consumer society which both testify of the subordination of our environment to economics. In their opinion, it would be essential to question our need for pesticides and our dependence on them. Agriculture is then perceived as being guilty (sometimes in spite of itself since some people acknowledge that farmers are overtaken by the pressures which they undergo) and, at one and the same time, as a possible vehicle for change. Consumers are considered likewise. That is why it is essential to educate consumers and not allow them to use pesticides. Nature, seen as being threatened, is perceived as a considerable resource, which should inspire the development of more natural means of pest management. Past and foreign societies are also seen as sources of inspiration to find more environmentally benign solutions that should be preserved. Consequently, science is perceived ambiguously. It can indeed be an ally provided that it is coached so that it is at the service of alternatives and that it draws inspiration from or takes into account ways of doing things in the

past or by other societies. We could also ask ourselves what type of model would have to be constructed to take that into account. Science can also be the worst enemy if it contributes to the development of synthetic chemistry.

This outlook reveals that there are different underlying metaphysics of nature: a good nature with which people should seek to be in harmony versus an imperfect nature that needs to be controlled. Neither of these metaphysics has *a priori* priority over the other and they are often combined. It should, however, also be emphasised that citizens who defend this position do not express a sort of fanaticism towards Mother Nature. They try to defend another negotiation with nature.

Can we do without pesticides? Yes in the long term!

Contrary to what people might have thought, the previous position was in the minority within the group. That indicates, first and foremost, that most participants consider the pesticides issue differently, seeking to make dependence on pesticides coexist with the wish to do without them. It therefore seems that this group's statement could be summarised as follows: 'we would like to do without pesticides, but we can only achieve it in the long run'. The specificity of this group compared with the first one lies in the consideration given to the time factor - and the need for an accurate definition of the timeframe in question - and to the means that need to be employed to carry out the proposed changes. In this way, they intend to be realistic or pragmatic, focusing their proposals on what they consider feasible. Nevertheless, their proposals are still general ones and are distinguishable from the ones of the first group in that they emphasise the attractiveness, competitiveness and greater effectiveness that should be developed regarding alternatives to pesticides. In that way, they target the causes of the problem - and their solutions - mainly at economic and scientific levels.

Another specificity of this group's position is that it would prefer to adapt management to the different situations, especially to situations of great crisis. The pragmatic attitude is interesting inasmuch as it tries to relate an economic health risk (the participant spoke of rats and consequently of the special use of biocides against rats) to the risk of pesticides. This arbitration is therefore necessarily in situ arbitration. The participants compared their suggestion to the prescription practice of medicines. They refer to existing similar cases, in order to generalise this 'in situ management'. It seems that this is a characteristic feature of citizens' participation, namely a readiness to generalise, either by multiplying experiences or by analogies.

Can we do without pesticides? No!

It seems that their statement may be summarised as follows 'we cannot do without pesticides, but we must attempt to reduce them'. This group puts forward both the need for pesticides and the need for research regarding alternatives to pesticides, with the former not ruling out the latter. The positioning is clearly different from the first group, since it does not aim at doing away with pesticides, but at 'living with them' while endeavouring to act for the best (reduction of their use and search for alternatives).

This position is based on the consideration of our present dependence on pesticides or, to put it another way, of the constraints that would prevent us doing without them at the current time. This third group considers simultaneously our present need for pesticides, their capacities and the progress of which they testify, but also the problems they cause. The relationship with the past is also perceived ambiguously. On the one hand it is perceived negatively, as a step backwards, which is neither possible nor desirable. At the other hand, however, the future is frightening since it does not necessarily imply progress. Nature is again perceived as a resource and an ally.

The importance given to the practices of the actors in assessing the problem and its solutions is also interesting in this group. A good assessment of the pesticides issue should strictly distinguish between the use made of the products and the actual products themselves and take both these issues into account. The scientific work should therefore integrate this type of elements into its assessment, which is related to the in situ work of farmers, bee-keepers, etc. That corresponds to a perception of science that simultaneously considers its strengths and questions its limits. In this group, the importance of framing science and adding dimensions is put forward in a similar way as in the other two groups. In this case, however, it looks as if the concept of framing extends from science to the work of the "producers" and as if the latter takes priority. In other words, this group advocates framing a pragmatic solution.

Since the latter group aims at pesticides reduction (versus elimination), it comes closer to the issues at stake in the PRIBEL model. This poses, nevertheless, a whole series of issues concerning pesticides management. The group proposes to focus on practices to define and/or implement management measures (i.e. reduction measures) of the risks related to pesticides. That is the second main topic that was studied in depth on Sunday with the citizens. This second topic (presented here after) allowed us to regroup the relevant elements in this respect and to analyse what they teach us, both with regard to the model and with what goes beyond.

C. 2nd main classification: how should risks and/or pesticides be managed? Who should do what?

It is interesting to note that the citizens expressed a lot of views and proposals, not only regarding the general topic of pesticides and its alternatives, but also about concrete management measures. Once again, citizens did not focus on the model or its construction. In exchange, they revealed what are, according to them, the elements that cause problems in current management practices. They mention many elements which they do not want to separate from each other and which, in their view, represent potential solutions or potential leads for the current model to be acceptable. In other words, they hold together the risk assessment and the management of pesticides. That is why, according to the participants, the elements discussed in this second session can be treated as the elements to be taken into account for pertinent risk assessment. Before making a connection with the third session, it seems, however, important to us to give a short transversal analysis of this second session. The details can be found in Annex 5.

The different actors on whom the participants were asked to pronounce have been mentioned by them spontaneously on Saturday and they assigned different responsibilities to them. Listed alongside each other (industrialists, scientists, consumers, private users of pesticides, politicians, bee-keepers and farmers), it looks as if the list is complete. However, we should point out that other actors were added and that, in addition, not all participants did mention all actors. It is clearly a result of the collective process that it allows to approach the topic with regard to its different dimensions.

Industrialists

The participants divided the industrialists into two groups: on the one hand, producers of pesticides and, on the other hand, industrialists as "big" users of pesticides[13]. It emerged from the whole of the discussions that the producers of pesticides were the main focus. Their strategies were indeed questioned time and again and criticised because of the assumed tensions between their financial and environmental interests. A lot of mistrust towards this group of actors

[13] *A: "Well, we had understood [industrialists] as users, and therefore the big companies that use them and cause pollution, our position can be summed up in a word "polluter pays" if we are to avoid discharges into the water and emissions into the air"[...]*

exists and participants expressed a readiness – even the need - to frame industrialists' actions in order to urge them to change.

Even though the participants greatly mistrust this group of actors and show their willingness to control its objectives, they also expressed another opinion, namely that the practices of pesticide use (including private ones) are perhaps more problematic than the practices of pesticide production. That draws our attention to another aspect of the problem: not the product in itself is blamed, but the use that is made of it. Once again, a usual tension within participatory settings was observed, namely that participants show *a chain* of responsible persons rather than *one* responsible person.

Between these two positions that summon to different potential solutions, a common path appears, namely that of the importance of framing the problem and of framing it independently from the producer (separating the role of the phytosanitary adviser from that of the seller). In a similar vein of questioning this independence, the citizens distrust the data that industry provides and that scientists use to assess pesticides toxicity. At the same time, they avoid demonising in favour of questioning the type of institution (or rule) that governs the assessment, use and distribution of the products.

Scientists

We will come back to this group of actors later on since the improvements that the participants proposed to make the – simplifications within the - model acceptable concern more particularly the organisational practices of scientific activity.

Private users of pesticides

Citizens usually consider private pesticide uses less necessary than professional ones[14]. That is why one of the measures proposed is to ban private uses of pesticides, except for a number of cases, and to propose effective alternatives.

It is also interesting to emphasise that this discussion does not directly concern the PRIBEL model since the latter does not take private use of pesticides into account. Nevertheless, it is an important point for citizens, certainly because it concerns them directly but also because it gives them the opportunity to pinpoint a political contradiction between the observation that pesticides are widely used by private persons and that this is not taken into account by the model. Furthermore, if private use should be assessed, it should also be regulated. The participants notice here a relatively simple way to achieve an objective that they all consider important, namely, reduction of pesticide use. This, thus, allows to stress what has already been said, namely, the wish of some participants to reframe the question at stake. They do not want to restrict the discussion to the model itself, but to extend it to the pertinence of the model given actual uses. This is confirmed, in an opposite way, by the remark of a bee-keeper – whose participation was termed instrumental -. For him this reframing was not interesting, insofar as he lost the connection that he considered relevant for the bee-problem, since private persons seldom cultivate melliferous plants.

> *J: That's another argument that gets on my nerves a bit. It is taken up in Professor H.'s study when he accuses amateur gardeners of not working properly. I agree with him that many private gardeners use too many products unwisely and they use too large amounts of them, etc. but I say once again, I'm selfish because when an amateur gardener stupidly sprays his rose bushes, when he stupidly sprays anything at all, I don't give a damn, because bees don't gather pollen on cabbages, on rosebushes or on dahlias.*

[14] It would be interesting to see how they are prepared to make certain types of compromises or arbitrations and which interests are part of it or not. It seems that they weigh up the economic constraints that might result from discontinuing the use of pesticides for professionals on the one hand and the ensuing difficulty for the housewife or the private user of pesticides.

Consumers

Consumers were considered as playing an important role. This means that production modes were not dealt with independent from consumption modes, so that the agro-food chain comes full circle. We should emphasise that this holistic outlook, also posed in terms of needs and dependences, is actually a result of the collective process. As a matter of fact, the interactions between the citizens induced them to adopt a critical reflection regarding their own responsibility.

> *A: well, you are forgetting a point which seems to have been slightly overlooked or perhaps it does not quite come within the scope, but from the moment we manage to educate the consumer so that he accepts a product with a slight flaw, frankly speaking, I'll cut my number of spraying operations at least by half …*

Citizens' belief in the possibility of changing consumer behaviours is also very interesting. In this way, consumers are considered as actors, on the one hand and, on the other hand as receptors of messages that have to be learned how to decode them (to help them to become actors even more), messages that also need to be redirected (role of public policies in relation to mass retailing outlets in particular).

Politicians

The participants consider that politicians have a double role to play with regard to pesticides[15]. It involves, on the one hand, regulating the use and production by some actors (industrialists, private persons, etc.) and, on the other hand, encouraging some projects (search for alternatives, promotion and marketing of quality products ...). Another set of proposals indicate the problems that relate less to the role that the State has to play than to the way in which it presently fulfils its role[16]. Finally, some participants were keen to stress that politicians were only partly responsible since, on the other side, there are the persons who elected them. The expressed ambivalence of questioning both politicians and one's own role, as an elector, is interesting insofar as it reveals that the *dispositif* induces citizens to be critical and self-critical, clear-headed and subtle, showing that they are competent to assess or explore a problem in its complexity. Since citizens are not in a position to have to decide, they point to the politician in his role as a regulator but refer to themselves, at the same time, as "authors" of politics.

Bee-keepers

Two different visions seem to emerge from what was expressed concerning bee-keepers, their problems and their responsibilities.

For some people, bee-keepers are "victims". Farmers (and the agricultural developments of which they testify) are mainly the ones responsible for the problem suffered by bee-keepers. The argument underlying this position is, more particularly, that, since bee-keepers have not changed their ways of doing things in recent years, the causes of the current bee problem can only be external (implying the use of new pesticides - and the changes in society and in agriculture that they reflect). On the other hand, the defenders of the other position use the same argument to draw the opposite conclusions from it. In their view, the problem could actually emerge because bee-keepers have not changed their practices and have not, therefore adapted to external changes (implying, in particular, that the bee-keepers are not prepared to cope with the appearance of a new disease - varroasis). Even though, from this point of view, there are, of course, external elements that come into play, the question is rather one of knowing how bee-

[15] It should firstly be pointed out that there is possibly a bias with regard to the State since the panel is informed from the outset that the project is funded by the Belgian Federal Science Policy.

[16] They also mentioned their wish for greater independence of politicians from lobbies, for politicians performing politics in the noblest meaning of the word (versus party infighting), for a continuity of policies –and project consistency- between the different terms of office (versus regular changes in ministers and powers), etc.

keepers themselves (amateurs in particular) adapt to them and, above all, question their own practices and their own limits (spontaneously and reflexively or through external support). Moreover, the defenders of this position also draw attention to the fact that scientific assessment is conditioned by the practices of those who are questioned. They question, hence, at the same time the collection of data and the type of product assessment.

> *J: […] Everybody does not necessarily do his job properly. The work of bee-keepers should be [accurately] represented so that scientists may perhaps receive some guidance when they look into the problem of the bee. The way in which bees collect pollen and work is something that needs to be analysed more thoroughly, because … er … if 25% of bee-keepers do not keep their bees correctly, that will obviously pose problems for the investigation since some of the information will be wrong.*

Farmers

Some participants consider farmers, as pesticides users, to be partly responsible for the problem. Their proposals then consist of urging farmers to reflect on their pesticide use. The aim is to reduce the use of them and/or to monitor their use to avoid negative impacts. This, hence, presupposes continuous coaching, information and education.

At the same time, the participants also expressed their awareness of the current difficulties of farmers, of their uneasiness. If they are considered responsible, they are considered at the same time victims of a system with an increasing number of constraints, which they suffer rather than discuss, accept or share among the different actors concerned. And farmers are not the only ones concerned. Continuous monitoring, information and training mean, from this point of view, more than just a willingness to protect the environment. They also mean providing support to farmers. Moreover, the citizens imagine that this support and guidance to change should materialise through setting up local committees. These committees could bring together the different actors involved and enable the circulation of knowledge, reflections, technical alternatives and, in addition to all that, moral support.

D. 3rd main classification: what about the model? What are its strengths and weaknesses? How and in what way can it be helpful … ?

Before dealing with this final point, it is worth recalling an important element of method and clarifying the choices for which we opted. Indeed, the material - the discussions and debates among citizens - may be analysed in different ways. We propose two of them (see 3.2 and 3.3). They are distinguishable by the categorisation adopted. The first one is based on the output produced by the citizens on Sunday morning, organised around three categorising questions (can we do without pesticides? how should risks and / or pesticides be managed? what about the model, its strengths and weaknesses and in what way can it be helpful?). The perspective is a holistic one. It gives, on the one hand, as much weight to the reframing as to the elements directly concerning the model. On the other hand, it analyses citizens' positions as much as their assessment criteria. By contrast, the second analysis (3.3) puts greater emphasis on the elements relating to the model and to the modelling work. It suggests proposals and reflections about new or different possibilities that might be derived from the participatory workshop, and concerning the modelling work. For a future exercise, we could consider integrating both analyses. Nevertheless, in a multidisciplinary project, we find that it is also pertinent to allow a variety of approaches, corresponding to the specific objectives of each of the research teams involved, which allows talking about the same elements differently.

Generally speaking, the participants considered the risk assessment that the model provides for bees unsatisfactory because, in their opinion, it does not take a whole series of relevant elements into account. These elements are of various kinds. Some concern the failure (or the

unsatisfactory way) to take agricultural and other practices (and the surrounding circumstances) into account. Others regard the failure (or the unsatisfactory way) to take the effects of pesticides into account. They regard, finally, the failure (or unsatisfactory way) to take the constraints of scientific activity into account (this will be explained below). The participants, thus, provided their perception of the latter and made some related suggestions. (Some elements have been mentioned in the first classification "can we do without pesticides").

A first element is the failure to take into account that the uses and the applications of pesticides are connected with the advice that farmers receive and which mostly comes from the representatives of phytosanitary firms. That means that, in the citizens' view, a pertinent assessment of the risks related to pesticides must take into account not only the uses but also the surrounding circumstances or the conditions that predetermine them to a considerable extent (the advice given to farmers, but also the cost of phytosanitary products ...). In the same way, bee-keeping practices with regard to pesticide uses must be taken into account, while watching that the data obtained regarding such practices are an accurate reflection of them.

> *J: [...] if 25% of bee-keepers do not keep their bees correctly, that will obviously pose problems for the study since some of the information [about pesticides effects] will be wrong.*

Risk assessment must take into account the surrounding circumstances that predetermine agricultural and bee-keeping practices but also the actual practices themselves (including the lack of qualification of, for instance, bee-keepers or pesticide appliers) and knowledge (findings, observations, hypotheses) of bee-keepers and all other actors in the field (directly or indirectly concerned).

> *F: I grant that phytosanitary products can be used, but everyone should be qualified to use them*

The participants pinpoint the fact that science does not sufficiently take into account the effects of pesticides on the environment and the need to take the data and experiences of field actors (directly or indirectly concerned) in order to understand these effects. Scientific measurements and field observations should also be taken into account and not calculations based on models:

> *P.: What struck me was that when we look at the methods of reduction and therefore those used for calculation [the methods used to calculate risks in the reduction plan], we come to quite different results, depending on whether small risks are taken not very often, or big risks are taken very often. There is a risk that if one really wants to achieve a reduction [of pesticides risk], one will choose the method in order to achieve a reduction. It would perhaps be more interesting to calculate such a reduction in the living environment. Directly. Particularly among bee-keepers. Do bees dye more or less than before?*

Concerning the effects on the environment, the participants question the degree of complexity with which the environment should be taken into account. Pesticides risk assessment should, according to some, take into account not only the risk for the bee but also for all that surrounds it (at field, orchard level, etc.). Different results are obtained by taking this wider scale into account. Indeed, the risks of a very toxic but very effective pesticide, if it is applied once in a professional way, may be considered less harmful than the risks involved in using a less toxic pesticide that is applied more often. In this case, the effects of plant resistance, indeed, also need to be taken into account, but also the recurrent elimination of the auxiliaries useful to crops[17]. In the same vein of the way in which risks should be considered, another wish is that the

17 The participants held the same reasoning on the issue of the price of phytosanitary products: was it more interesting to use a cheaper product often or to use an expensive product less frequently?

assessment should take into account not only the risks for the domestic bee but also for other insects, which are relatively close to it.

> *A: I thought things over […] the domestic bee was a good example, it is true that it has undergone genetic manipulations by crossbreeding to improve not its resistance, that has nothing to do with it, to phytosanitary products, but to have a better honey yield. Studies into the domestic bee must continue, but I find that it is absolutely necessary that a second insect should be taken as an example.*

The citizens also emphasised that the opinions of experts (for instance, the fact that they consider, a priori, that, in some cases[18], the risk for bees is zero) do not suit them. More precisely, according to some persons, these expert opinions do not take into account the changes that are likely to make them inappropriate within several years time. The example mentioned is that of land management (crop rotations) which poses the future problem of the remanence of some pesticides in the soil. The assessment should therefore consider the long-term management of sown areas.

> *J : […] in relation to farmers, for example, they are going to grow sugar beet, and afterwards they are going to put […] something else. That's the time that the risk is really present in the form of […] remanence, […] a long-term land management policy is needed.*

The citizens add to that the fact that insufficient consideration is given to the influences that scientific activity undergoes (lack of independence, conflict of interests). It is therefore interesting to emphasise that some participants were particularly mistrustful of science, when they considered its concrete practices. Their perception of scientific activity was therefore far from the myth of objective science, perfectly reflecting reality to control it as best it possibly can. However, by analysing citizens' perceptions of science as revealed by their proposals, they can be split into two.

- Some people actually refer to this myth, wishing more from science and for science to be "purer", more independent, more general. That is what seems to underlie the following remarks:

H: can your work –so simplified- really be termed scientific?

F: we are given the illusion of scientific work but in fact nothing is done

- On the other hand, the other type of proposal provides a different conception of science, wishing science to be more localised, more controlled, more guided. Science is considered imperfect and should constantly be coached and assessed to be able to be redirected.

> *F: First of all, I believe that people should continue to put their trust in science, because they do have a better quality of life for 100 years. That is undeniable. That's the job of science … to succeed in determining the use, the choice of what should be kept and what should be thrown away. But I also think that we will never have a completely perfect tool. Because things change and so we have to get a move on […] we have to stay focused to re-adjust continuously our sights and improve the tool. We have to show flexibility and reactivity and a readiness to challenge.*

18 Pesticides used for coating seeds

That is clearly what seems to be at stake in the proposal to set up local committees bringing together the persons concerned[19] by pesticides to get them to work together, especially with scientists. This proposal reflects the recognition that science is imperfect and that making use of it and developing it is, nevertheless, good because it is considered essential. This solution shows us an original, localised or "in situ" form of managing uncertainties, one that involves many actors and knowledges, a reversible management that should be framed.

A final criticism of the type of risk assessment proposed is that it is governed by available means and confined within their limits. For several participants, some simplifications of the model were not acceptable and the modeller's answer that those simplifications were due to a lack of data was not acceptable either, arguing that if the problem was a lack of data, it should be attended to!

> *J: this aspect cannot be calculated –like chronic risks, for example- because we don't have the data*
>
> *J-N: if there is no data, they should make some data, they should find some, people have managed to do it in other countries […] "yes, research is indeed expensive but what is the cost of health, of the inheritance that we will leave to our children?".*

This interaction indicates something very important to us insofar as it reveals a different definition of possibilities and priorities between the participants and the modeller. This is another way of reframing the issue. This time it involves noting that, for the participants, it is not acceptable to subordinate the objectives to the means or data available, but that it is indispensable, on the contrary, to determine the objective and then to see how to use the available data and to create others, if necessary.

3.3. ANALYSIS FROM A MODELLER PERSPECTIVE

The modeller's analysis was based on:

- notes taken during the workshop
- recordings of the discussions
- a classification created by the modeller of the content of the recorded discussions
- a reflection according to five axes
  - citizens' suggestions for modifying the indicator set
  - modifications of the expert's perception of the PRIBEL indicator set, induced by the participatory exercise
  - openings suggested by performing the participatory exercise
  - feelings and impressions gathered with regard to the results
  - visions on science and scientists popping up during the participatory exercise

Some results of the modeller's analysis (possible adaptations of the indicator set, more general ideas, …) were directly and explicitly suggested by the citizens themselves. In other cases the analysis performed by the expert/modeller stimulated his scientific creativity. Consequently, he also reached conclusions that the participating citizens did not pronounce

19 *H: it also seems to me, but that goes slightly outside the scope of pure scientists. It seems to me that doctors are informed actors. Because they are also persons who are in the field, who are going to come across the issue of pesticides at one time or another in their work, and they should therefore be informed so that they can work with scientists.*

themselves, or that are even contradictory to their utterances. Also the reflection stimulated by the expert's participation in the preparatory phase of the citizens' workshop allowed interesting ideas to emerge, both in his mind and in the mind of the other members of the research team.

3.3.1. POSSIBLE ADAPTATIONS OF THE INDICATOR SET

A. Other factors?

- As suggested by the participating citizens an exchange of experiences between bee-keepers or farmers and scientists could help the latter ones to see new factors that are relevant for the indicator set. Experts are often a peculiar kind of scientists because many of them mainly base themselves on experimental literature rather than on direct experimentation. This induces the fact that they have often little field experience about what they are modelling.
- Experts should consider concrete agricultural practices, both the ones that diminish risks of pesticides use and the ones that augment them. Together with the farmers, scientists should induce a dynamic of ameliorating practices of pesticides use.
- The participating citizens and the expert look at the bee-problem from a different perspective. The citizens look at bees from the perspective of their habitat as a whole, while the expert considers them from the perspective of the pesticide reduction plan (PRP) because it is the objective of the research project he is involved in. Consequently, the expert is interested only in agricultural practices, while citizens want other risk factors for the bee to be considered.
- Bee-keepers mention the climate as a factor. Scientists should investigate this.

B. Alternative practices?

- The citizens suggest investigating not only the use of different molecules and application practices to reduce the risks, but also to compare conventional agricultural practices with possible alternatives as, for instance, organic agriculture. This is not considered by the indicator set. However, it would be interesting to investigate the relationship between risks calculated and percentage of surface used for organic agriculture. Which percentage could imply a significant change for the risks measured? (given that some of the products used in organic agricultural present a significant toxicity).
- This analysis should be accompanied by a cost-benefit analysis of the various alternatives, because risks and benefits are connected to all types of alternatives.

C. Constraints imposed by the objective of the indicator set

The indicator set has a function in the context of the PRP. It takes only those risks into consideration that are linked to agricultural use of pesticides. Consequently, it is difficult to compare the results that come out of the indicator set with observations on the spot, because not all the factors that pose risks for bees are related to (agricultural) pesticides use. Obviously, an indicator set that allows for such comparisons would be better and scientists should, hence, try to modify it in this vein.

D. Future risks?

The citizens suggest taking future risks into consideration, i.e., risks linked to molecules that industry will introduce in the future. This poses a problem because industry is not inclined to provide information on future strategies.

E. Aggregation methods?

- The citizens understood that different risk aggregation methods are possible and that preferring one method to another (amongst those that are scientifically relevant) depends on politics. They even expressed the concern that the choice for a particular aggregation method would be influenced by its results: it is tempting for politicians (or related civil servants) to choose the one with favourable results in the context of the PRP. One indeed has to formulate first which kinds of risks one wants to monitor and then look which of the aggregation methods is appropriate, rather than *vice versa*.
- Citizens' suggestion to fix thresholds for each indicator separately, next to a global figure, is interesting.
- The discussion with citizens about aggregation methods showed both the possibilities and the limits of this kind of interaction. Some of the suggested ideas where scientifically sound, while others came from a good problem framing but the proposed solution was not acceptable scientifically. The responsibility of the scientist here is to translate good ideas in sound scientific concepts.

F. Better data/Missing data

- It is indeed correct that some data that are possibly very useful are missing, despite the severity of data collection imposed by the authorisation procedures for new products. It is also correct that chronic effects can emerge from mixes of low doses of substances.
- The citizens suggest that centralised data bases should be created. Public authorities are working on it.

3.3.2. FUNDAMENTAL MODIFICATIONS OF THE INDICATOR SET

Due to his reflections as a result of the citizens' workshop the expert developed a list of possible fundamental modifications.

- Introducing spatial relationships into the indicator set (distance to the field, adjacent fields, horizontal pesticides movements, etc).
- Refining the indicator set from the phyto-sanitary practices point of view
- Developing the indicator set in a more holistic direction, so that a) it gives an idea of the global effect of pesticides use on an ecosystem rather than on separate compartments and b) it takes cumulative effects into consideration. This is, however, unavoidably a long term endeavour.
- According to the citizens (and the expert) risk indicators should in principle be allowed to include all kinds of risks, especially those that can be observed on the spot in the post-commercialisation phase. However, there is a consensus at the European level amongst many experts that pesticides risk indicators should remain as close as possible to the regulation process (directive EU91/414 describing the authorisation procedure). Consequently, there are things that are not presently considered. One example could be the fact that concentration of pesticides in pollen is not considered. If this risk is

demonstrated on the field, then we should consider that even if not taken into account in the authorisation process.

- Some citizens suggest to work on the effects, namely on observed mortality rates. Scientifically spoken, this is an innovative idea (up to expert's knowledge, there are very few indicators using that principle, amongst them a Canadian bird pesticide risk indicator). It presupposes, however, fundamental research for which, presently, no budgets are available in the expert's institution.
- They even suggest taking wild species that are close to bees as an indicator. This suggestion was directed at the scientist specialised in entomology who was invited as stakeholder in PEPAM. This means that citizens also challenge stakeholders, next to the PRIBEL expert.
- Citizens' suggestion to consider the indicator set problem from a European or even planetary perspective urge to reflect on the effects of the transportation of pesticides over long distances (e.g. by wind).
- Citizens' suggestion to take cumulative and synergetic effects into consideration poses serious problems since there is a striking lack of data in this respect. This is certainly an important research topic.
- The suggestion to take the selectivity of a product into consideration is interesting.

3.3.3. CHANGES IN THE EXPERT'S INTERPRETATION OF THE INDICATOR SET

A. Clarifying the indicator set, its hypotheses, its context

- The expert's participation in the preparation, performance and analysis of the participatory exercise made him conceive his responsibility in a different way. The kind of projects he is involved in are heavily goal-driven, and short-term. In many cases, this implies that there is no time to acquire a general perspective on the problem even from the scientific point of view. The PEPAM project left him no other choice than taking the time to read to acquire this more general view because citizens are not constrained and pose the problem very openly. As an example, he is involved in aggregation of risks, so his job did not directly relate to the bee indicator itself. The fact of being confronted with bee-keepers made that he had to read about toxicity for bees more in detail. He sees this as a more responsible and 'civic' way of doing science. On the contrary, when you are pressed by time (i.e. budget), you choose conventional and accepted solutions which prevents you from considering alternatives (alternative indicator sets, considering more factors, but also alternatives practices).
- Citizens' persistent references to a multitude of factors have influenced the expert's contribution to a future research project. Part of this research project will be devoted to a comprehensive description of the possible factors that constitute the bee-problem.

B. Added value and relevance of the indicator set

- The expert agrees with the citizens that the indicator set should evolve more towards a monitoring tool: it should be based more on observations on the spot and less on data regarding sold quantities and toxicity.
- The indicator set should perhaps be considered as a compromise that introduces at least the idea of reducing risks.

- Some citizens challenged the usefulness of the indicator set by saying that the kind of risks the indicator set is calculating (based on acute toxicity) can be easily seen on the field by bee-keepers, while the chronic risks are not taken into account in the indicator set, and can not easily be seen. According to the expert, this is a misinterpretation of the indicator set. This indicator set is useful in the sense that it allows a broad view of the problem, at the national scale, and takes into account data that are not accessible from the local point of view: sold pesticides quantities, cropped area, etc. Moreover, it allows to make a monitoring in time.

C. The indicator set as a tool: the sieve

One citizen compares the indicator set to a sieve. The expert considers this metaphor as very instructive. It allows him to look at the indicator set with different glasses. This metaphor allows him, first, to see the indicator set more as a tool to select pesticides, rather than to calculate risks. Consequently, the strategies of industry and the effects on agricultural practices come on the screen. Secondly, the metaphor points to the pesticides not retained and going into the environment where they can interact with each other. Since we cannot exclude the possibility that strong toxic synergies exist between pesticides with low toxicities when taken separately, one should conceive the hypothetical possibility that using the indicator set to discard some pesticides and introduce others, results in raising rather than lowering risks.

D. The indicator set as a tool: an executive dashboard

Another citizen compares the indicator set with a business executive dashboard. The construction of a business dashboard implies that indicators must be selected according to the activity of the users of the dashboard, and selection must end with indicators that reflect at best the evolution of this activity, and in particular abnormal evolutions. Indicators in the dashboard must be selected in order to give the opportunity to act on the factors that determine their value, in order to take corrective actions. This metaphor points, again, to a particular *use* that can be made of the indicator set, in this case, by the public authorities who will try to influence indicators by taking particular measures. Both metaphors point to the fact that the indicator set will be used as an instrument to realise particular objectives rather than to observe evolutions.

E. Neglected risks/uncertainties

The citizens dealt extensively with the topic of neglected risks. Experts are aware of three types of risks that are not generally taken into consideration in indicator sets: risks that cannot be calculated, hypothetical risks and unknown risks. Risks induced by using the indicator set have, until now, been overlooked by the experts.

Known, but incalculable risks

The expert is aware of – and even introduced via his own presentation of the indicator set - most of this type of risks mentioned by the citizens. The expert justified the neglect of those risks arguing that not enough data or knowledge are available. This argument was not accepted by the citizens.

Hypothetical risks

Citizens questioned the fact that risks of using seed-dressing pesticides are considered to be zero in the indicator set for bees. This type of risk previously was an unknown risk, but has now evolved into a hypothetical risk from a scientific point of view.

Unknown risks

Another citizen touched this topic by referring to the history of commercialised molecules which, in a later phase, had to be withdrawn from the market. The problem of unknown risks is, hence, a relevant topic.

Risks induced by using the indicator set

See the section on the sieve. The expert considers this as an important learning aspect for him and also as a significant output of PEPAM

F. Worst cases

The discussions with the citizens made the expert reflect on the meaning of the concept of 'worst cases'. While, initially, the expert understood this concept as a way of taking uncertainties into consideration, he considers it now as the result of a political decision. It is, indeed, possible that important uncertainties are not covered by this concept.

3.3.4. MORE GENERAL QUESTIONINGS

A. Who plays the role of watcher?

Thinking about neglected factors and unforeseen risks, the expert asks himself who in our society watches the unforeseen. Many organisations that are supposed to play this role take known risks as a starting point. Scientists hardly detect the unforeseen, they mainly come to the fore when measures have to be worked out *a posteriori*. It seems that it is mainly citizens, persons who are directly involved and their organisations who take initiatives to get unforeseen risks recognised. Shouldn't scientists play a bigger role here?

Some citizens suggested involving physicians in the assessment of chronic effects of pesticides use. This is an interesting idea to contemplate.

B. Feedback

Citizens propose that the indicator set should be flexible enough to integrate feed back information from persons that work on the spot. Such flexibility presupposes an iterative process. Since the indicator set will be used in a policy context this 'flexibility' is something that should be institutionalised.

C. The local level

- The indicator set allows assessing risks that cannot be observed directly by citizens. This understanding causes unease with citizens.
- The expert agrees that he should, at least, spend some time to be directly confronted with the practices on the local level. It is interesting for the expert to gain an overview of the factors that constitute risks, even though the indicator set only takes (some of) those factors into consideration that relate to pesticide use.

D. Meeting with stakeholders

- Thanks to the fact that we had the opportunity to interact directly with the stakeholders in this project, we gained a better insight into the different stakes. It is relevant for us, experts, to be aware of the roles we can play within this field of stakes.

- One of the stakeholders was another research team. They performed a kind of external audit of our indicator set – with citizens as witnesses - and this was a special, but – for both research teams - interesting experience.

E. Politics

Citizens expressed several political opinions and visions of our society. We experienced that some of these topics cannot be separated from the scientific content of the indicator set, contrary to prevailing beliefs.

- Citizens questioned the political frame of our indicator set. How will the indicator set be used? These are questions for which experts cannot play deaf. The expert even asks himself whether debates regarding the role that the indicator set should fulfil in society should not be an obvious part of its development process.
- Many questions uttered by citizens testify of their distrust in industry.
- Citizens also questioned the independence of scientists. The expert is convinced that participatory exercises can help to clarify the (economic, political) position of experts, because they offer a good deal of transparency. Is this, however, sufficient?
- Citizens mention the 'polluter pays' principle to indicate financial resources for scientific research regarding alternatives to pesticides use. We should avow, indeed, that not much money is spent to research regarding, for instance, organic agriculture.
- One citizen suggests using the methodology developed in the PEPAM project to deal with the pesticides problem on the local level. This is an interesting idea, but it would change the aim of the participatory exercise, namely, involving citizens in the management of risks of pesticides use rather in their assessment. The expert questions whether it is necessary to organise the participatory exercise at the local level if the latter objective is at stake.
- Citizens are aware that the risk levels that are deemed acceptable result from political decisions. Scientists have translated this question by defining 'worst case' scenarios (generally the 5% highest risks). These represent not so much the highest level risks, but risks higher than 95% of the risks considered as plausible. This figure of 95% is in fact a technical norm, which allows for circumventing the question of which risks are acceptable and which are not.

F. Without pesticides?

The fact that citizens expressed their opinion on this topic raised the expert's scientific interest. He wonders whether scientific research comparing various agricultural scenarios on a global (world) level has been performed.

G. Pluralism as a means to objectivity

- Citizens' idea to let two different research institutions perform calculations in order to guarantee objectivity inspires the expert to reflect on advantages and disadvantages of making the indicator set an open source as a means to allow for peer reviews. Expert's opinion is that classical peer review (scientific papers) is not sufficient any more when dealing with indicator sets that present themselves as complex programs, since results can hardly be reproduced by others without the program.
- Citizens' observation that scientists of different institutions do not very often discuss their mutual research activities in a profound way is right (they often know each other's work

only through published papers or 10 minutes congress presentations). That discussion happened in this research project is due to the presence of citizens.

H. A historical perspective to add?

As the citizens suggest, it would indeed be interesting to make a historical overview of changes in the official perception of the toxicities of various active substances. Which percentage of substances that were once authorised still remains?

I. Participatory research

Citizens' idea to involve bee-keepers (or farmers, or other concerned persons) with scientific research can, indeed, have positive results. It could complement the kind of participatory exercise performed in this PEPAM project.

J. Stakes related to the indicator set

The citizens succeeded in grasping some of the general economic, political and environmental stakes that are reflected in the choices and decisions made within the indicator set. They also understood that preferring one indicator set to another is not unequivocally because of scientific reasons, but also because of political reasons.

The expert was already familiar with most of the stakes that citizens mentioned. He deems, however, that one stake mentioned, namely how the indicator set will be used, is very important. In this respect, he found it interesting to watch how the various stakeholders are still working their way to determine the use of the indicator set.

3.3.5. CITIZENS MIRROR THE EXPERT'S WORK

Though citizens remained gentle, they mirrored, nevertheless, a particular image of the expert and his work. Confrontation with citizens unavoidably entails this risk, but the expert considered this experience instructive. Here are some elements of this image:

- Scientists should focus more on (both the advantages and disadvantages of) natural processes, on old practices or practices of other societies as a source of inspiration.
- They should have more contact with persons on the spot and with their practices.
- The normative content of their work should be considered.
- They should be more independent from industry, lobby groups, politics.
- Their research should be more fundamental, transparent, interdisciplinary, prospective.
- Scientists should be more aware of the limits of their knowledge and instruments. According to citizens, it is scientists who introduced many of the risks they now try to assess, and it is also scientists who can possibly define solutions to the problems they caused.
- Not so much science itself, but the use made of it should be considered as a problem.
- Science should regain a more realistic, i.e. more relative position within society. Citizens conceive both of a horizontal (everybody controls everybody) and a hierarchical (council of sages) control (the group was divided regarding these two options).

Though many of the above topics are part of larger philosophical and sociological discussions, the expert testifies that they are not simply theoretical matters, but things that he is concretely confronted with while performing scientific activities.

3.3.6. CONCLUSION FROM AN EXPERT PERSPECTIVE

The discussion with citizens about aggregation methods showed both the possibilities and the limits of this kind of interaction. Some of the suggested ideas where scientifically sound, while others came from a good problem framing but the proposed solution was not acceptable scientifically. The responsibility of the scientist here is to translate good ideas in sound scientific concepts.

To start with, scientists definitely need time to integrate into their scientific work, both in a direct and in an indirect way, things they learnt from a citizens' workshop. This time should be provided in a future research project.

The expert retains the idea to involve other research teams in his scientific work and to realise contact with the persons and practices to which his scientific work relates (and not only those involved in its own projects).

The expert already put some topics on the policy agenda of the reduction plan. He, for instance, tried to convince the responsible politicians not to restrict themselves to one single figure to reflect a complex reality, but to make use of several figures. He also mentioned the relevance of a list of products that are retained/ removed, in addition of the simple aggregated risk.

The expert judges positively the idea to organise the participatory exercise at a local level. He adds, however, that to reap the benefits connected to a local exercise, much more time is needed both to explain the indicator set and to prepare the exercise (including an interactive model).

4. DISCUSSION

4.1. EVALUATION OF THE PEPAM PROJECT

4.1.1. FOCUS ON THE BEE-INDICATOR AND TWO TYPES OF PARTICIPATING CITIZENS

The researchers focussed on the testing of the bee-indicator and of the aggregation methods. The bee-indicator is one of the seven indicators that are part of the PRIBEL indicator set. It was chosen due to influences from the policy context in which the PEPAM research project took place. The selection of this bee-indicator as a focus for the participatory exercise had an influence on the selection of the participants and the invited stakeholders for this exercise, on its location, and on the contents of the various presentations that were developed as tools to communicate with the participants.

We were aware that choosing this focus implied a risk. We were not sure beforehand that the participatory exercise would not be abused by some participants and stakeholders to strengthen their own position within the Walloon bee-controversy. If this would be the prevailing stake, it would hamper sincere reflection and deliberation on the bee-indicator itself and, consequently, it would prevent the research team to conclude whether a participatory exercise could succeed in realizing its principal objectives.

Now we can conclude that the bee-controversy did not jeopardise the participatory exercise. Many participants and the PRIBEL expert expressed that they learnt a lot from each other and from the stakeholders' presentations. Nevertheless, the risk to lapse into a polarised discussion was present. One participant clearly expressed, both verbally and physically, that he was only prepared to participate as a defender of a predefined position, namely that of a bee-keeper who accuses scientists of not recognizing particular pesticides as the main cause of bee mortality. Thanks to the presence of another bee-keeper with a more open attitude, this position could be questioned and discussed.

From this experience we learn that, for future participatory exercises, some precautions should be taken in order to reduce the risk that a controversy does hinder genuine deliberation. When selecting participants one should distinguish between 'citizens' – persons with an interest in the topic but without direct concerns – and 'local stakeholders' – persons with an interest in the topic and with direct concerns. Both groups of persons have a valuable role to play and precise instructions regarding these roles should be provided during the participatory exercise. Persons with a direct concern should be invited to act as witnesses, i.e. to share their concrete experiences and the links between these experiences and their particular concerns. Persons without direct interests are invited to formulate more general, public concerns. Both groups of participants are, then, asked to balance the (rather short term) particular concerns of the local stakeholders against (rather long term) public concerns and to suggest ways to accommodate both.

4.1.2. SELECTION CRITERIA, LOCATION, LEVEL

A. Selection criteria for the participants

We decided to recruit two general kinds of participants: citizens and stakeholders. They were assigned different functions. Citizens are the main participants who have the task to discuss the indicator set through all the weekend. And the stakeholders (representatives of industry, environmental organisations, farmer organisations, bee-keeper organisations, of the Minister's cabinet that is responsible for the Pesticides Reduction Plan, responsible administrations) were invited to present briefly to citizens their point of view on the PRIBEL indicator set and on the Reduction Plan in order to inform and help citizens to construct their own view and evaluation of the indicator set.

Within the group of citizens, we distinguished the six citizens with a direct concern, linked to their profession, with the topic (3 farmers, 3 bee-keepers) and the six with an indirect one (4 consumers, 2 gardeners). This criterion (direct or no direct concern) came *a-posteriori*, we first started by taking people from a single region that had all 'something to do with pesticides' (consumers, gardeners, farmers, bee-keepers) because we supposed that it could bring into the discussions interesting elements based on the different points of view. Our assumption was correct, nevertheless some disadvantages appeared too. In order to explain and take these into account for a future experience, we elaborated the distinction 'citizens with direct and no direct concern. This was explained above (see p. 27) and we concluded that the distinction 'ordinary citizens'/'local witnesses' would be more relevant when selecting participants and consequently when assigning them their different function.

Two other selection criteria were added to obtain sufficient diversity in the group: sex and age. About sex, it is worth noting that on 12 participants, there were only 2 women. This is linked notably to the fact that citizens with direct concern were mainly men. About age, one participant was very young (17), perhaps too young and he did not participate as actively as the others. We also assume that the length of the workshop made the participation of young parents less obvious. It is what we observed through the average age of ordinary participants. Nonetheless what is important to remember is that these classical variables were not selected in order to *explain* the differences of discourses but to *stimulate* them. A future exercise should stress the question of the representativeness of the members of the panel and with this, the question of the status of the results of the workshop.

We fixed a common point for selected citizens, namely, living in the Dijle valley. This refers to the local dimension of their discourses, interests and experiences that we expected (see p. 13). However this criterion could not be fully respected, due to the fact that there were few bee-keepers and organic farmers in the Dijle valley, and we could not take the risk to do the exercise without them, since it was a political demand to work with the bee-indicator. Another common point was, as we observed, the motivation of participating citizens. We observed that they conceived of the 40€ offered more like a compensation than a real incentive. This commonality does not mean that participants had the same motivation, but that their participation was really voluntary, i.e. not mainly motivated by this remuneration received. For a future exercise, it is important to continue to offer compensation to participants - this is also a means to recognize and thank for their effort - but to pay attention to its amount in order not to transform it into a main incentive. We argue indeed that personal engagement (as different as it can be) remains a precondition for a high quality of debates.

The fact that citizens did not know each other before the workshop was also a criterion. This criterion was possible in the case of 'ordinary citizens' but hardly in the case of farmers and bee-keepers who live in the same region. Nevertheless, it had significant consequences for the possibility of expressing themselves freely, what was expected in this case. The objective was

not to achieve a consensus but to produce a diversity of opinions. Another precondition to give citizens the opportunity to say what they really think is a suitable size of the group. The bigger it is (more than 15 participants), the less time everybody has to express him- or herself and the less they feel confident. These are two important conditions. We conclude that twelve participants, in our case with our means, was a good number.

Finally, it is to be noted that we recruited participants ourselves. Consumers were recruited on the local market at Court St Etienne. This took a lot of time and energy but it offered a first contact with citizens (interested or not) that appeared very useful. We learned, notably, that despite the length of the workshop, people were interested by this kind of project that lets citizens pronounce themselves on these topics. Some days before the workshop we received phone calls from persons who wanted to participate and we had to refuse them. It is worth underlining that people of this region seem to be particularly inclined to participate at such projects. On the other hand, we learned that a lot of persons felt unable to participate at such a discussion regarding a scientific indicator set and its construction. Having identified this feeling before the workshop, it got us to include this dimension in the introduction of the workshop, where we explained to the participants that we know that they are no experts and that we aim at a collective learning process throughout the workshop.

B. Location and level

We chose to organise the participatory exercise on a local level with local people since we started from the supposition that risks depend on the characteristics of a specific region and on the particular way farmers use pesticides. Moreover, we wanted to see how local participants would discuss the problem of risk aggregation between different levels, from the local to the national.

We have to say that finally this local aspect was not at the core of the discussions between participants. Even though this dimension was not stressed by the PRIBEL expert himself (notably due to time limits), it is worth noting that citizens did not put it on the table any more. Although many citizens came from the same small region, they did not know each other and did not express the feeling of belonging to a same territorial community. On the contrary, they adopted another kind of attitude that seems to be linked to the citizen position (see before on p. 28-29). This refers to their will – and capacity - to focus less on private questions than on general ones, like, for instance, the role of science, agriculture, lobbies, and so on. This remark implies that if discussions regarding local dimension aspects are important for the future, it is worth reflecting on how to suggest and introduce them. At least three proposals have to be considered. First, explaining, stressing and illustrating this dimension in the presentation of the indicator set (for example by running the indicator set in an interactive way with local data and at the local scale). Second, selecting participants from different Belgian areas seems to be a possibility to make this question emerge because of the divergences of views between participants (and in the PRIBEL case, this is more adapted to the data we had at the beginning of the project, which were mainly at the regional, not at the local level). Three, evaluating the relevance of this question in relation to the expected citizen positions.

Practically, it is to note that the location (at Court St Etienne) where we organised the workshop was not very comfortable for the organisers. The research team still had, for instance, to clean the meeting room and to organise a catering service and audio-visual aids. But it was not too expensive and easily accessible and not intimidating for the participating citizens, which is an important point.

4.1.3. STRUCTURE

In this section we will pay attention to the elements of the structure of the participatory exercise that should be improved in a future exercise.

Firstly, a crucial point is the presentation of the research team to the participants at the beginning of the workshop. We made acquaintance with the various persons present (facilitator, PRIBEL experts, representatives of public authorities, stakeholders, local people) and their role in the research and in the week-end but we forgot to really present ourselves. Our own presentation should not be neglected because, as we tried to explain to the participants, we have to make our positions and the rules of the game as transparent as possible. Moreover, as we participated at the workshop with the aim of listening to and observing citizens, we should not forget that we were also observed. The fact that we were numerous (6) and in the same place as the participants reinforced their need to understand who we are, what they immediately asked to us, expressing their strange feeling of being observed with such attention. It seems to be a practical detail but it may have major influence on the quality of discussions, by creating confidence or not. The meal offered the first day and the aperitifs played a rule in helping to correct this initial mistake.

Secondly, the stakes of the project have to be presented and repeated at various times of the workshop. We did it at the beginning but citizens asked us to explain it again at the end of the weekend. It demonstrates that one presentation is not sufficient and that this question is crucial for participants. It refers, notably, to the political and/or scientific mandate assigned to this workshop.

Thirdly, the preparation time with the facilitator should not be neglected given the fact that the facilitator is the guardian of the structure but that the structure has to remain a means to reach our objectives. An important constraint which the facilitator had to face was time (one day and a half). In order to bring citizens to build their opinion and discuss the indicator set, it was necessary to present them information from the PRIBEL expert himself and from many stakeholders. This implied a strict distribution of speaking time between citizens themselves, between citizens and the expert, between citizens and stakeholders, and between citizens and organisers. It also implied to define - with the facilitator - which kind of discussions we expected. The facilitator prioritized, for instance, the 'round table' technique rather than interactions or debates between people. For a future exercise we argue that a first 'round table' has to be kept because of its capacity to promote equitability in the expression of the various participants. We argue, however, that interactions and debates also have to take place because of their capacity to make various points of view emerge and evolve. Regarding the distribution of speaking time, we chose to give more time to discussions between citizens themselves rather than with the PRIBEL modeller and the stakeholders. In a future exercise time for discussions between citizens themselves has to be kept and more time has to be spent to interactions between citizens and stakeholders on the one hand and between them and the modeller on the other. Consequently, more time is needed to perform a future participatory exercise. This is possible, for example, by using a supplementary afternoon. The solution found in our case was to allow citizens to write their personal reflections on sheets, with the inconvenience then that these ideas are not submitted to the collective discussion and difficult to analyse. Another point to prepare with the facilitator before the workshop is the type of questions that have to be addressed to the citizens. We should clarify more exactly if we want, for instance, their ideas, their amazements or their proposals.

Fourthly, the previous remark brings us to underline the necessity of defining 'procedural' rules in such a participative experience, but also the necessity of reflecting on their consequences - or their meaning - for participants and researchers. For instance, from the point of view of the facilitator, it is easier to manage a round table than inviting people - not used to it

- to express themselves in a debate. Another example, from the point of view of some citizens, is that the strict distribution of speaking time is frustrating while, for other shyer ones, this is a precondition to express their opinion. Another procedural rule, important for stakeholders, was the respect of speaking time but also the fact that stakeholders were not allowed listening to each others' presentation in order to avoid that they would adapt their discourse in response to the previous presentation. Consequently, researchers and facilitator had to be attentive to these aspects before and during the workshop because they form part of the preconditions of the success of the exercise.

Fifthly, one difficulty we experienced with the facilitator concerns the precise definition of the objective of the workshop. As we told before, this was particularly difficult because the scientific and political contexts were still evolving and because of our exploratory approach which presupposed not to fix a priori what questions can be asked by the citizens and what opinions regarding the intended use of the indicator set are relevant or not. We argue indeed that the specific objective of this kind of participative exercise is precisely to give the possibility to the citizens to express any views on the problem and, then, possibly to (re-)frame it. For a facilitator who is external to the research project, this kind of exploratory approach can appear difficult to imagine and to manage.

4.1.4. PRESENTATIONS

In order to evaluate the various presentations, we will analyse whether they provided sufficient information regarding a) the technical functioning of the PRIBEL indicator set, b) the policy context in which and for which the indicator set was developed, c) the choices made within the indicator set and the reasons for these choices, and d) the impacts of the choices made both for the local and the national level.

a. The technical functioning of the indicator set

Three presentations were given before the participative event

1. The first technical presentation ('Pesticide control tools') presents some general theoretical concepts (hazard, risk, risk indicator) and principles (necessity to chose between types of damages, compartments, stages of development, spatio-temporal contexts; methods to gather and/or define data; ways to calculate risk indicators and to combine them for several compartments).
2. The second technical presentation ('POCER-II') goes into the characteristics of the PRIBEL indicator set as it evolved from the earlier indicator sets POCER-I and –II. It explains that while POCER-I counted 9 and POCER-II 14 compartments, PRIBEL takes 7 compartments into considerations: consumers, applicators, birds, bees, water organisms, earthworms and ground water. It also explains that the risk indicator is, after calculation, transformed into a risk score, that aggregations are made based on a distribution frequency both in function of space, time and active substance, that the final index is based only on risks considered to be excessive, and, finally, that the compartmental aggregation procedure is related to the appreciation of stakeholders. This presentation remained too abstract for the social-scientific amongst the members of the research consortium. Understanding the technical functioning of the indicator set presupposes illustrations of how the indicator set works: which data are used as an input, where does one find these data, what are the outputs of the indicator set, how should these outputs be interpreted.
3. The presentation developed for the stakeholders elaborates on the previous presentation. It shows step by step how the bee-indicator is constructed and how

they can be aggregated for several substances, several regions, several time intervals. It illustrates, moreover, with concrete figures that a wide variety of interpretations regarding the gravity of risk are possible depending on the type of aggregation one uses.

Two more presentations were given during the participatory event.

1. A presentation that explained the concept of risk and the exp/tox indicator.
2. For the second presentation developed for the citizens much attention was paid to the accessibility (many drawings) aspects of its design. It illustrates the various choices the expert has to make in the PRIBEL indicator set, but it does not provide reasons or motivations for the choices that are actually made. Contrary to the presentation developed for the stakeholders, it does not illustrate the results of choosing one or another aggregation method with concrete figures either. Consequently, it does not become clear what concrete results can come out of the (various interpretations and uses of the) indicator set when used at the local level of the citizens.

The latter presentation was a good, first introduction to the indicator set. However, more is needed to get a clear idea of how the indicator set with its inherent choices functions and to see what the various aggregation methods bring about. Therefore, it would be interesting to investigate whether the indicator set can be translated into an interactive indicator set, so that citizens can themselves substitute concrete data into the indicator set – for instance data they derive from their own gardening or farming practices - and check the concrete results that come out of the indicator set. According to the PRIBEL expert, this does not mean that citizens will play directly with the indicator set. The interface between the indicator set and the citizens is the expert, both for introducing new scenarios in the indicator set and for allowing dialogue regarding the way the indicator set is constructed and works.

b. The policy context

The presentations dealing with the policy context mainly explain the PRIBEL indicator set as one aspect of the Belgian federal Pesticides Reduction Plan (PRP), next to other aspects such as improvement of information, sensitisation, transparency, adaptations to the authorisation system for pesticides and to the system of traceability, separation between professional and non-professional use of pesticides, introduction of a spraying licence, setting up of fourteen sectorial working groups in charge of defining reduction strategies, and so on. Less attention is paid to the European and wider international context. The European 'Thematic strategy on the sustainable use of pesticides'[20] is, for instance, not mentioned and this 'Thematic strategy' is not situated as part of wider, international policy endeavours to reduce the risks of pesticide use. Nor is attention paid to the fact that the national PRP is one possible interpretation of the European 'Thematic strategy' amongst others. The refusal of Denmark to make use of an indicator set to assess risks and its strategy to fully stake on reduction of the use of pesticides is, for instance, very instructive.

We expected that the presentations of the representatives of industry, of the farmers and bee-keepers organisations and of the environmental organisation would provide the citizens some information regarding these stakeholders' interests and concerns with regard to the PRIBEL indicator set. They did indeed. The representative of industry told, for instance, that it is possible to use pesticides that are less risky but that they are often rather expensive, while the representative of the farmers' organisation expressed his concern that the industry could use the indicator set as a means to remove cheap pesticides from the market and replace them by more

[20] (COM(2002)349 final; see http://europa.eu.int/scadplus/printversion/en/lvb/l21288.htm, consulted November 4, 2005)

expensive ones. We did not get the opportunity to make a more complete analysis of this type of elements.

c. Choices and reasons

The various presentations, both the technical ones and the ones referring to the policy context, mentioned various choices that had to be made to construct the PRIBEL indicator set. The reasons for these choices were, however, rarely provided. Why 7 compartments? Why the 7 compartments mentioned? Why only acute bee mortality as a risk considered relevant within the indicator set? Why is the particular formula chosen for the risk indicator? And so on. We suppose that it is possible, in a future real scale exercise, to make the link between choices and their reasons more explicit (see the RIVM guide). Making these links more explicit would allow that citizens' evaluation of the PRIBEL indicator set is based on more precise and comprehensive information.

d. Impacts

The presentations did not give much information regarding the concrete impact the use of the PRIBEL indicator set could have for the citizens at the local level. Which pesticides will remain on the market and which will be replaced? Which agricultural practices will be stimulated and which will become more difficult? What will be the consequences for the bee-keepers? And for the consumers? It would be interesting to consider methodologies to explore these questions more extensively in a real scale participatory exercise. However, in our test it was hardly feasible since these questions were still under debate within the 14 sectorial working groups of the PRP.

4.2. COMMENTS OF SOME STAKEHOLDERS ON THE PEPAM PROJECT

A meeting with the involved stakeholders took place on 19th December at CERVA. To this meeting attended a representative of CERVA, the coordinator of the Pesticides Reduction Plan and his colleague, a representative of a bee-keeper organisation, a scientist with expertise regarding bees, a representative of the pesticides industry, and two representatives of an environmental organisation. The King Baudouin Foundation and the cabinet of the Minister of Public Health were not represented.

The aim of this meeting was to present to and discuss our results with stakeholders in order to collect their impressions on their own participation to the workshop and their suggestions for a future exercise. The PEPAM project was not focused on the participation of the stakeholders. Nevertheless, it is interesting to underline that we can learn from their own learning processes.

Stakeholders expressed different remarks regarding the presentation they had to make to citizens. They pointed to the difficulty to be clear and transparent (not hiding some important elements on the pretext of having not enough time) in such a short time of speech (10 minutes). The fact that they did not know exactly which kind of citizens they would face to stressed this difficulty. However, nobody can exactly know this in advance because citizens interact with each other and this makes group effects not foreseeable. Another difficulty stakeholders encountered during the preparation of their presentation was the fact that citizens were few informed on the topic. This implied explaining elements in an understandable way, neither too complex nor too simplistic. Thus some stakeholders told us they were torn between addressing their presentation to the PRIBEL expert or to citizens, because of the significant difference of discourse to adopt. In the same order of ideas, something they also underlined concerns the clear definition of the objective of their message: should they focus their presentation on the functioning of the indicator set, on the bee keeping situation, on the contextualisation (deconstruction) of the indicator set or on their suggestions for improvement (reconstruction), etc. ?

What seems important to conclude from these remarks for a future research project is the attention (and the time) to attach to the stakeholders' preparation. On the one hand, this preparation has to be done by the stakeholders themselves (expressing clearly their position and evaluation of the indicator set) and on the other hand, this preparation has to be guided by precise information regarding the expectations of the research team towards the stakeholders. Some stakeholders suggested to organize a repetition before the workshop where each of the stakeholders would present his or her presentation in front of the others in order to improve it (timing, objectives reached, ...). Other stakeholders opposed to this. They prefer not revealing their position before the workshop. It shows us that whatever rule is chosen (repetition before or not), it is important to clearly announce the rule to everybody in advance.

Another conclusion for a future research project is the necessity of foreseeing two distinct forms of stakeholder participation. A first form is to provide, before the participative event, the research team, both the indicator set expert and the social scientists, with information in order to deconstruct the indicator set. A second form is to provide citizens with information.

The stakeholders commented other aspects regarding the modalities of interaction with the citizens. Some of them regretted the fact that citizens first had to listen to the presentation and to ask questions afterwards. The majority of the stakeholders would have preferred more interactions with citizens in order to have the possibility of adapting their presentation to the citizens' expectations, questions and reactions. Interactions with citizens thus have to take the form of a discussion rather than the form of just 'questions-answers'.

A last concern of the stakeholders was about the representativeness of the panel. In other words, they wanted to know which weight to give to what had been said by citizens. This question brought us to conclude that we have to clarify various elements in a future research project, based on our experience. To start with, the composition of the panel was not built on demographical or democratic representativeness. What was aimed was a representativeness of the diverse positions with regard to the topic at stake. This conception had concrete repercussions on the type of analysis, the results and the use of these results. Therefore, in our case, it was clear that the ideas, criticisms and suggestions of citizens would not be translated into direct political or scientific actions. They were analysed and used in order to allow the research team to reflect and evaluate whether such an experience can be used by stakeholders and experts/modellers as a sink of new ideas that can help elaborating political and scientific propositions. This is why we did not aim at reaching a consensus but a diversity of opinions. If we would receive a political mandate to organise a participatory exercise (a real scale exercise or a punctual and local exercise) in a future research project, it is necessary to specify the expectations and the possible outputs of the participatory process. These outputs can *either* be concrete propositions for actions that would be literally expressed by citizens (in this case, the sampling would be very important; it is not our option) *or* propositions from researchers based on a diversity of citizen opinions and on the reflections and differing perspectives with regard to the topic these opinions caused to emerge. We are in favour of this latter option. But it is important to underline that these different options question in a different way the meaning of democracy in science, the role to be given to the citizens and their discourses, the panel's legitimacy, and so on.

In a general way, we conclude that stakeholders are in favour of another experience. They provided us with useful elements to improve the *dispositif*, both practically and analytically.

5. CONCLUSION AND PREVIEW

5.1. POSSIBLE SCENARIO FOR A REAL SCALE PARTICIPATORY EXERCISE

5.1.1. OBJECTIVES OF A REAL SCALE PARTICIPATORY EXERCISE

A first result we can derive from the test we performed in this very short research project is a more precise formulation of the objective of a participatory exercise. Since we understand the PRIBEL indicator set as a social construction that takes place in a particular (policy) context with the help of particular actors, the main objective of a participatory exercise is to test the societal validity of this social construction. This societal validity can, however, not be tested, without testing at the same time the capacity of the participatory exercise itself. Testing the capacity of the participatory exercise to provide useful information regarding the societal validity of the socially constructed indicator set implies

- ✓ Testing the capacity of the research team to explain the indicator set as a social construction
- ✓ Testing the capacity of the participants/citizens to understand the indicator set as a social construction
- ✓ Testing the capacity of the participants/citizens to evaluate the indicator set as a social construction and to motivate this evaluation
- ✓ Testing the capacity of the participants/citizens to formulate and substantiate suggestions for reconstructing the indicator set so that it remains scientifically founded and becomes socially more robust. A reconstructed indicator set remains scientifically founded and becomes socially more robust on condition that both scientists and citizens can – more than before - agree with the alternative choices made within the reconstructed indicator set and that this agreement is based on arguments that are substantiated both in a normative and factual way.

In order to realize these testing objectives, we suggest that the real scale participatory exercise should consist of the following elements.

1. Explaining and learning how the indicator set functions technically: which formulas and databases are used, which are the results. We suppose that the learning process will be supported if the participants get the opportunity to interact with the indicator set.
2. Deconstructing the indicator set, i.e. making explicit which elements – the (policy) context, the actors, their (reasons for) choices made within the indicator set - influence the construction of the indicator set.
3. Estimating the impacts of the choices made within the indicator set
4. Evaluating the indicator set: can participants agree with the functioning and objectives of the indicator set and with the reasons for and impacts of its inherent choices.
5. Reconstructing the indicator set, i.e. proposing alternatives for the constructive elements that the participants deem problematic and providing reasons for these

alternatives (e.g. through references to the contexts and motives of the participants themselves).

5.1.2. THREE TYPES OF WORKSHOPS

We suggest that the core of a full scale research project consists of three types of workshops.

- The first workshop is with experts of the indicator set, the authorities who are going to use the indicator set and the social scientists of the research team.
- The second one is with stakeholders (representatives of industry, environmental organisations, agricultural organisations, consumer organisations, …), experts and social scientists.
- The third one is with citizens, both citizens with direct concerns (farmers, bee-keepers, professional gardeners, retailers, …) and with indirect concerns (private gardeners, medical doctors, housemen and –wives, …), experts and social scientists.

A. The experts' workshop

The main objective of the first workshop is to deconstruct the indicator set with the experts who originally constructed it. This deconstruction can be organised in three subsequent steps. The first step consists of making the choices that are made in the indicator set explicit and of providing reasons for these choices. The Nusap methodology can support this exercise. The second step consists of a presentation of the policy context in which the indicator set is intended to be used. A third step consists of deliberating on possible impacts of using the indicator set in the policy context presented. Do the experts agree with this possible use? Or do they have some concerns? Are these concerns connected to particular choices that are made within the indicator set? The output of this first workshop consists of a matrix completed by the experts. The matrix looks as follows (Table 1).

Table 1: The experts' matrix

Choices	Reasons	Concerns

B. The stakeholders' workshop

The main objective of the second workshop is to complete and/or adapt the experts' matrix from the perspectives of the stakeholders and to provide a first evaluation of the indicator set. In order to realise these objectives, this second workshop should consist of the following steps. The first step is meant to understand the technical functioning of the indicator set. This step consists of an explanation of the indicator set and of interaction with the indicator set. In order to interact with the indicator set, the stakeholders make as much as possible use of the data they have themselves. The second step consists, again, of a presentation of the policy context in which the indicator set is intended to be used. In a third step, the stakeholders complete and/or adapt the experts' matrix and they add a fourth and fifth column: 'evaluation' and 'suggestions'. In the fourth column they give their evaluations of the choices that are made within the indicator set. In the fifth column they suggest other choices and argue why they would prefer these latter

choices to the former ones. The output of this second workshop will then be the following matrix (Table 2).

Table 2: The stakeholders' matrix

Choices	Reasons	Concerns	Evaluation	Suggestions

C. The citizens' workshop

The structure of this third workshop is mainly the same as that of the second one. Its main objective is, hence, to complete and/or adjust the stakeholders' matrix. The stakeholders' matrix that is completed during the previous workshop thus functions as in input to this third workshop.

One could consider the possibility to make two groups of citizens in order to perform the third step of this participatory exercise: one group with citizens who are directly concerned and one group with citizens who are not directly concerned. Each of these groups completes the citizens' matrix independent of the other group. An additional step of the citizens' workshop then consists of confronting both matrices and discussing the results.

A second objective of this additional step could be to evaluate not only the choices that are made *within* the indicator set, but also the choice *for* an indicator set as one tool among other ones in a strategy to reduce the risks of pesticides use.

The output of this third workshop consists of two types of matrices (Table 3 and Table 4).

Table 3: The citizens' matrix

Choices	Reasons	Concerns	Judgement	Suggestions

Table 4: The indicator set as a choice

Reasons	Concerns	Evaluation	Suggestions

It is still an open question whether the citizens' workshop should be organised at a national, regional or local level. We think that, if one succeeds in making an interactive version of the indicator set, the local level is recommended. Organising the workshop at the local level would allow citizens to use the knowledge and data they dispose of as an input into the indicator set, to see the results that come out of the indicator set and to become aware of the possible impacts that using the indicator set could have for their local community This concreteness can help citizens to evaluate the indicator set and to formulate alternatives. An additional advantage of organising several citizens' workshops at a local level is that one can investigate to what extent

the various participatory exercises provide common results for the indicator set itself, for its use, and for the strategy to reduce the risks of pesticide use.

If one decides to organise the citizens' workshop(s) at a local level, one has to define criteria in order to choose which and how many local places represent relevant socio-geographical research sites.

5.1.3. RESEARCH TASKS

In order to prepare, perform and analyse the three types of workshops that are previously suggested, the research team has to perform several research tasks.

To start with, a more extensive analysis of the policy context within which and for which the indicator set is developed should be made. This analysis will allow the research team to provide the participants of the various workshops with a justified selection of relevant information in this respect.

Secondly, the research team should investigate whether an interactive version of the indicator set can be constructed, so that the participants of the stakeholders' and citizens' workshops can use the data they dispose of as an input into the indicator set and experience the concrete outputs thereof.

Thirdly, the research team has to investigate the Nusap methodology and to explore ways to use it within the intended research project.

The main part of the research efforts are needed to organise, perform and analyse the various workshops. For each workshop, the research team has to prepare a substantial input. The input of the experts' workshop includes the analysis of the policy context and of the Nusap methodology. The output of this workshop, i.e. the experts' matrix (and a supplementary analysis of the deliberations that took place at this workshop), will serve as an input for the stakeholders' workshop, next to the analysis of the policy context and the interactive version of the indicator set. The output of this second type of workshop (and a supplementary analysis of the deliberations of this second workshop) will serve as an input for the citizens' workshops, together, again, with the analysis of the policy context and the interactive version of the indicator set.

The practical organisation of the workshops comprises a) defining the sites, b) selecting, checking and preparing the rooms where the workshops will take place, c) organising a catering service, hotel accommodation, transportation, d) selecting, inviting, informing and instructing participants, e) working out the protocols for the workshops together with facilitators, and f) preparing presentations to be held at the workshops.

5.2. ECONOMIC FEASIBILITY STUDY OF A REAL SCALE PARTICIPATORY EXERCISE

The structure we propose for a full scale participatory exercise is quite different than the one used during the test, and is quite more complex. The budget, hence, reflects this complexity.

Research tasks	***man.days***
Making documentation and developing a presentation regarding the technical aspects of the model and the history of the model	15
Analysis by the expert of the hypotheses and simplifications of the	15

Research tasks	***man.days***
indicator set (including bibliographical review)	
Analysis of the policy context (including bibliographical review, meetings, interviews) and development of documentation and a presentation	75
Investigation of the possibility to create an interactive version of the indicator set, adapted to the local context, with the necessary data. This is dependent on the indicator set considered. Estimation here is for the case of POCER	60
Analysis and adaptation of the Nusap methodology	20
Preparation, performance and analysis of the experts' workshop	160
Preparation, performance and analysis of the stakeholders' workshop	160
Preparation, performance and analysis of the citizens' workshop	160/citizens' workshop
Final (and other) reporting (dependent on how many citizens' workshops should be held)	60 + 20/citizens' workshop
Coordination and management activities	100 + 15/citizens' workshop
TOTAL	665 + 195/citizens' workshop

This means that the minimum amount of man.days is 860 or, in case three research institutions or involved to an equal extent, approximately 14,5 man.months per research institution. This means that the participatory aspect in a model or indicator development, as proposed here, is not an additional nice complement to the techno-scientific work: it is considered essential. However this can render the things more difficult since this may not be so easy to justify within current research funding programs.

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ANNEXES

ANNEX 1: DEFINITION OF THE OBJECTIVES OF THE PARTICIPATORY INDICATOR SETLING EXERCISE

Ideas that pop up to test the indicator set are, for instance, to investigate whether the PRIBEL indicator set

- can be used to monitor both conventional and alternative agricultural practices
- is flexible enough to make it applicable on a local level
- complies with the expectations and concerns of citizens, farmers, and so on (social robustness of the indicator set)
- is acceptable for local people in the sense that its results will generate acceptable policy decisions
- is a useful tool in order to reduce the risks of pesticide use
- is a valuable tool to stimulate discussions regarding scientific uncertainties
- can be used to structure debates regarding the problem of how to assess the risks of pesticides use for bees.

Testing the participatory exercise can mean investigating whether

- citizen participation can provide knowledge/information that helps the scientists and experts to decide whether and how (the functioning of) the indicator set and, more especially, the bee-indicator should be adapted
- the workshop can provide, more particularly, information regarding an appropriate way to aggregate various indicators
- the workshop provides information that allows the public authorities to adapt the way they (intend to) use the indicator set
- the workshop provides information regarding other ways to realise a reduction of the risks of pesticides use
- citizens can provide their opinions regarding the effectiveness of the indicator set as a tool to reduce the risks of pesticides use.
- citizens can provide substantiated arguments for their opinions
- citizens have the opportunity and ability to deliberate on the indicator set
- the experts succeeded in developing a tool to communicate with citizens about the indicator set
- the experts can learn from the discussions with citizens

ANNEX 2: STRUCTURE OF THE PARTICIPATORY EXERCISE

Saturday October 15, 2005

1. Welcome, General Presentation, 9:30 – 10:00

Objectives

- ✓ Understanding the context of the workshop (who are the initiators, what is the political context of this initiative, constitution of the fifteenth group)
- ✓ Understanding that the exercise is not meant to solve the problem of the bees/pesticides controversy
- ✓ Understanding the goal of the workshop
- ✓ Making acquaintance with the various persons present (facilitator, PRIBEL experts, representatives of public authorities, stakeholders, local people) and their role in the research & in this week-end

2. The policy goals and the functioning of the simplified indicator set, 10:00 – 13:00

Objectives

- ✓ Understanding the legal context for which the simplified indicator set is developed
- ✓ Understanding policy choices that are included in the simplified indicator set
- ✓ General presentation of the simplified indicator set and its history
- ✓ Understanding the consequences of some choices about some crucial items of the PRIBEL simplified indicator set
- ✓ Discussing the policy choices
- ✓ Understanding the 3 levels of discussion (How to reduce the risks of pesticides, the simplified indicator set as a device to measure these risks, the use of the simplified indicator set to measure risk reductions)

3. Stakeholders' perspectives, 14:00 – 16:50

Objectives

- ✓ Making explicit the stakeholders'
  - o comments and perspectives on the simplified indicator set (its functioning, its policy contribution)
  - o the amendments to the simplified indicator set that the various stakeholders propose
- ✓ Estimate how the opinions of the citizens about the simplified indicator set and the choices evolved after they heard the stakeholders

Sunday October 16, 2005

4. Citizens' perspectives, 9:30 – 11.30

Objectives

- ✓ Citizens formulate proposals, recommendations, advices

5. Evaluation of the test, 11.30 – 12.30

Objectives

- ✓ To evaluate if following objectives of the workshop were reached
  - o Can the organizers prepare a common ground for the discussion (test of the presentation of the indicator set)?
  - o Did citizens get the opportunity to deliberate on the indicator set starting from their own perspective, experiences?

ANNEX 3: TACIT ASSUMPTIONS, SIMPLIFICATIONS AND PRECONDITIONS IN POCER

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Analysing the assumptions, simplifications, choices and preconditions of a model can not be done independently from a particular usage of the model. Moreover, a model can not be considered alone, as a set of formulas: it comprises a certain ontology, which links parameters to 'real entities'. This ontology is to be found in documents describing the model, and in papers describing the particular usage of the model that is considered. The search for assumptions and simplifications is then done by comparison to a 'reference world', which is constructed by the 'state of the art' in the scientific publications, the particular use of the model that is considered, the socio-economic, politic and juridical context. The reference world is constructed by the person who is making the analysis, and must be made as explicit as possible. The reference world can be the defined through a participatory procedure, which is the purpose of PEPAM.

In this exercise, the particular usage considered is the use of POCER for estimating the evolution in time of risk linked to pesticides, in the framework of the pesticides risk reduction plan of the Belgian Federal Government.

We give here after a table where some characteristics of the model are compared to the chosen reference world. This analysis explains the context in which the model is constructed, not the particular opinion of the analyst about the assumptions in the model (this is done through the choice of a reference world that tries to reflects a diversity of views about this kind of models amongst scientists and model users).

Table 1. Assumptions, simplifications, choices and preconditions of POCER model.

Reference world	***Model***
Risk is defined as the probability of a given danger, and the danger is the damage resulting from exposure to a toxic substance. Information from experiments exists about mortality associated to increasing doses (probability of death) but is not widely available.	Risk is defined as $RISK = \frac{(\mathrm{EXP} * SAFETYFACTOR)}{TOX}$, i.e. exposure over toxicity. TOX is the amount of substance causing a damage chosen as reference (e.g. LD50, the dose which kills half of the population). EXP is the amount of substance to which the organism is exposed. The safety factor is chosen through negotiations involving political choices, and stated in legal texts. The risk can be > 1, which means that EXP/TOX is clearly not a risk according to the 'reference world'. It is called a risk indicator.

Reference world	***Model***
The relation between dose and risk is not linear.	The chosen risk indicator means that a probability of death of 50% is chosen as reference, and a linear extrapolation is done for the rest. Information about intermediary doses is lost. The model allows correcting this linear behaviour by 'scoring', which is a transformation according to a chosen curve. A linear transformation has been chosen, and the model presupposes that danger above the legal dose is constant (maximal). The form of the curve is not modifiable by the users. The consequences of the choice of a given scoring on the final risk calculated is still under investigation.
Additive and synergistic effects between pesticides exists, but are poorly studied. The reason that is given is that the number of combinations of substances is too big.	Additive and synergistic effects are neglected. Risks are mainly considered as independent. Aggregation of risks is mainly done trough the calculation of statistics of distribution of independent risks (like mean, percentiles, etc).
Risk should be measured in-situ (like birds death in relation to pesticides applied).	Risk is extrapolated from laboratory experiments, and often from data coming from species different that the one for which risk is estimated. Ecosystems are reduced to independent and representative species.
Pesticides are applied by farmers, but also in private gardens, in parking spaces, roads, railways, etc.	The model only considers risks from agricultural pesticides.
Consequences of an extreme and global decrease of the pesticides quantities used with a change in agricultural practices, are not well investigated. Historic cases of large phytosanitary epidemics date mainly from the 19th century. Investment on research on low-inputs agriculture is small.	The main variables that can be tuned for risk management are: • pesticide type • application type (date, amount, formulation, ...) A cost/benefit analysis is not done, and does not consider alternatives to pesticides. The quantity of pesticides used is supposed to be mainly linked to epidemiology and not to marketing practices. Risk management is the tendency to keep risk at an accepted level.

Reference world	***Model***
People are submitted to a multitude of risks, not only from pesticides. To stop the production of pesticides will decrease rapidly the risks linked to them, but other risks (often considered as greater) will remain, and suppressing pesticides can (according to some) generate other risks that are not presently submitted to a careful cost/benefit analysis.	Risks will always exist. The purpose is to keep them to an accepted amount.
EU directive 91/414 defines the conditions to accept a pesticide on the market. The goal of this directive (according to the commission) is to increase safety while allowing at the same time the production of innovative pesticides. If a product is accepted, it is considered that use of the pesticide in some agricultural areas is safe if application prescriptions are respected. However: ✓ Accidents and misuse of pesticides exists ✓ Unknown and hypothetical risks can become recognized risks after some time. The directive allows the withdrawal of old pesticides that are considered too risky according to legislation in force.	It is supposed that the use at doses superior to the legal ones is marginal. The non respect of the safety measures (gloves, etc) is considered. Accidents and illegal behaviours (like rinsing pesticides recipients in a river) are not considered. Hypothetical risks are not tested.
Quantities sold and doses used are poorly known (detailed surveys only for 2-3 years, sold quantities known often only at a national level, the destination of part of the pesticides is not known). Many data are confidential, and provided by the industry and not by an independent organism (sales and pesticides toxicity parameters).	Sold quantities are extrapolated to doses using a survey (supposes constant proportions of quantities used of a pesticide between plants, when years are compared). Uncertainties are not considered. Data from the industry are used.
Many organisms and ecosystems are submitted to pesticides risk.	Only a few organisms, considered 'representative' are studied. Risks for the environment are extrapolated from them. Organisms considered are seen as independent with respect to risk (no ecosystem mechanisms considered).

Reference world	***Model***
Agricultural practices are very complex.	Complexity is reduced through the use of simplified scenarios, describing agricultural practices and pesticide application. Moreover, all considered scenarios include pesticides.
Minimal perturbation of the environment is when no pesticides are applied.	Maximal environment protection is attained when a minimal protection of the crop is attained.
Various ways for calculating aggregated risks exists.	Modellers propose some aggregations, and decision-makers choose between them.

ANNEX 4: THE RESEARCH TEAM'S CLASSIFICATION OF CITIZENS' CONTRIBUTIONS TO THE FIRST PART OF THE WORKSHOP

Stratégies pour la réduction des risques liées aux pesticides	Forces et faiblesses du modèle	Propositions générales	Questions
Séparer les médecins des pharmaciens = séparer les conseillers des vendeurs ; Quid d'une information indépendante fournie aux agriculteurs ?	Il est nécessaire de tenir compte du terrain et des savoirs autres que scientifiques	Tous les scientifiques ont leur rôle à jouer	Poids et influences des lobbies ?
Stratégies au-delà de 2010 ?	Urgence à agir : Ne pas attendre d'avoir un outil parfait pour lancer les réglementations ; de façon éclairée	Urgence à agir : mais dans la recherche d'alternatives	Le risque 0 n'existe pas : Pourquoi ?
Les particuliers ont-ils besoin des produits phyto ?	Croire que la nature, ce sont les conditions de laboratoire	Pourquoi l'étude d'Haubruge ne prend pas en compte la contamination du pollen ?	Risques acceptables (produits considérés comme acceptable car passe le stade de l'homologation), alors pourquoi réductions ?
Ok utilisation des pesticides (même amateur) mais précautions d'usage	Stratégies européennes plus pertinentes du point de vue de l'agrégation des risques	Campagnes d'éducation au niveau national	Quelles sont les retombées de ces études et à quoi elles vont servir ?
Réduire les applications préventives	Abeille domestique (sélectionnée) est-elle encore un bon indicateur ? (effets génétiques)	Il faut accepter de perdre une partie de ses cultures = prise de risques économiques	Pour la varroase pourquoi ne pas se mettre en conformité avec les produits d'autres pays ? (pas pesticides agricoles)
Eliminer les pesticides inutiles et pratiquer qu'en temps voulu	La toxicité pour les enfants n'est pas prise en compte (ni parkinson)	Les produits naturels ne veulent pas dire nécessairement des produits non-toxiques	A part les abeilles, quelles sont les autres indicateurs biologiques et les possibilités de les étudier ?

Stratégies pour la réduction des risques liées aux pesticides	Forces et faiblesses du modèle	Propositions générales	Questions
Pas d'autres solutions que le plan de réduction ?	Y-a-t'il d'autres indicateurs insectes (eau, santé …) que celui des abeilles ?	A force de réduire les risques, autant arrêter tout…	
L'homologation des produits doit se faire au niveau européen pour éviter les coûts	Il faudrait spécialiser les mesures par région	Il faudrait un organisme indépendant pour l'évaluation de la toxicité des produits	
Pour contourner la résistance il faut garder une variété de pesticides	Accumulation des pesticides dans les organismes	Il faudrait plus de motivations de la part de l'industrie pour produire des solutions efficaces	
Il faudrait copier la nature pour imaginer des remèdes	Besoin de plus de données	Il faudrait des collaborations plus étroites avec les différents acteurs (les scientifiques) pour produire des outils.	
Pourquoi une réduction de 25 % ?	Les betteraves (plante pas méliphères = risque 0 Imidacloprid (enrobage) = risque 0	Confiance dans la science	
Pourquoi ne pas ne faire que du bio ?	Climat comme facteur de la perte de récolte de miel n'est pas pris en compte	Utilité, besoin des pesticides	
Il n'est pas possible de ne faire que du bio	Remise en cause de la méthode de calcul du taux de mortalité des abeilles	Incompréhension du public sur la réalité des pratiques agricoles	
Comment mettre en balance le prix de la vie, de la santé avec les coûts de recherche ?	Le milieu vivant n'est pas calculable	L'enjeu = l'argent	
Réduction ne doit pas être supportée par les seuls agriculteurs	Prendre en compte d'autres facteurs (varroase, climat…)	Agriculteurs obligés utiliser pesticides	
Stratégies à prendre concernant l'usage domestique de pesticides	Scientifiques devraient aller sur le terrain	Agriculteurs subissent réglementation	
Changements des habitudes des consommateurs (beaux fruits)	Pas d'outil parfait mais à tt le temps perfectionner	Trop lourdeurs administratives	

Stratégies pour la réduction des risques liées aux pesticides	**Forces et faiblesses du modèle**	**Propositions générales**	**Questions**
Traçabilité (+) (- lourdeurs)	Trop grande simplification (arriver à un chiffre)	Cause = industrialisation de l'agriculture (monocultures, etc)	
Cibler sur l'éducation des jeunes	Rémanence	Si plan de réduction, on délocalise la production -> pas de contrôle de la qualité, pratiques	
Mise en responsabilité de l'industrie	Risques aigus seulement (pas chroniques, synergies, cumulatif)	On ne va pas retourner en arrière (moyen-âge), investir dans science	
Interdire les pesticides aux particuliers ?	Pas d'effets type écosystème	Il y a des choses que l'on ne maîtrise pas	
Tirer leçons de la bio	Pas de relations spatiales (déplacement des abeilles et des pesticides)	La science doit envisager des alternatives	
Tenir compte aussi du fait que la manière de travailler des apiculteurs a une influence sur les abeilles	Risque = grandeur et fréquence ?	Utiliser la force de l'autre (aikido)	
Besoin des pesticides ?	Choix d'agrégation ??	Bio aussi des risques	
Quel usage ?			
Supprimer les pesticides les plus risqués			
Harmonisation des mesures de risques			
Travailler précautions d'usage			
Publier presse lorsque quelqu'un a de bons usages			
Autre manière de vivre			
Suivre la nature			
Aides de l'Etat pour faire sans pesticides			
Pollueur payeur			

Stratégies pour la réduction des risques liées aux pesticides	**Forces et faiblesses du modèle**	**Propositions générales**	**Questions**
Travailler sur les valeurs (argent comme moyen, pas comme fin)			
Tenir compte des enjeux larges (économie, nord/sud, riches/pauvres)			
Agriculture intégrée			

ANNEX 5: RESULTATS – PROPOSITIONS DES CITOYENS / DIMANCHE MATIN

I. PEUT-ON SE PASSER DES PESTICIDES ?

GROUPE 1. PEUT-ON SE PASSER DES PESTICIDES ? OUI

Pourquoi s'en passer ?

Tout de suite, ce n'est pas possible sans une transition, bien sûr.

MAIS LES RAISONS POUR LESQUELLES IL FAUT ABSOLUMENT S'EN PASSER SONT LES PROBLEMES GRAVES QU'ILS CAUSENT SUR L'ENVIRONNEMENT ET SUR LA SANTE

Comment s'en passer ?

1. Il faut faire des recherches scientifiques pour comprendre les processus naturels, trouver [et utiliser] des molécules naturelles [et non de synthèse] car rétablir l'équilibre naturel permettra de se passer des pesticides.

→ Exemple : bio pour ses méthodes est à la pointe (et non à l'ancienneté)

2. A côté de ça, il faut aussi une prise de conscience, qui est la clé du changement. Ça suppose l'éducation des adultes comme des enfants

→ davantage de compréhension de la nature
→ davantage apprendre le RESPECT de la nature et de l'environnement,
→ stopper le gaspillage et la société de consommation
→ inverser l'échelle des valeurs, en ne subordonnant plus l'environnement à l'économie
→ lutter contre les idées reçues telles que "on a besoin des pesticides pour nourrir le monde"

3. Mener des recherches à partir d'autres modèles sociétaux (par exemple les sociétés indiennes) car les changements ne doivent pas venir uniquement du fonctionnement économique mais aussi du fonctionnement social

4. Aller aussi voir dans le passé comment ils ont fait pour respecter la nature

GROUPE 2. PEUT-ON S'EN PASSER ? OUI A LONG TERME

Pourquoi ne s'en passer qu'à long terme ?

Volonté de le faire tout de suite mais manque de moyens, d'outils et d'incitants, donc besoin de temps

On ne peut s'en passer qu'à long terme mais en outre, on ne peut pas s'en passer en cas de grosses crises. Dans les cas de véritable crise, il faut encore pouvoir recourir aux pesticides.

Comment s'en passer à long terme ?

- D'abord, il faut définir ce qu'on entend par le long terme et identifier les différents acteurs et décideurs

- Il faut intéresser les acteurs financiers aux produits alternatifs aux pesticides pour que ce marché prenne progressivement le pas sur le marché actuel
- Il faut développer ces recherches et produits (aller au delà des "recettes de cuisine", de manière plus professionnelle, plus scientifique !) pour qu'ils soient efficaces
- Il faut favoriser l'utilisation de méthodes douces mais comment le faire ?
- Il faut voir avec les agriculteurs pour améliorer les méthodes
- Il faut un leadership européen fort pour aller vers cet objectif, ce qui demande de se fixer une philosophie, des objectifs et avoir la panoplie de moyens à notre disposition pour communiquer à tous niveaux, notamment sur le modèle du web comme création de databases communes (unité centrale)
- Pouvoir encore recourir aux pesticides en cas de catastrophes, de crises, de nécessité

GROUPE 3. PEUT-ON S'EN PASSER ? NON

Pourquoi ne peut-on pas s'en passer ?

- Essai de les réduire mais les professionnels ne peuvent pas s'en passer complètement car contraintes économiques, sociales, politiques, du consommateur et des grandes surfaces, le type actuel de cultures (monocultures).
- S'en passer serait un retour en arrière et on ne peut pas revenir en arrière
- Les particuliers, par contre, devraient pouvoir s'en passer
- Pour réduire les problèmes liés aux pesticides, il faut différencier les usages qu'on fait du produit et les produits eux-mêmes

Comment peut-on non pas s'en passer mais les réduire ?

- Aller vers des pulvérisations à bon escient complétées par différentes méthodes naturelles et utiliser de produits moins nocifs pour l'environnement, ce qui implique de favoriser l'observation et le raisonnement au bon moment c'est-à-dire avant de pulvériser systématiquement (raisonner la prise de risque)
- cela implique également de former la personne qui les applique à cette réflexion et à l'application à proprement parler
- Education du consommateur (pour modifier la demande : "à partir du moment où l'on arrive à éduquer le consommateur qu'il accepte un produit avec un léger défaut, franchement je divise au moins par deux mon nombre de pulvérisations").
- Les scientifiques ne peuvent pas dire leurs résultats (par exemple qui favorise tel traitement) avant une certaine validation scientifique, qui devrait inclure les observations et connaissances des acteurs de terrain

II. COMMENT PEUT-ON GERER LES RISQUES ET/OU LES PESTICIDES ?

QUE SIGNIFIE GERER ?

Groupe 1. Diminuer l'usage des pesticides (les réduire !)
Groupe 2. Ne s'est pas posé la question
Groupe 3. S'était déjà positionné puisqu'il s'agissait du groupe qui voulait se passer des pesticides

QUI DOIT FAIRE QUOI ?

Industrie

1. Il faut imposer aux industriels (producteurs de pesticides) un cadre par la loi (législation contraignante) car nous ne voyons pas bien comment les industriels peuvent réduire les pesticides d'eux-mêmes.
2. Il faut exiger des industriels qu'ils fournissent, sur leurs produits, des indications précises d'utilisation pour le consommateur (mode d'emploi sur le flacon -et non pas séparé de celui-ci- qui soit très précis par rapport aux quantités, aux périodes)
3. Pour éviter différents rejets de pesticides (dans l'eau, l'air) de la part des industriels (utilisateurs de pesticides), il faut instaurer le principe pollueur-payeur. Il faut que l'argent ainsi récolté serve à d'autres objectifs environnementaux.
4. Favoriser aussi des industriels (utilisateurs de pesticides), en dehors des lois, à prendre leurs responsabilités, à faire eux-mêmes l'effort et en faire la publicité pour leur image de marque

Scientifiques

- plus pousser la recherche "pure" c'est-à-dire indépendante des "bailleurs de fonds"
- favoriser le décloisonnement -et donc les synergies et collaborations- entre *scientifiques*
- la science doit collaborer avec les *acteurs de terrain*
- Plus de transparence sur la recherche et les solutions trouvées (par exemple par rapport à des produits "miracles" dont les brevets seraient "planqués" pour amortir les anciens produits créés par les grosses firmes)
- Science indépendante mais contrôlée par "un conseil de sages" car la science peut être la pire ou la meilleure des choses (sécurité)
- Nécessité d'un organisme indépendant qui ait le pouvoir et les moyens, qui à la fois dépasse le niveau belge et européen sur la problématique des pesticides et à la fois soit au niveau local.
- Il faut que les scientifiques aillent sur le terrain et création de comités pour travailler ensemble avec les différents acteurs concernés par la problématique, directement ou indirectement. Un acteur notamment qu'il est important d'intégrer, ce sont les médecins car ils rencontrent aussi la problématique des pesticides (il faut donc qu'ils soient informés et qu'ils puissent travailler avec les scientifiques et donner des feedbacks de leur expérience aux scientifiques)

Consommateurs

- Les consommateurs devraient prendre conscience que les produits les moins chers sont souvent fabriqués de manière nocive, car les consommateurs c'est le nerf de la guerre
- L'éducation avec l'échelle des valeurs, plus regarder la qualité intrinsèque des fruits et légumes qu'ils consomment (versus calibre, esthétisme, couleurs)
- Leur apprendre à décoder les publicités (le bon (sain) du beau)
- Cohérence du message qu'on adresse aux consommateurs par rapport aux risques des pesticides et aux marchés qu'on développe les concernant (Parallèle avec la cigarette : elle tue mais rapporte des milliards) : faut-il diminuer ou non, quel est le message ? Il faut travailler aux 2 niveaux
- Les consommateurs peuvent évoluer, cf. Angleterre où il y a un changement de mentalités (produits beaux ou... bons !)

Utilisateurs privés de pesticides

- Interdire (par une loi) l'utilisation de tous les pesticides (car on peut s'en passer)

- Interdire l'utilisation des pesticides les plus polluants,
- Interdire leur utilisation et les autoriser dans certains cas
→remarque : il ne faut pas pour autant qu'interdire l'usage des pesticides aux particuliers les démotive à cultiver eux-mêmes et les poussent vers les grandes surfaces. Il faut du réalisme... (démocratie)
→ dans les cas où on interdit leur utilisation, il faut former les utilisateurs privés à des alternatives qui fonctionnent (formations)

Politiques

Mesures qui ont été avancées concernant les acteurs que le politique doit réguler ou soutenir :

- Législation contraignante pour les industriels qui produisent les pesticides
- Instaurer le principe pollueur-payeur (amendes –à utiliser pour investir dans la recherche...)
- Concernant l'usage privé de pesticides :
    - Interdiction de pesticides particulièrement nocifs aux particuliers (711)
    - Interdiction de pesticides aux particuliers et autorisation dans certains cas (1)
    - Interdiction totale de pesticides (2)

    → Eduquer l'utilisateur à un usage intelligent qui lui permette de continuer à cultiver (versus devoir aller acheter), le former à des techniques alternatives qui fonctionnent
- Allouer des subsides pour encadrement et formation continue à des techniques culturales respectueuses de l'environnement
- Allouer subsides à la *promotion et commercialisation* des produits de la qualité
- Etre à l'écoute de relais et comités locaux mixtes (scientifiques, acteurs de terrain)

Mesures qui ont été avancées directement concernant les politiques et leurs pratiques :

- Faire en sorte qu'ils soient indépendants
- Pas de lutte de partis mais avoir une conscience politique, au sens noble du terme
- Oser prendre des mesures – avoir la volonté de le faire
- Aassurer une continuité des politiques -et cohérence des projets- entre les différentes législatures (versus les changements réguliers de ministres et de compétences)
- Le politique c'est aussi nous qui le choisissons

Apiculteurs

- Observation
- Ethique
- Diversité et non sélection (génétique, monoculture)
- Apiculteurs amateurs à encadrer, à informer mais aussi les pousser à eux-mêmes se former, s'informer (notamment meilleures indications sur les produits)

Agriculteurs

- Utiliser toutes les techniques autres que l'usage des pesticides (créer des abris et éviter de tuer les organismes auxiliaires qui peuvent être utiles pour lutter contre les maladies, favoriser les rotations et les cultures diversifiées versus monocultures, etc.)
- Usage raisonné des produits
- Observation avant de pulvériser systématiquement
- L'information :
    - Que les agriculteurs s'informent entre eux (création de comités où on invite un conférencier, où on partage les informations et les idées cf. CETA)
    - favoriser l'information qui provient de véritables conseillers (et pas uniquement des vendeurs de produits phyto)
    - formation continue (pas seulement l'information via le sillon belge)

- Les agriculteurs ne doivent pas rester seuls par rapport à cette problématique qui concerne toute une série d'autres acteurs autour d'eux (création de comités pour que les agriculteurs puissent y discuter cette problématique avec d'autres acteurs)
- Résoudre le malaise de l'agriculteur : il se sent soumis à des contraintes, auxquelles il n'adhère pas... il faudrait qu'il puisse en discuter pour ne pas qu'il soit soumis aux contraintes mais acteur de changement !

III. QU'EN EST-IL DU MODELE ? QUELLES FORCES ET QUELLES FAIBLESSES ? PEUT-IL AIDER A REDUIRE LES RISQUES PESTICIDES? SI OUI, COMMENT ?

GROUPE 1

- L'utilisation du modèle oui mais en l'améliorant. Notamment en consultant les gens de terrain (agriculteurs, apiculteurs, ceux qui connaissent la nature)
- Pour nous le modèle ne permet pas de réduire les risques mais de les calculer !
- Il faut prendre plusieurs indicateurs, ne pas se contenter des abeilles (car abeilles peuvent aller bien mais pas les eaux souterraines)

→ prendre plusieurs indicateurs un par un + une moyenne de tous les indicateurs

- Utiliser différentes méthodes de calcul pour le même indicateur et en faire une moyenne pour ne pas choisir la méthode qui aboutit au meilleur résultat
- Faire faire les calculs avec le modèle par 2 organismes indépendants l'un de l'autre

GROUPE 2

Pribel a le mérite d'exister. Mais y-a-t-il d'autres modèles qui existent ?

[les enjeux] La messe est-elle dite ? Est-ce que le modèle peut encore être adapté, modifié ? Quelles seront les conséquences du travail fait maintenant avec nous, citoyens ?

Le modèle est une simplification outrancière de la réalité, notamment de points vitaux. Ce qui nous pose problème

Point 24, 21...

Quelle justesse des données (notamment quand elles viennent de l'industrie ? besoin d'une vérification supplémentaire ?!)

Est-ce que 25 paramètres sont suffisants (n'en faut-il pas plus 100 ?)

Est-ce qu'un calcul des effets ne serait pas important ? Observer les effets sur les comportements (même s'il n'y a plus de trace de pesticides, il y a peut-être des effets sur le comportement), ça implique de travailler avec les gens de terrain

La question d'arriver à un chiffre : c'est bien de commencer par un chiffre comme base de départ

Le chiffre va donner la mesure de la toxicité d'un pesticide mais si le modèle est trop simplifié, certains produits très toxiques ne seront pas pris en compte

→ modèle doit être adapté à la gravité du problème et à la complexité de la réalité (risque de laisser passer les produits toxiques, passoire). Modèle est trop simple par rapport à la complexité

Que pensent les scientifiques de leur modèle ? est-ce que la démarche est vraiment scientifique ou non (c'est-à-dire faut-il donner un chiffre pour le "plaisir" du politique) ?

L'effet cumulatif des doses au niveau de la chaîne alimentaire ? est-ce pris en compte ou bien est-ce un gros trou du modèle-passoire ?

[les enjeux] L'évaluation qu'on va donner au politique, vous ont-ils dit ce qu'ils allaient en faire? (va-t-on vraiment faire un test à grande échelle ?

ANNEX 6: LIST OF PARTICIPANTS TO THE PEPAM WORKSHOP

Citizens	Consumer	Etienne
	Consumer	Aline
	Consumer	Francoise
	Conventional farmer	Frans
	Organic farmer	Hermann
	Integrated Pest Management farmer	Alain
	Bee-keeper	José
	Bee-keeper	Jacques
	Beekeeper	Englebert
	Gardener	Pierre
	Gardener	Jean-Noël
Speakers	Cabinet of the Minister of Public Health	Alexandra Monteiro-Baretto
	Centre d'étude et de Recherches vétérinaires et agrochimiques	Vincent van Bol
	Centre d'étude et de Recherches vétérinaires et agrochimiques	Luc Pussemier
	Centre d'étude et de Recherches vétérinaires et agrochimiques	Juan Piñeros
	Representative of a farmers organisation (Fédération Wallonne de l'Agriculture)	Bernard de Cock
	Representative of a bee-keeper organisation (Union Royale des Ruchers Wallons)	Jean-Marie Hoyoux
	Universitary bee-scientist (from Faculté universitaire des Sciences Agronomiques de Gembloux),	Kim Nguyen
	Representative of Phytofar (association of Belgian plant protection products industry)	Hervé Tossens
	Interenvironnement Wallonie, an environmentalist organisation	Anne Thibaut (IEW)
Facilitator	Athanor-médiations	Florence André-Dumont
Research team	MTT/STEM, Universiteit Antwerpen	Lieve Goorden (sociologist)
	SEED, Ulg	Marc Mormont (sociologist)
	Centre d'étude et de Recherches vétérinaires et agrochimiques	Juan Piñeros (bio-engineer and anthropologist)
	Comité Régional Phyto, UCL	Jean Marot (bio-engineer)
	SEED, ULg	François Mélard (sociologist)
	SEED, Ulg	Mélanie Louviaux (sociologist)
	MTT/STEM, Universiteit Antwerpen	Marian Deblonde (physicist and philosopher)