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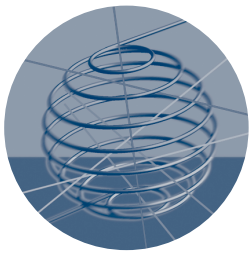
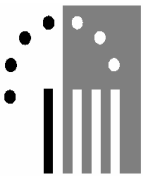


LEVERS FOR A SUSTAINABLE DEVELOPMENT POLICY

SCIENTIFIC SUPPORT PLAN FOR A SUSTAINABLE DEVELOPMENT POLICY SPSD 1

This booklet is realised in the framework of the Scientific Support Plan for a Sustainable Development Policy (SPSD I). The available publications are :

- *"Antarctica"*
- *"Levers for a sustainable development policy"*
- *"Earth observation by satellite" TELSAT 4*
- *"Prénormative research in the food sector"*
- *"Global change and sustainable development*"
- *"Sustainable management of the North Sea"* (available from spring 2003)
- *"Sustainable mobility"* (available from spring 2003)
- *"Supporting actions"* (available from spring 2003)



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THE "LEVERS FOR A SUSTAINABLE DEVELOPMENT POLICY" PROGRAMME

Sustainable Development is a broad concept which refers to all the interactions between social, economical and environmental aspects. To reach to sustainable development demands a change of our production and consumption patterns. This transition asks for a big effort in terms of information and communication in order to change collectives and individual behaviours.

This concern has led, in 1996, to the implementation of the research programme “Levers for a sustainable development policy” of the SPSD I (first "Scientific Support Plan for a Sustainable Development Policy"). The "*Levers for a sustainable development policy*" programme contributes to making the concept of sustainable development operational, so that it can be used on the political level. This mission presupposes not only the study of the concept itself, but also an understanding of the human behaviours responsible for the essentially unsustainable character of development in Western societies, as well as the way in which these behaviours can evolve. This is an overarching societal problematic involving all human-science disciplines.

The objectives of the programme are multiple :

1. Aiding decision-making at the national level :

Here the programme refers to the sustainable development policy described in the governmental declaration of 7 July 1999. This policy aims " to harmonise the economy, the ecology and social protection in order to arrive at a society where environmental quality forms an integral part of every behaviour ". The government proposes to achieve these ambitious goals through a number of instruments and political measures, including an active environmental policy in favour of sustainable production and consumption patterns ; control of the ecological repercussions of joint development projects; integration of the dimension of sustainability into economic indicators/balances; tax measures; legislation. Providing scientific support to this political commitment was the first objective of the programme.

2. Aiding decision-making at the international level :

The goal was to help political decision-makers meet the international commitments (e.g. UNCED of 1992 in Rio, etc.). The realisation of these commitments often requires scientific validation or argumentation, such as testing the implications or possibilities of certain commitments, effectiveness studies relating to instruments capable of satisfying these commitments, etc.

3. Establishing and/or strengthening research capacities :

The goal is to reinforce Belgian research potential. Thanks to this programme, research teams are offered the possibility of acquiring expertise with respect to problematics which until now have not been addressed nationaly. This programme also allows them to become familiar with international expertise and know-how and supports basic research.

Potential users of the research results include society's various decision-makers (public authorities, companies, etc.), specific advisory bodies such as the Federal Sustainable Development Council, the research world, interested members of the general public, and so on.

Some research projects, which are presented here, are part of the programme "Supporting Actions". They also deal with aspects of the programme "Levers for a sustainable development policy".

HL/10/021

REFERENCE POINTS FOR SUSTAINABLE DEVELOPMENT POLICY: PRODUCTION AND CONSUMPTION

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1. INTRODUCTION

The present research « Reference points for sustainable development policy : production and consumption », aims at making the concept of sustainable development operational, by viewing and analysing the economic system from the viewpoint of the three dimensions of sustainable development : environmental, economic and social. This stress the importance of a joined study on production and consumption. The integration of these two kinds of concerns in the same research seems to be necessary and promising, since the sectors of production and consumption are integrated in our economic system and as they are part of the same Chapters in international agreements (Agenda 21, Climate Convention) to which Belgium subscribed.

In order to jointly study the sectors of production and consumption, we propose to identify factors which contribute either to the unsustainability of the system, or to its sustainability. This study is necessarily multidisciplinary, as the problems of sustainable development are.

2. OBJECTIVES

This research aims at developing a good understanding of the sectors of production and consumption, by identifying the factors influencing the sustainability or the unsustainability of behaviors. The goal is to make the concept of sustainable development operational so that it can be taken into account at the political level. We seek to identify ways of change, « levers for a sustainable development policy », according to the title of the program in which this research fits, and we endeavour to translate our results into political recommendations.

This research is multidisciplinary and is integrated, due to the set of social problems posed by the sustainable development and the nature itself of the "objects" of the market mechanism, namely the products. These are the results of the production processes, goods of exchange between the sectors of industry and the households, as well as consumption goods of the households.

The research team gathers the following disciplines : economy and management, law, social psychology, sociology and demography. By tradition, some of these areas are open-minded to various disciplines and they use as well quantitative as qualitative approaches : this is the case for management and demography. Others, as social psychology constituted a theoretical framework tested by many empirical

research. Within the framework of this research, it would have been useless and probably sterilizing to want to build a single conceptual framework that would have been precise enough to be tested empirically, but broad enough to include the various disciplinary points of view. Consequently, each research area refers to the paradigms of the disciplines to which it belongs.

3. GENERAL METHODOLOGY

The object of the research is multidisciplinary, the approaches are managerial, legal, sociological and of social psychology : they gather the complementary expertises of several social sciences.

Each of the parts of the report is characterized by a particular disciplinary filiation. The first relates to the sector of production and belongs to management sciences, while adopting a conceptual framework inspired from social psychology. In the second part, which concerns sociology and social psychology, the consumers' practices are analyzed. Lastly, the third part concerns the regulatory framework and it analyzes various legal instruments being able to facilitate the co-operation between the producers and the consumers, so that they produce or buy more environmentally friendly products.

However, these various disciplinary approaches were somewhat adapted in order to fulfill two requirements : each study (materialized by one of the three parts) has to be integrated in a coherent whole, and it has to lead to recommendations towards the political or economic actors - this scientific posture not being common in sociology and social psychology -.

In the first two parts, the analysis of the sectors of production and consumption was carried out according to a comparable methodology, which combines on the one hand, the collection on a large scale and the statistical analysis of many quantitative information, and, on the other hand, the collection of qualitative data and their analysis by suitable methods. The quantitative information offers a good statistical representativity, a large sample and many information, mainly on the practices and perceptions of the questioned people ; the qualitative data are characterized by their level of depth.

The third part is devoted to the regulatory framework analysis. This is made by the way of a cross analysis between the sectors of production and consumption and it uses the following methods : inventory and comparison of the Belgian and European legal provisions, critical documentary analyses.

4. RESULTS

4.1 The production

The salient results that can help to develop levers for a change towards sustainable behaviors on behalf of the industrialists are the following (Callens, 2000) :

Research enabled us to identify the motivations that constitute the starting point for environmental actions of the companies, and to understand the related decision-making processes. We indeed identified the factors for environmental protection within the companies. We brought a theoretical justification of these factors and their process (Callens, 2000). We established a measurement of intensity and a taxinomic measure of the environmental answer, and we built an explanatory model of the environmental answer, integrating the various identified factors : attitude of the firm towards the environmental answer ; perceived stakeholders pressures ; obstacles ; business factors (size and branch of industry mainly).

The firms' *motivation* most likely to lead to the action is of financial type : the company will invest in environmental actions, provided that these enable the firm to reduce costs. On the other hand, the managers do not expect to profit from new market opportunities after having implemented environmental actions.

The most influential *stakeholder* is the national or regional legislator. Some actors of the company also have a considerable influence, and they are likely to impulse the change : they are the top management, the owners/shareholders and the employees. Local population, environmental organizations, press/media also hold an important role. But the market dimension does not seem to be a potential factor of change.

Obstacles of financial and technical types constitute a barrier to the implementation of environmental actions. Problems of information also arise, and especially, the lack of competing asset constitutes an obstacle to the change.

In terms of relations between factors and actions, the following points summarize the whole of the results :

- The more the firm's attitude is in favour of environmental answer, the more the firm is active in environmental matters.
- The more the firm strongly perceives environmental pressures from the stakeholders, the more the firm is active in environmental matters.

- The larger the firm, the more it is active in environmental matters.

- The least the company perceives the obstacles related to the setting of environmental answers, the more it is active in environmental matters.

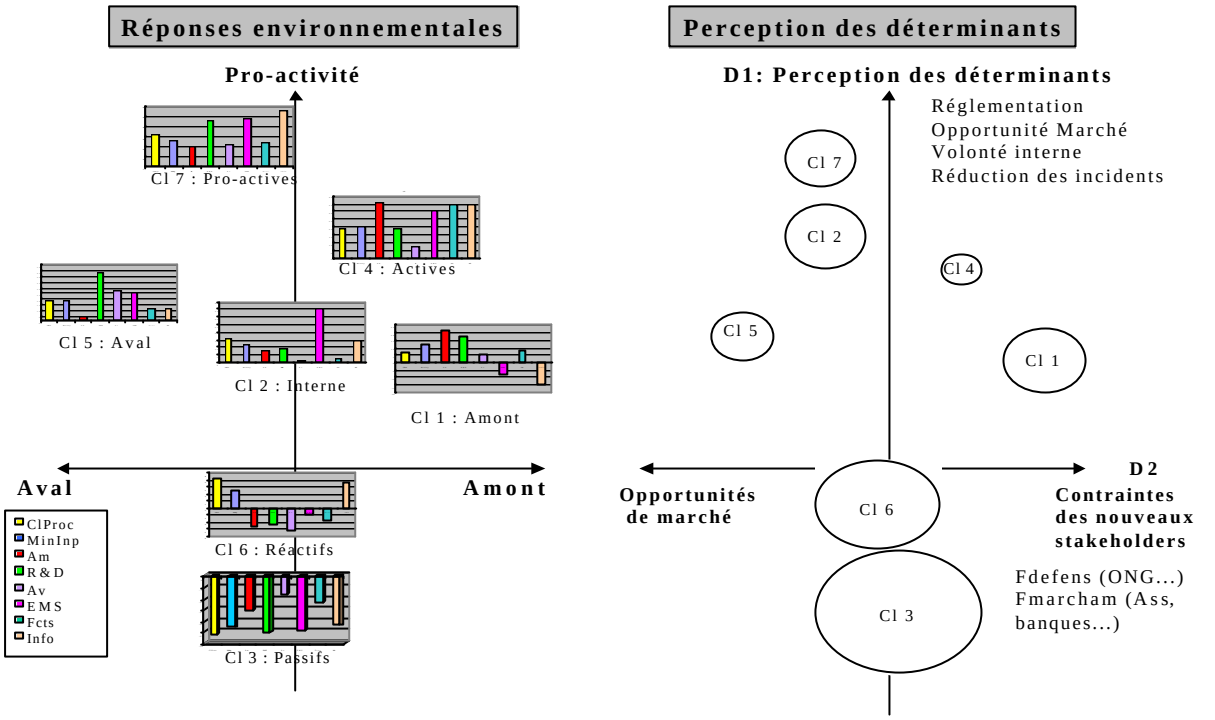
- The size of the firm exerts an influence on the intensity and/or the sign of the relation between the firm's attitude and the intensity of its environmental answer.

- The perceived obstacles exert an influence on the intensity and/or the sign of the relation between the firm's attitude and the intensity of its environmental answer.

- The degree of perception of the stakeholders pressure influences the intensity of the firm's environmental activity, by the means of its attitude.

We also distinguished seven great types of firms' behaviors vis-à-vis the environmental problems : the passives ; the reactives ; the medians (upstream, inside, downstream) ; the actives ; the pro-actives. This classification suggests a non exclusively evolutionary path for the company : there is a path from passivity to pro-activity, however at an intermediate stage, the median stage, the company chooses a class of behaviors with actions characterised as "upstream", "downstream" or "inside".

Lastly, the following graph summarizes the results of the environmental answers related with the factors of influence. On the left, we classified the various groups of companies, according to the intensity of their environmental answer (vertical axis). We classified the companies of the group "medians" according to the type of environmental answer : in the center, the companies act in-house and set up an EMS ; on the right, the companies act upstream by for example, exerting pressures on their suppliers ; on the left, the companies act downstream by for exemple, recovering their products at the end of the lifecycle, reducing packaging, ... On the graphic at right, we reproduced the results of the discriminating analysis. The vertical axis **D1**, is the degree of perception of the whole influencing factors, and in particular the perception of the market opportunity and the legislation pressures. The horizontal axis **D2** set the new market opportunity against the constraint exerted by new stakeholders (NGO, media, insurances, banks, …). A simultaneous reading of the two graphs shows that the different clusters of firms have similar positions in these two graphs (except cluster 2).



The results show that companies guided by the same internal and external factors and perceiving the same obstacles provide very similar types of answers to this new challenge of environment management. This is interesting in the sense that the search for levers for a policy of sustainable development can consequently be considered according to a segmentation policy of the industrial landscape, allowing the definition of levers that are relevant and specific to the policy target groups.

4.2 The Consumption

Nothing to choose between all waste !

To sort all the different kinds of waste is not of equal difficulty. On the one hand, the newspapers, papers, cardboard box and glass bottles do not seem to pose problems. The plastic bottles, the tetrabriks and food waste pose more problems. The respondents tend to sort the whole of various waste, especially if they say that they sort the waste that is the most difficult to be sorted. On the other hand, not sorting the most difficult waste to be sorted does not prevent from sorting “easier” waste. But when “easy” waste to be sorted is not sorted, we do not observe any recycling behavior, whatever the waste.

The link between sorting and other environmental actions

Whereas one could think that people sorting in a rather intensive way adopt definitely differentiated recovering and recycling behaviors, it is not empirically shown. There is

a link between sorting and recovering in the sense that recovering behavior is more important when the sorting behavior is intensive than when the sorting behavior is almost absent, but this effect remains relatively low. With regard to the treatment of certain particular objects, one notes that recycling is more important for magazines and drugs and that gifts to associations is the option preferred for shoes and clothing. This pattern is primarily due to the action of people who sort, and among the latter to those which sort in a rather scrupulous way the complete set of waste (even waste that is difficult to be sorted). Indeed, except for clothing, people who do not sort overall waste tend to throw other waste in the dustbin.

In many results, we observe the lack of relation between sorting and purchase. In other words, the respondents generally do take into account criteria of sustainable development when they carry out their purchases. Even if it remains overall rather low, the most satisfactory performance in terms of buying products is for products with returnable and refillable packaging. The environmental protection as such is neglected and the fact that some products could generate less problems at the time of recycling is not taken into account at the time of the purchase. On the contrary, the fact of recycling does not seem to be related to the act of purchase and worse, the fact of recycling seems to justify some unconcern at the moment of acquisition. The qualitative investigation shows well that at the time of the purchase, the ecological arguments are only very seldom advanced, and that even if they are, they never constitute a determining criterion. The determining criteria are the facility and economic lower cost, and, to some extent, the taste, affinity for the product. Thus, it is by the way of one of these three criteria that a change could be produced at the time of the purchase.

It is clear that major incentives are absent and that, consequently, the consumers are not disposed to establish the link between their purchase, consumption and recycling behaviors. Maybe due to facility, practice or economic interest, they continue to support behaviors in such a way they have to make amends for it through recycling. No link seems to exist between the individual and societal benefit of recycling and the act of purchase. If a clear repercussion of the recycling costs was notified at the time of the purchase, the consumers would undoubtedly be likely to better consider it. Conversely, one could imagine to explicitly reward the consumers for decisions for buying products which are environmentally friendly. The idea of a eco-tax refund is to be debated.

The weight of external pressures

With regard to the pressure on recycling, the most of the people say to feel it important. The pressure is more important in Flanders than in Wallonia and it is the lowest in the Brussels area.

« Ils nous ont forcés à le faire, parce que de nous-mêmes, on ne l'aurait pas fait. » Few people have this clearness and honesty, and few people anticipated the change as regards sorting by a personal initiative. Thus the obligation of sorting waste made by the municipalities to their inhabitants seems at first sight necessary and effective. Necessary in a sustainable development viewpoint, summarized by several people by « *c'est pour un bien* » or by « *c'est pour un mieux* ». Effective, for several reasons, which should be specified because sometimes municipalities "obligations" are not obligation but only proposals. This "proposal-obligation" is accompanied by a financial constraint (the paying bag for the not sorted household refuse), by a vague sanction (rumour on the risk of fine, fear of remaining waste) and by certain information on the usefulness of the sorting and on practical matters. Finally, the municipalities set up a logistic organization to ensure the selective collections of waste.

One of the major points of this investigation is that the perception of a strong pressure on recycling leads to a sorting behavior. Interestingly, the pressure is more marked on the behaviors which are a priori difficult to pose. Thus, the sorting of tetrabric, the plastic bottles and the food waste largely profit from the introduction of a certain pressure.

Conversely from the sorting, the pressure seems to less affect the purchase behavior even if the influence is quite significant. It is clear that the links between the two environmental actions are closer for people supporting low pressure. Taking into account simultaneously the external pressure and the sorting behavior to predict the purchase, one notes that the relation between the sorting and the purchase is reversed. Such a pattern suggests that the sorting is strongly influenced by the external pressure, but that the introduction of the constraint does not generate a similar improvement of environmental criteria consideration when purchasing goods. Nevertheless, the introduction of a sorting obligation seems to promote sorting and waste recycling, and by this way, it allows to draw attention to the purchases criteria.

Back to the pressures which can influence the purchase behavior, we observe that it is desirable to see the public authorities linking, much more explicitly, sorting obligations and incentives, and purchasing obligations and incentives. As an example, one can imagine a disposal allowing to accumulate credits for a tax

reduction relating to the waste collection when purchasing certain types of conditioning.

However, it has been showed that the obligation to sort domestic waste could have been generally respected thanks to the fact that it met a general concern (although this is never explicitly formulated) : the management of the “exteriorisation” of waste is founder of self. Indeed, the separation of self and waste takes part in the constitution of self and its specific territorial inscription. Domestic waste contributes to the construction of the identity of the members of the domestic group, and to the construction of the identity of the group itself, by the processes which the deposed objects require for their production (the purchase), their definition and their management. When categorizing, differentiating, relegating, throwing, sorting, recycling, giving or selling, the definition of self, of the couple or of the family is updated : the identity is built and is rebuilt in common acts. From these results, one can reasonably assume that the factors of identity are certainly also powerful determinants at the time of the purchase, in particular of foodstuffs, which produce most of domestic waste. It would be necessary to pursue the research in this way for proposing levers of action towards a more sustainable consumption.

The obstacles

The various aspects which can facilitate or not the realization of the sorting process do not seem to meet major obstacles. The only one is undoubtedly the space needed at home to manage the sort, which seems to pose a problem for a considerable part of the participants in the investigation.

The demographic and the psychosocial variables

The result of adding demographic variables to the external pressure is a better prediction of the sorting behavior. As well regional as marital status are of influence. Belonging to the Brussels area clearly decreases propensity to sort ; in the same way, living in Wallonia decreases the sorting behavior (compared with Flanders). Moreover, the sorting is a more important act for married people.

The psychosocial model predicts a little better the sorting behavior than the strictly demographic model. Interestingly, the values and two types of activity “to have participated to an action for environmental protection” and “to have read an article on environmental protection” significantly improve the prediction of the sorting behavior. Lastly, two potential obstacles significantly predict the sorting behavior, “the waste collection frequency” and “the space at home to sort waste”.

The demographic model is rather poor in predicting purchase criteria. The variables which predict these are mainly diploma, marital status and health. On the contrary to what occurs with the sorting, the external pressure is not the best predictor of purchase criteria consideration. In the complete model, nor external pressure nor diploma but values are the best predictors of purchase criteria consideration. Moreover, activities intervene in the prediction, more than the demographic variables.

All in all, the sorting is especially well predicted by the external pressure, by the fact of living in Flanders or Wallonia rather than in Brussels and by the values accorded to the domestic waste recycling. On the other hand, the best predictors of purchase criteria consideration are the values with respect to the domestic waste recycling, the fact of having voted for an ecological party and of having participated to an action for environmental protection.

It is noted that the external pressure involves a lower relation between the demographic and psychosocial variables on the one hand and the sorting and the purchase on the other hand. Another interesting fact relates to the best capacity of the variables to predict the sorting than to predict the purchase arguments. Lastly, we observe the important role of the psychosocial variables beyond the only demographic variables. For example, one improves by a factor 4 the prediction of the purchase arguments, from one demographic model to a complete model which includes also the psychosocial variables.

5. CONCLUSIONS AND RECOMMENDATIONS

In order to make the concept of sustainable development operational, one of the objectives of the research was to develop a good understanding of the sectors of production and consumption, by identifying factors of (un)sustainability in the managers and consumers behaviors. The various results of the research clearly suggest tracks of action for a sustainable development.

5.1 The production

Once the determinants of the environmental answer identified, the question arises on the relevant levers to set them in motion. We showed that a positive attitude vis-à-vis the environmental answer, the perception of the pressures of the stakeholders and the presence of some business factors influence the intensity of the environmental response of the firm. Consequently, which are the means which would enable us to act on these various factors ?

- To change the attitude of the firms and their beliefs in environmental issues constitutes the first lever of an environmental policy. It is a question of supporting a more positive attitude with regard to environmental actions, by demonstrating that companies can gain market opportunities, strategic advantages and image improvement. That supposes to replace previous dominating conventions by new conventions more favourable to "green" behaviors. The "success stories" and the scientific studies spread all over the business world constitute one of the means for pushing the new conventions in that direction.

- The stakeholders pressures (interns or external to the company) play a crucial part. Indeed, these pressures act on the environmental response by the way of the attitude, confirming the relevance of the school of contextualism, and the awakening that the firm takes part in a more global system to which it must adapt to survive. The stakeholders undoubtedly are the privileged actors for this change, provided that they exert the pressures. This result confirms the relevance of the "stakeholder theory" for this topic. The stakeholders should become aware of their capacity and they should be responsible for that. The official authorities could help them by setting up more means, adequate information systems as well as effective network of stakeholders.

- To remove obstacles also contributes to a reinforcement of perceived control on action and thus to a greater environmental activity. Nevertheless, this factor seems to play a less important part than the two previous factors, which tends to prove that the obstacles removal is not sufficient to develop a more environmentally friendly behavior. Perhaps, like Eagly and Chaiken say about the human behavior, such a factor plays a role, only in case of favourable attitude ? However, the obstacles removal (especially those of type “how”) constitutes an additional mean to improve the environmental answer of the companies.

- Lastly, the moderating effect stresses the importance of a differentiated policy, according to various business factors. It is at least what we could deduce from the moderating effect of the variable “size”. Indeed, the influence of the various beliefs on the environmental answer varies according to such business factors.

Up to now, the economists who studied environmental issues were concentrated on the levers suggested by the traditional theories : the legislation (political of the stick) or taxes aiming at the internalisation of externalities, two tools not so much popular within the business world. That supposed that the decisions of companies are based on rational economic criteria and that they result from cost-benefit analyses or obligations. In this logic, there is no place for cognitive rationality, subjectivity, preferences and beliefs. However, our work underlines the influence of other types of

determinants and other types of rationality. Disciplines as marketing take that into consideration for several years, exploiting perceptions and beliefs when there is a question of “moving the products towards the consumers”. Isn't it time now for the public authorities and the stakeholders to act in such a way with regard to the environmental problems ? Information and experiment remain the tools for change of perceptions, justifying means like media, advertising, education and stakeholders pressures to reinforce new convictions.

However that does not mean that the traditional means are obsolete or unsuited ! The empirical study confirmed the major part played by the legislative constraint and this, whatever the type of company. But we propose a set of diversified “levers” and we suggest to move towards more communicational policies, underlining the benefits of an environmental policy. It is a question of “image relifting” of the question of the environment, so that it is not perceived as a source of constraints, but as a source of opportunities. To make the stakeholders aware of their capacity, to make them responsible and to give them the means for action on companies would of great utility.

5.2 The consumption

The most outstanding result on how the consumers set up for managing domestic waste relates to the obvious effectiveness of the external pressures in the adoption of a sorting behavior. People tend to set up recycling behaviors as soon as they state feeling a strong pressure for it. This constraint is usually expressed by a paying bag for not sorted waste. Moreover, the pressure is particularly effective for more complex behaviors which would have very little chance to appear apart from a militant context not very likely to expand in all the classes of the population.

It also appears that if changes in behaviors can be obtained, it is definitely more difficult to modify chains of mental operations : « *se torturer les méninges à savoir ce que ça va produire comme déchet* » when shopping. In this case, public policies are perhaps more convenient and we propose several tracks.

It appears that one way is to impose at the moment of the purchase, a certain number of practices favourable to sustainable development.

- One can certainly preach the introduction of what we call financial incentives, the “eco-tax refunds”. This could be a VAT tariffs reduction for the more environmentally friendly product. One could imagine a compensation by some energy taxation or by a direct financing resulting from the recycling sector. Indeed, the fact of not having to treat waste constitutes a substantial economy and the

recycling sector could directly intervene to prevent the waste by decreasing the purchase price of products which prevent its constitution.

- In the field of production, one can suggest to develop the principle of sustainable conditioning : that would be the obligation to provide conditionings fulfilling the requirements of sustainable development (eg. by the obligation to offer adapted formats of packaging -adaptation of capacities by categories of products- or of reusable refills for certain categories of products).

- In the retailing sector, one can also incite to oblige all the products of a given range to be available in the shelves of the supermarkets in a “sustainable version” beside the standard version. One can oblige the retailers to provide as much space and advertising to the sustainable version than to the standard version of the product.

- Just as any publicity for cigarette is supposed to warn the consumer on the danger on health, one can oblige publicities to inform about the environmental characteristics of the product and his packaging. More specifically, one could impose the products for which a sustainable version exists to mention it, with for exemple, an explicit mention of the ecological and financial advantages of the sustainable version. It is important to encourage, in particular thanks to the adoption of suitable legal rules, the ecological information beside and through the traditional promotional modes. It is the principle of the need for environmental information in publicity. Products standards could be established in order to meet certain general rules applicable to the markets : easily consulted databases, revision of the system of labels in order to integrate dynamic advances in companies, discount cards and promotions for environmentally friendly products.

- For prevention, one can undoubtedly strengthen the link between purchase and recycling and promote public awareness campaigns aiming at establishing, in a more systematic way, the substantial reduction of waste by a well better managed packaging and conditioning.

- One could also think of setting up systems who would bind psychologically as much as financially the purchase and recycling behaviors (as in the case of returnable glass for example).

- Lastly, we showed that the purchase criteria for a product are the price, the facility and affinity. These criteria would have to be combined with environmental criteria (the refills for upkeeping products are often preferred to other conditionings, not for ecological reasons, but for transportation facilities and use; in addition, to tax superfluous packaging would make possible to decrease the price of products with

less or without packaging). The application of the principle of the tax incentive for the producers and the retailers should make possible to decrease the price of products meeting environmental standards. On a European scale, the support of a reduction of VAT on products labellized for environmental, social and ethical reasons should compensate for their generally high prices.

Four factors seem to ensure the effectiveness of the selective waste collection systems : financial constraint, fear of sanction (financial or other), information and public logistic organization. These four factors constitute as many levers to improve the domestic waste sorting, and more largely, they could usefully intervene in any public environmental policy, even related to other aspects than waste management. In this field precisely, the financial constraint could provide a cost clarification, which could take the form of a reduction in the municipal tax on the refuse collection and of an increasing price of the paying bag, with the objectif to decrease the imbalance that people who do not sort their waste perceive between the required effort and the service offered. Information should be improved, in particular on the final destination of the sorted products and their use. The logistic organization could be facilitated by various means : reduction of the size of the bags for the sorted products (consequently reduction of the necessary space and time to fill them), offer of these bags, introduction on the market of the dustbins with several partitions, etc.

However, what can be the adjustment, inconsistency of public authorities will be pointed out by several people (why are the bags for sorted waste not made of recycled material, … ?). A well balanced agreement has to be found in the public policies between the obligation to sort domestic waste and the risk of refusal from some part of the population of too much technocratic policy (“The Green Big Brother”). To avoid this, we suggest to diversify to some extent the offer of services facilitating the waste sorting, so that the citizen can select the most appropriate system. In our society which develops individual autonomy so much, such a diversified system would leave open various motivations for the same kind of behavior : act of citizenship, (more seldom) ecological reason, fear of penalty and feeling of personal freedom are as many justifications of people who sort their waste. Additionally, such a diversification of the services would also contribute to improve logistics.

There is a quite important cost to change practices so that they are in conformity with sustainability, for companies (by the required investments) as well as for consumers (by the change of practices and the mental effects the change implies). In order to accept this cost, the companies motivation is the financial profit or the setting in conformity with a new regulation. Seldom if ever, financial advantage push the consumer to more environmentally friendly behavior, and the factor of major change

is the external pressure coming from the official authorities (incentives on waste sorting) as well as from the market (if some recommendations we made were applied and cause a drop in the price of more environmentally friendly products).

Which are the benefits of these changes ? The producers mention the reduction of production costs, but they do not expect to profit from new market opportunities. The consumers mention the satisfaction to do useful things. However, the in depth analysis of discourse on the change of practices revealed many unconscious secondary benefits : the separation of self and waste takes part in the constitution of self and its specific territorial inscription. Domestic waste contributes to the construction of the identity of the members of the domestic group, and to the construction of the identity of the group itself, through the processes which the deposed objects require for their production (the purchase), their definition and their management. The identity is built and rebuilt in common acts aiming at the continuity of self, its coherence and self-esteem and claiming the unicity of self and its diversity.

These unconscious benefits for the identity are the consumers specific advantages, without equivalent for companies undertaking environmental actions. At the same time, competences for the change of the various economic agents - producers, retailers and consumers - should be compared in suitable research : the companies often plead for a legislation based on a longer term, so that uncertainty can be reduced and anticipation of the change can be made with more accurate information ; the consumers do not ask for changes which they will have to carry out for the next years …, from domestic waste sorting to the euro, shouldn't the consumer be seen reinforced in his competence for the change … ?

Actions suggested by the companies are the awareness development and the education. If there is a need inside the company, for the employees as well as for the managers, it would also be necessary to develop a “green awareness” on a large scale, which would lead to a more attentive society to environmental matters (“*c'est une démarche de société*”). Education has to be delivered especially to young people. In that case, larger awareness will exist. This topic refers to the capacity of children to induce changes in their parents’ behaviors, even in the adults behaviors in general. This stress the role of education (in family, at school, …).

Will these changes in our production and consumption modes be powerful enough to imply other changes, which would relate to our relation towards the world and the environment ? In our society indeed, the socialization of the world is marked by predation and rejection -domestic waste is the daily proof-. Are other choices like the gift or the reciprocity possible, as some anthropologists (A. Caillé for example) affirm?

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THE DYNAMICS OF A NON-SUSTAINABLE DEVELOPMENT: BORINAGE FROM 1750 TO 1990

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The dynamics of a non-sustainable development : Borinage from 1750 to 1990

Paul-Marie Boulanger and André Lambert

"*We are interested in territoriality not because of some obscure spatial metaphysics but because people inhabit these spaces, and it is these flesh-and-blood people who suffer the booms and busts of the economy. People are not an abstract category of labor that moves mechanically at the right time and in just the right proportions to wherever economic opportunities arise. They are social, connected beings who live in families, households and communities and who interact with neighbors, kinfolk, friends and familiars. Over time, people inhabiting particular places evolve typical patterns of speech, ritual practices, and social practices with which they are comfortable and feel 'at home'.*[1]"

1. INTRODUCTION

Although the first region in Belgium and perhaps on the continent to be industrialised[2], Borinage has not been in a position to bring about true sustainable development, to the point that it is possible to describe it as industrialisation without development[3]. Since the crisis of the thirties the region has been regarded as the most underprivileged in the country and if it has benefited from the rise in the standard of living, education and health which has occurred since the war throughout the country it has benefited less than the other regions in the country and continues to display clear privations in all these areas compared with the other regions and the national average.

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1 J. Friedmann (1992), Empowerment : the politics of alternative development, Oxford : Basil Blackwell, p.40.

2 E.A.Wrigley (1962), Industrial Growth and Population Change, Cambridge.

3 H.Watelet (1980), Une industrialisation sans développement. Le bassin de Mons et le charbonnage du Grand-Hornu du milieu du XVIIIe au milieu du XIXe siècle, Ottawa : Editions de l'Université d'Ottawa.

We are of the opinion that analysis of this failure is an original and possibly beneficial way of improving the problem of sustainable development, not by attempting to define the latter by means of its positive characteristics but by detailing a clearly transient case of development.

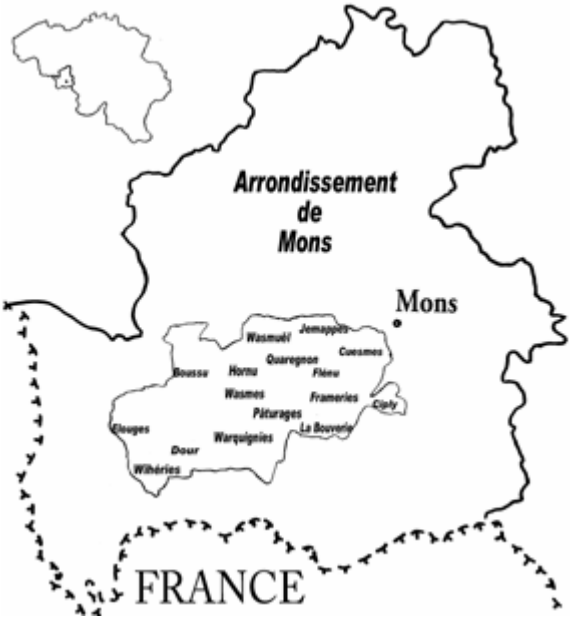
For this analysis we chose to concentrate on four sectors : the demographic dynamics, the evolution of the economic structures and activities, training and education and, finally, the occupation of the space.

2. BORINAGE : GEOGRAPHIC POSITION AND DEMOGRAPHIC EVOLUTION

Historical Borinage – which interests us here – is a very old industrialised area, located to the west of the town of Mons and to the south of the Mons-Condé canal.

The map below shows the position of the district of Mons in Belgium (in the inset) and, in the enlargement, this district and Borinage within this district. As can be seen, it concerns a very small area. In fact, the surface area of Borinage in the strict sense hardly exceeds 100 km².

The fact that this area does not correspond exactly to any administrative or statistical entity obviously complicates the historical statistical analysis. In fact, analysis of Borinage can only be an approximation; sometimes using the district of Mons, which magnifies the picture, sometimes using the “Couchant de Mons” for facts on the coal industry, sometimes using the distorting picture provided by the new communes.



In order to show the parallels between the demographic evolution and the economic evolution of Borinage we have had to reconstruct the past dynamics of its population.

Doing this means establishing a demographic prospective of the past starting from a known initial situation and ensuring that the results of the simulation coincide with the observations for the years where the latter are available.

The available statistics therefore act as markers for the reconstruction of the events and make it possible to estimate missing information.[4]

Table no. 1 shows the evolution from 1793 to 1970 of the population volumes of Borinage as defined (16 former communes) and of the entire district to which it belongs minus these sixteen Borinage towns.

From table no. 1 it can be seen that :

- The population of Borinage has broadly increased five-fold while the rest of the district has hardly doubled its number of inhabitants.

- Borinage reached its demographic height in 1930 and then slowly declined while the rest of the district never ceased to grow, albeit it very slowly.

[4] For a detailed presentation of the results of this reconstruction see Lambert, A. (1998), L'évolution de la population totale des anciennes communes de l'arrondissement de Mons et les nouvelles communes au cours de la période 1831 - 1970, Ottignies, ADRASS, Rapport de Recherche n° 1, August 1998.

Table no. 1 - The populations of Borinage and the rest of the district from 1793 to 1970

	Borinage					Rest of the district			
Year	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(5)
1793	26 035	100	18	0,400	0,016	65 018	100	51	0,007
1831	47 443	182	32	0,569	0,020	83 342	128	65	0,008
1846	64 371	247	44	0,681	0,018	94 556	145	73	0,004
1856	77 191	296	52	0,784	0,017	98 461	151	77	0,001
1866	91 494	351	62	0,937	0,014	97 674	50	76	0,004
1880	111 148	427	75	1,080	0,008	102 930	158	80	0,004
1890	120 918	464	82	1,131	0,009	106 917	164	83	0,006
1900	132 044	507	89	1,166	0,008	113 200	174	88	0,004
1910	143 181	550	97	1,218	0,000	117 599	181	91	0,002
1920	143 471	551	97	1,250	0,003	114 759	177	89	0,005
1930	147 816	568	100	1,222	-0,003	120 955	186	94	0,001
1947	140 990	542	95	1,191	-0,001	118 406	182	92	0,003
1961	138 142	531	93	1,121	-0,003	123 222	190	96	0,005
1970	134 326	516	91	1,044	0,000	128 699	198	100	0,000

(1)= total population (2)= the population reduced to 100 in 1793. (3)= the population in relation to the maximum reached (4)= the population of Borinage in relation to that of the rest of the district. (5)= the annual demographic growth.

During the 19th century the annual demographic growth rate of Borinage is more than double that of the rest of the district. Consequently, the relative weight of Borinage in relation to the rest of the district went from 40% in 1793 to 125% in 1920. In 1970, Borinage still represents just over half of the population of the district.

Compared with what happened in the two other mining (and industrial) districts of Wallonia, the demographic growth in Mons is both more advanced and weaker. In fact, the maximum population for the entire 1831-1997 period is reached in 1930, with 2.1 times the population at the beginning of the period for the district of Mons. With regard to Charleroi, the maximum is reached in 1961 with 4.8 times the initial population and Liège reaches its demographic height in 1970 with 3.5 times the number of inhabitants in 1831. On the other hand, the demographic decline of Mons and Borinage starts thirty years before that of Charleroi and Liège!

Table no. 2 compares the density reached both in the main Walloon industrial districts in 1831 and in 1970 and in Borinage. The 16 communes which make up the latter scarcely cover a surface area of 100 square kilometres and the demographic **density** rapidly reached a very high level[5].

Table no 2. – The demographic density in a number of industrial districts and in Borinage

Entities	Surface area	Inhabitants in 1831	Density in 1831	Inhabitants in 1970	Density in 1970
Dist. of Charleroi	561 km²	95 983	171	456 690	814
Dist. of Liège	765 km²	177 038	231	618 192	808
Dist. of Mons	616 km²	130 785	212	263 025	427
Borinage	100 km²	47 443	473	134 326	1.338

Sources : Population censuses, INS, calculations ADRASS.

In fact, from the first half of the 19th century certain communes experienced very high densities for the period. This is the case for Pâturages with 2,182 inh/km² in 1846 or Warquignies with 1,391 inh/km². In 1927 the highest densities noted are: Pâturages with 3,561 inh/km², La Bouverie (2,721), Wasmes (2,277), Jemappes (2,217).

5 Moreover, according to J. Puissant, it is this demographic density that draws attention to Borinage: “It is a geographic whole which, from the demographic point of view, is characterised by a particularly high population density and which, since 1831, clearly distinguishes it from its neighbouring rural towns”; J.Puissant (1982), L’évolution du mouvement ouvrier socialiste dans le Borinage, Brussels : Académie Royale de Belgique, p 3, our translation.

Table no. 3 summarises the history of migration in the district of Mons from 1750 to 1930 comparing what would have been the population of this district – and its Borinage component – in 1930 if there had not been any migratory movement since 1750 with what it actually was. It is as if the demographic growth of Borinage was the counterpart of the decrease in population of the non Borinage towns of the district, to within 9,511 units ! The demographic power of attraction of Borinage was, in fact, limited to its immediate hinterland or at least to its equivalent.

Table no. 3. - Impact in 1930 of the migration history in the two parts of the district of Mons since 1750

	Borinage	Rest of the district of Mons	The entire district of Mons.
Population without migration in 1930	74 131	185 129	259 260
Reality of 1930	147 816	120 955	268 771
Difference	+ 73 685	- 64 174	+ 9 511

Source : calculations ADRASS

The demographic growth of the district of Mons, a lot more moderate moreover than that of the districts of Liège or Charleroi, is therefore above all the result of the very strong growth of sixteen former communes making up historical Borinage which contrasts with the very slow rise in population of the rest of the district. It is therefore indeed Borinage which was the driving element of the demographic dynamics of Mons during the industrial revolution and even up to the thirties. It remains to be asked what produced these dynamics and why they abated so rapidly compared with those of other industrial districts of Wallonia. Because, from the point of view of it migrational "attractiveness" - which moreover scarcely exerted itself beyond the immediate neighbouring rural towns – the "glory years" of Borinage are limited to four decades at the beginning of the 19th century from 1820 to 1860. Certainly, substantial migratory movement occurred after 1945 – in particular the immigration organised by the Belgian government to win the "battle of the coal" – but they are almost neutralised. Thus between 1945 and 1959, taking the internal movements and those external to the

district into account, 318,393 came in but 317,865 left, being a migration balance of 528 for the period or an average of 35 people a year. The diagnosis of the migrational attractiveness made for 1750-1930 is also confirmed for the period 1930-1970, except that the migrants after the war – mainly Italians – contributed to the demographic rejuvenation of Borinage because of their higher reproductive rate.

3. EVOLUTION OF ECONOMIC STRUCTURES AND ACTIVITIES

The demographic growth and decline of Borinage are closely related to the fortunes of the coal activity of the region. The latter, traditional in the country since the Middle Ages, experienced considerable expansion from the moment the steam engine appeared on the scene bringing a solution to the problem of pumping out which, until then, had formed the physical barrier to working deeper seams of coal and from when the building of the Mons-Condé canal (1814) opened up the large French market to coal from Borinage. With the introduction of the steam engine first for pumping out, then for extraction the Borinage coalfield entered the industrial era and, at the same time, that of capitalism. In fact, the necessary capital to install these machines was inaccessible to the "pit masters" and other "colliers" who were mining the underground resources of Borinage still largely on the basis of associations. First French capital then "Belgian" capital after the independence of Belgium and the formation of the Société Générale de Belgique, established itself in the region ending the traditional system of mining coal, regrouping little by little – however without ever completely regrouping –the concessions too numerous and too small to make the necessary investments for mining the deep and low yield seams produce a profit.

In order to pay off and ensure the profitability of these investments, the only way was to produce as much as possible because, from the beginning, the competition between collieries in the same coalfield, then between coalfields of the same country and, finally, with the falling of transport costs, between coalfields of competing countries exercised continuous downward pressure on prices. The collieries strived therefore to attract – and the most prudent managers to retain – as large a workforce as possible in order to make maximum use of the production capacities of their concession.

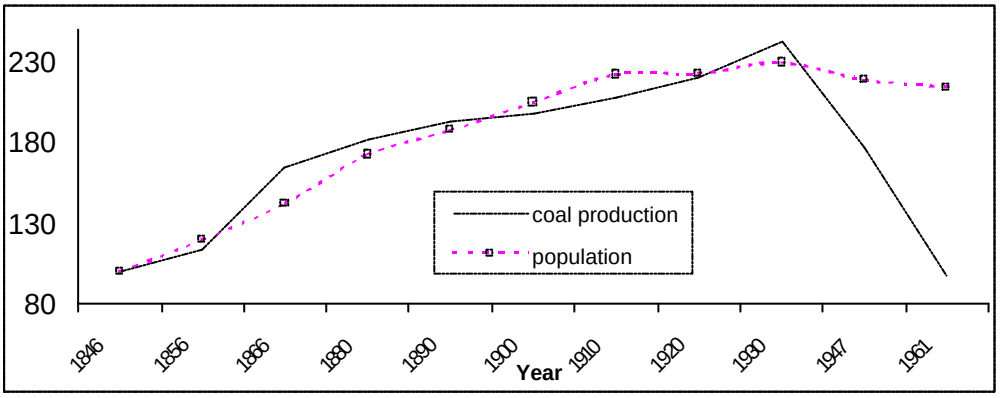
As H. Watelet writes: " ..the lack of workforce appears in the region, if not as a constant at least as a periodic phenomenon.[6]" The immigration into Borinage, undoubtedly

[6] H. Watelet, op.cit., p 274.

spontaneous initially then becomes the result of a deliberate policy of the mine operators to attract the workforce which they greatly need.

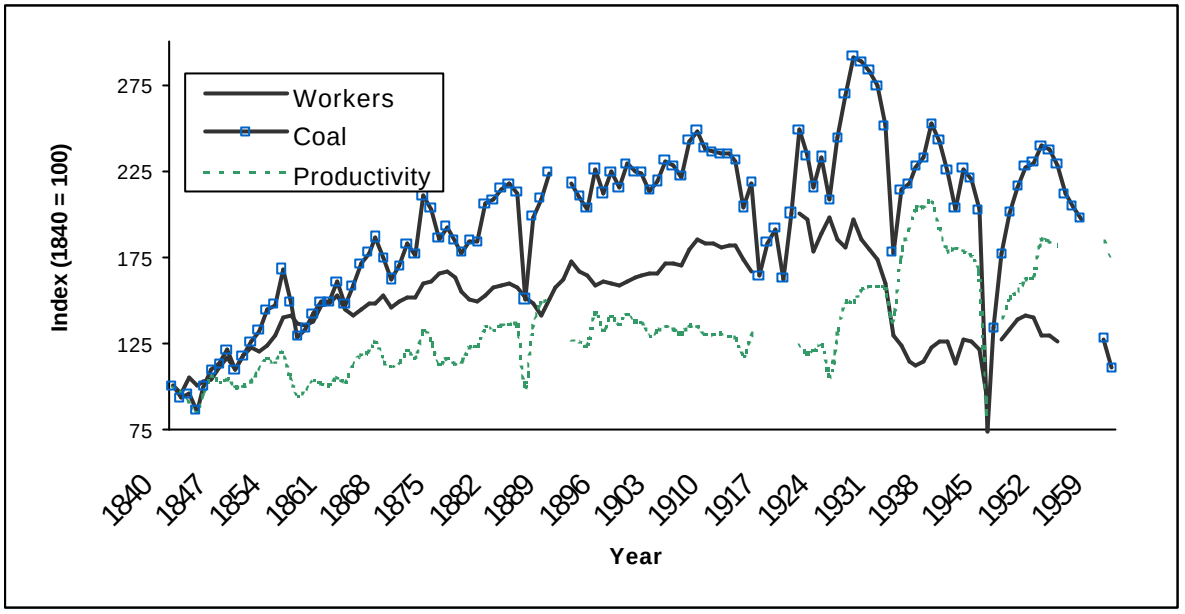
Figure 1 shows the evolutions, standardised at 100 in 1846, of the quantities of coal mined between 1846 and 1961 in Borinage and the total population of the 16 communes. In order to better visualize the convergence of the evolutions the values between those observed for the census years have been interpolated. The parallelism is striking until 1930. From this date coal production collapses and from the first years of the decline in production the population starts to diminish even if the area does not become deserted, unlike in some regions. .

Figure 1. - Evolution of the population and the production of coal between 1846 and 1961



Sources : J. Puissant (1982), Belgian Mine Records (1895-1962) and calculations ADRASS

Figure 2. - Evolution of the production of coal, of the number of miners and of productivity from 1840 to 1960 (1840=100)



Sources : J. Puissant (1982) and Belgian Mine Records. Calculations ADRASS

Figure 2 shows the evolution in indices of the number of workers employed in the coalfield and of production. It can be seen that the two variables experience numerous fluctuations between 1840 and 1960. The crises follow one after the other: 1856-1858, 1877-1879, 1884-1886, 1914-1918, 1920-1924, then the “great crisis” of 1931 (in fact, production growth rates fall continuously from 1926 onwards, which was the historic peak of production of the coalfield, and fall below 1 from 1927), the 40-45 war then the final decline from 1950 onwards. The number of workers follows the fluctuations in production quite closely but not exactly: the falls in productivity which accompany the crises show this, demonstrating that the number of workers does not decline at the same tempo as production, the adjustment mainly being brought about by falls in wages.

The period which marks the end of the great crisis and the beginning of the war experienced a substantial growth in activity: this is explained by the large investments which occurred at this time in order to no longer be dependent on the manpower available, a dependence characteristic of the coal industry. As an economist of the time says: “The substitution of the human factor by the more plentiful capital factor, has been

pursued since the war at a very fast rate which makes it possible to remove the coal industry to some extent from its previous dependence on manpower.[7] »

The period after the war is characterised by a voluntary and quite artificial recovery of production within the framework of what it known as "the battle of the coal" which moreover necessitated the employment of prisoners of war and then of Italian workers literally "imported" into Belgium for this. This recovery was only a flash in the pan: the development of the CECA put an end to this from the mid fifties. At the beginning of the sixties, the Couchant de Mons disappeared from mining statistics in as much as its production became marginal. Not that its seams were geologically exhausted : only a few years before the last collieries closed their gates the reserves of mineable coal of the four main collieries in the region had still been assessed at some 800 million tonnes, ensuring at the extraction tempo of the period (4.7 million tonnes) another 170 years of existence for these enterprises[8]. By comparison, the total production of the coalfield between 1829 and 1961 can be put at approximately 480-500 million tonnes. It is therefore not the exhausting of the deposits which explains the closing of the pits but their lack of competitiveness in the face of, on the one hand, the competition from Belgian (Campine) and foreign coalfields and, on the other hand, the development of a new form of industry based on the car and petrol[9].

The decline and then cessation of coal production in Borinage would not have meant its demographic death sentence if other industries had been able to prosper on the heels of its collieries.

As the first coalfield of the continent – in a chronological sense but also, for a time, in the sense of main producer – Borinage should have been the first centre of growth of the region and attracted businesses – in particular from the iron and steel industry – interested in being closer to this raw material, a source of energy and of carbon, which is expensive to transport. However, throughout the modern history of Borinage the extraction of coal remained the main if not the only industry and, in any case, the only driving force of other enterprises which never succeeded in freeing themselves from it

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7 A. Coppé (1940), *Problèmes d'économie charbonnière*. Bruges : Desclée de Brouwer, p.101.

8 Commission Internationale d'Experts (1954), « Expertise relative à la rentabilité présente et future des charbonnages borains », *Annales des mines de Belgique*, November 1954, 6ème livraison : 684-748.

9 *Cf*. P-M Boulanger (1999), "Technologie, diversité et développement durable: l'expérience boraine" in SSTC, *Modes de consommation et de production durables : le rôle des technologies, de l'aménagement du territoire et du transport*. Workshop du 1er Juin 1999, PADD.

This is shown by the data, from successive industrial censuses, relating to industrial jobs outside collieries in the region. On analysing them it can be established that the parallel between the evolutions of the total population of the 16 Borinage communes, those of coal production and those of the number of miners is true for the entire workforce. In table 4 it can be seen that the workers who were not miners were never the majority of workers before 1947. And the 52% fall in the number of miners from 1947 to 1961, is repeated among workers who are not miners.

This confirms that the industrial activities which were able to develop alongside the coal industry in Borinage were always of secondary importance to the latter and had to depend closely on it for their opportunities, so that they hardly stood a chance of surviving when the collieries disappeared.

Table no. 4. – Workers, miners and non-miners at Borinage from 1846 to 1961

Year	Total no. workers	Miners	Other workers	Share of the non-miners in the total no. workers (in %)
1846	26 414	20 604	5 810	22
1856	31 068	25 387	5 681	18
1866	35 721	27 574	8 147	23
1880	42 702	28 341	14 361	34
1890	49 076	30 025	19 051	39
1900	55 476	30 466	25 010	45
1910	60 786	33 404	27 382	45
1920	58 856	37 279	21 577	37
1930	56 926	32 316	24 610	43
1947	55 539	24 724	30 815	55
1961	26 567	11 825	14 742	55

Sources : Industrial censuses (INS) and calculations ADRASS

The fact of insufficient industrial diversity in the district of Mons can also be established from a comparison with the two other mining districts of Wallonia which coped better with the disappearance of their coal industry. Table no. 5 shows an industrial diversity index[10] calculated for these three districts from different industrial censuses.

[10] It concerns the index of relative entropy, also known as the «Shannon-Weaver » measurement. For details see P-M Boulanger (1999), op.cit. p 13.

Table 5. – Industrial diversity index of the districts of Mons, Liège and Charleroi from different industrial censuses

Census	Mons	Charleroi	Liège
1846	0,468	0,694	0,730
1880	0,563	0,640	0,747
1896	0,622	0,649	0,747
1910	0,600	0,624	0,730
1930	0,579	0,654	0,747
1937	0,667	0,686	0,763
1947	0,668	0,694	0,752
1961	0,821	0,695	0,722
1970	0,857	0,760	0,704

Sources : Industrial censuses (INS) and calculations : ADRASS

This index has the value zero when all observations are in the same category (maximum homogeneity) and reaches its maximum (1) when all the observations are divided in a uniform way among the various categories (maximum heterogeneity).

It can be seen that from 1836 until 1961, the date when the coal industry more or less disappeared, Borinage had a entropy index[11] which was lower than the other two districts, Liège always displaying the strongest diversity. The closing of most of the collieries in 1961 of course contribute to the increase in the entropy index from the moment only a few small factories and workshops, depending more on arts and crafts than on industry, still exist in the region. It should be noted that this extreme specialisation of Borinage only in the extraction activity occurred right from the

[11] We note that here it concerns the diversity within the single industrial sector. It is more than probable that the conclusions would be even more clear in terms of economic diversity, i.e. taking into account the agriculture and tertiary sectors.

beginning of the industrial revolution and was pointed out in a report from 1785 to the ambassador of Belgiojoso[12].

An explanation for the non-sustainable character of the industrial experience of Borinage must be sought in the understanding of this incapacity to attract, retain or favour the growth of dynamic businesses possessing the necessary resources to innovate and adapt to the evolutions in technology and in demand as well as to the pressure of competition.

H.Watelet suggests an interesting explanation for the absence of a centre of the iron and steel industry near the mines of the Couchant de Mons. According to this explanation the coalfield "benefited" very early from an advantageous transport network, unlike at Charleroi and at the Centre, an advantage which would definitely have been to its detriment because it "permitted" it to dispose of what it produced abroad and "a certain routine, a tendency in business circles to export rather that to create opportunities locally may have played a role.[13]" In more polemic terms, it was said that the existence of these transport networks permitted a form of colonial exploitation of Borinage.

This circumstance undoubtedly played a role but is not sufficient, in our opinion, to explain a situation which continued for 200 years in spite of a number of attempts at reconversion and redeployment.

The non-development of Borinage is more probably due to the lack of investments in two forms of capital, the importance of which is underlined by the theory of sustainable development on the one hand and that of endogenic growth on the other: environmental capital and human capital.

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12 "…If someone says to me it is necessary to extract coal to support lots of people who, without this, would be poverty-stricken, I will reply that if one is forced to extract this precious fossil, one must at least attempt to use it here in factories which will give us as much gold as the coal gives us copper today. I cannot remember without groaning the comparison I made during my journey between the town of Mons and Liège, both equally surrounded by coal. The latter … has a very high population and announces the wealth of its inhabitants from afar, wealth mostly acquired by processing iron by means of which they converted their coalmines into true gold mines. The town of Mons, on the other hand, only announces its solitude … Mons restricts itself to extracting the coal, it sells it and does not use it …" (F.X.Burtin (1785), *De la houille et des houillers. Rapport au Ministre Plénipotentaire Belgiojoso*. Quoted in H. Hasquin (1999), *La Wallonie, son histoire*. Editions Luc Pire, our translation.

13 Watelet, *op.cit.*, p 296.

4. HUMAN CAPITAL

Borinage seems to have suffered a lack of general education of its population. In any case it is this that emerges from the statistics supplied on this subject from the various censuses and which show that the level of education of the population of the district of Mons and even more of that of Borinage, is constantly lower than that of Belgium in general, at least since statistics on this have existed, i.e. since 1866. This does not exclude the possibility of a more favourable situation at the beginning of the industrial revolution.

Table no. 6 shows in the form of indices the discrepancy between the levels of the district of Mons and of Borinage compared with the situation for men and women of the whole of Belgium. The index is calculated from the unweighted rates of the elimination of illiteracy from 1866 to 1947, and afterwards on the basis of those possessing a diploma beyond secondary education. The change in the basis for the calculation results in the gap between the values of the indices between 1947 and 1961.

Table 6. - Evolution of the indicator of the level of education in the male and female populations of the district of Mons and Borinage from 1866 to 1991.

Year	Belgium		District of Mons		Borinage.	
	Men	Women	Men	Women	Men	Women
1866	100	88	86	76	68	57
1880	100	92	93	83	81	69
1890	100	94	93	83	81	68
1900	100	96	95	88	85	76
1910	100	98	97	91	91	83
1920	100	99	99	95	97	92
1930	100	100	100	97	--	--
1947	100	101	101	101	--	--
1961	100	80	85	83	54	59
1970	100	51	92	53	56	35
1981	100	85	85	76	53	34
1991	100	92	79	75	58	59

Sources : Population censuses, INS, calculations ADRASS

It can be seen that from 1866 and regardless of the period Borinage always shows a deficiency in its level of education. The main cause of this deficiency in education is undoubtedly due essentially to the large presence of young people and even, until in 1914, of children from 12-14, in the mines. It is only from 1889 that a law will forbid children under 12 from working and from 1914 that school will become obligatory until 14.

The migrations can also explain part of this phenomenon: it is as if its qualified, educated population (its industrial and intellectual elite) left Borinage as quickly as possible. Inversely, it is a less educated population from the immediate surrounding countryside, then from Flanders and then from abroad which comprised most of the immigration. The arrival of less qualified people combined with the departure of the most qualified would explain such a low average level. This is why J. Puissant describes this population of miners to us as "left entirely to themselves. Only a minute marginal fraction of small businessmen and publicans form a reduced middle class… There is almost no middle class autochthons, almost no intelligentsia able to train executives and encourage change in the economic and social situation.[14]"

This lack of general education and middle class or working aristocracy is without doubt partly responsible for the lack of innovation in the industries other than mining which developed for a time in the region but which eventually disappeared, such as the engineering industry[15], the shoe industry, glass industry, textile industry, etc.

5. ENVIRONMENTAL CAPITAL

Another element which undoubtedly went against sustainable development and which has been too neglected in the studies[16] which we have been able to consult is the **environmental factor**.

The very rapid demographic growth at the beginning of the industrial era and which our demographic analyses give an account of translates, it has been seen, into very high levels of population density in the villages of Borinage. This density has been acquired in a very few years and therefore, of course, without any town planning regulation, in an anarchic fashion with the hurried construction of what has more in common with hovels

14 J. Puissant (1982), *op.cit.*, p.83.

15 According to M. Bruwier: "If the reputation of manufacturers of fire machines from Borinage extended beyond the region… no technological innovation could be attributed to them. They lived in close contact with the other coalfields, taking advantage of all useful modernisation. » *op.cit.*, p.126, our translation.

16 Only the work already quoted by R. Leboutte, J. Puissant and D. Scuto (1998) devotes a number of sections to the problem of the environment.

than real housing.[17] All this leads one to think that Borinage experienced a true "favelisation" due to too rapid growth of its residential area.[18] The testimonies note moreover that "thousands of large families, thousands of human beings, lower and degrade themselves, wasting away in overpopulated dwellings and in filthy houses.[19]»

At the same time, due to the very high number of concessions, extraction and ventilation pits and spoil tips multiplied and were so dissected, scored by the numerous railway lines taking coal to the Mons-Condé canal, then the miners to the pit heads, that according to a witness from the time: "the population often lives in appalling overcrowding on the remaining land. Along the narrow alleys, often without a garden, the houses are substandard and often the cellar, the ground floor and the first floor are occupied by a different household. Thus in Borinage the dispersion of residential areas and centres of social life is often accompanied by serious overcrowding of the population in poverty-stricken mining villages.[20]„

This lamentable situation hardly improved with time. Here is the description still given in 1950 by M. Crappe, provincial director of the town planning department, of the state of the housing and environment of Borinage : "

a) Shocking combination of industry and housing…

b) Inadequate and decaying housing.

c) Shacks for houses … more than 1000 shacks … in which almost 4500 people are housed

d) Mining villages caused by speculation … construction of sufficient housing to ease an unavoidable atmosphere of despair, boredom and ugliness.

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17 "In certain centres in Borinage the population poured in throughout the whole of the 19th century. Accommodation was improvised, as it were. Tiny houses were built for often large families and almost always with very limited resources. The landlords and the collieries divided their ground up to the extreme, along narrow roads and down sombre alleys. They only used relatively small amounts of capital in the construction." G.Jaquemyns, op.cit., p.87.

18 See the descriptions of Vincent Van Gogh, quoted in R. Leboutte, J. Puissant and D. Scuto (1998), op.cit. p.43.

19 H. Fauvieau, *op.cit*., p 67.

20 C. Mertens (1947), La répartition de la population sur le territoire belge. Etude de démographie sociale. L'édition universelle. Brussels, p.24.

e) Ugliness…

f) Lack of sanitation: lack of drains, water supply; pollution of waterways, lack of greenery, disappearance of forests, subsidence due to mining causing damage to buildings, formation of marshes and permanent or periodic flooding of residential areas.[21]"

In 1980, traces of this overuse of the space were visible in the cadastral statistics: the tips and roads (not registered in the land register) occupy a large share of the space as the table below shows. The development of that not registered in the land register is particularly notable : Quaregnon – which only consists of one village – thus sees 15% of its surface area devoted to transport networks, a share which is certainly less than that in Liège (20.6%) but which is larger than that in Charleroi (12.3), Mons (8.3) or Fleurus (5.8%).

Table no. 7. – Tips and occupation of the space in Borinage in 1980

Towns	Number of tips	Surface area occupied by tips (ares)	As % of built-up area	Built-up area as % of total	Not registered in the land register as % of total
BOUSSU	53	1123758	30,9	18,1	8,7%
COLFONTAINE	43	515152	16,1	23,4	6,0
FRAMERIES	19	190435	5,1	14,3	5,1
QUAREGNON	52	747471	25,1	27,0	15,8

Sources : Town planning administration, calculations ADRASS.

[21] M. Crappe (1950), "Le logement dans le Borinage", *Revue de l'Institut de Sociologie*, (2-3), Brussels : 281-305, pp 282-283.

When we add to that the pollution of the air which corroded the materials (stone, metals, marble) and the coal dust which settled everywhere the result is a countryside bereft of all residential attraction, detrimental to health[22] and therefore possessing little to retain a population which has the means of escape. It is therefore not surprising that the housing in the region is the oldest and most decrepit in Belgium: the tempo of new building there is still lower than that of demographic growth, so that in the years 1920-1930 there was only an average of 82 houses for 100 households.

Unfit for housing, the space was equally unsuitable for welcoming new businesses of any size. It is for this reason that the "coal by-products industry of Tertre", the only example of a business created explicitly with the aim of diversifying the industrial activity in Borinage – we note however that the domain of coal is still not left since it concerns a coking plant for processing Borinage coal – has to be located outside the region in the village of Tertre, according to its manager: "in a village without any direct contact with a railway line of any significance, without even having the advantage of being located on a waterway.[23]" It is because it had been impossible to find "a site of sufficient size free from the dangers of flooding and risks of mining subsidence[24]" near the collieries.

6. CONCLUSIONS

The impression obtained from this study may appear excessively sombre and pessimistic with regard to the fate of Borinage and its population. However, this impression should be tempered by recalling that our study is clearly not impartial and that, among other things, omitting the social capital of Borinage – considered by all observers to be very rich and active – contributes to emphasising the negative aspects of the table much more than the positive ones. We remind you above all that the Borinage which we have presented here is often more of a sort of diagram of the

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22 Even if there are no facts available about the impact of air pollution on the health of the population of Borinage, one can imagine that it hardly differed from that observed in other similar regions, such as Newcastle upon Tyne, for example, where chronic bronchitis was found in 36% of men and 17% of women aged 30 and above. Cf. W. Kapp (1971), *Social Cost of Business Enterprise*, London : Asia Publishing House, p.56.

23 Mine, M. (1950), "Compte rendu de l'exposé de M.Mine lors de la visite aux usines de la Société Carbochimique et Colorants de Tertre", *Revue de l'Institut de Sociologie*, (2-3), Brussels : 153-159, p 153.

24 Mine, *op.cit*., p 155.

real Borinage, intended to show the “exemplary” characteristics of non-sustainable development.

But it was not about instrumentalising, as it were, the region either, placing it at the disposal of the academic scarcely worried about the real Borinage and its inhabitants. This region certainly deserves interest in it for itself and attention paid to its real difficulties. It is also one of our objectives to contribute, however modestly, to drawing attention to the latter by showing everything that Belgian prosperity owes it and the debt that the country has incurred with regard to it. However, we have never claimed to provide a complete diagnosis of the region and even less posed as enlightened reformers in possession of the secret of its rectification. The “life forces” of the region are sufficiently dynamic and lucid not to need us for that. What they perhaps need more, on the other hand, is an institutional framework which places the financial and administrative means of appropriate long-term action at their disposal. Because Borinage as real and lively as it is at cultural, sociological, landscape and psychological level does not really exist at institutional level. In one sense, it never existed because it has always been included in larger entities such as the district of Mons and the province of Hainaut. However, before the reorganisation of local governments it corresponded quite closely to sixteen “former” communes which because of this reorganisation have been split up, certain parts of their territory having been incorporated in communes with which they have no sociological or historical affinity. We do not want to imply that the latter do not pay the attention to its Borinage component that it deserves but one can imagine that the interests of Borinage would have been better served if the administrative cutting up had had more regard for the socio-historical realities. The homogenous communes, sharing a past and identical problems, would probably have had greater force and greater effectiveness working together for their future, a bit like within the framework of the “country contracts” which have been invented in France precisely to allow communes which are ecologically, sociologically or economically similar to work together even if they belong to different districts or regions.

What allows us to attempt to draw information of more general significance from the experience of Borinage is that, in the first place, this experience is far from unique. Other regions – mainly mining ones but not only mining ones – in Europe (Great Britain, France, Germany, Russia, etc.) or in America have experienced the same process of rapid growth then decline, followed in the worst cases by abandonment or dereliction. Very close to Borinage, the Nord/Pas-de-Calais coalfield has experienced a fairly similar fate, if G. Chautard and E. Olszack are to be believed: “In terms of sustainability, the fact is undeniable: the coalfield is a perfect example of non-

sustainable development. The people and the area are “sustainably” marked by the scars of non-sustainable development and, at times, even irreversibly so.[25] »

This shared experience is not just a thing of the past. What justifies studying its development is that other mining regions in Asia, Africa and Latin America are now experiencing, or soon will experience if care is not taken, an identical fate.

The first lesson is that the tapping of a non-renewable natural resource itself – unless it is extremely rare – does not constitute sufficient requirement for the sustainable development of a region with an open economy; in the first place because of its non-renewable character and its possible disappearance, but also and above all, because sooner or later and generally well before this resource has been exhausted, the region will face competition from other regions, endowed like it and maybe even better than it with the same resource. Moreover this can be generalised to include all local resources liable to loose their rarity or attractiveness. The development of technologies and the internationalisation of economies are necessarily accompanied by changes of location of centres of activity. Thus, before the industrial revolution the power supplied by rivers was an important location factor. The invention of the steam engine meant this was no longer an attraction factor and it was replaced by the presence of large sources of fossil energy (coal). Then electrification made it possible to separate industrial activity from primary sources of energy, causing coal-mining regions in turn to lose their power of attraction. Each time, certain regions have foundered and have been unable to withstand the fact that their main competitive factor became commonplace, but not all. There is nothing inescapable about this decline because other regions, on the other hand, have adapted and have continued to develop despite everything.

With the economic success of a region being linked to the presence within it of local resources which are sufficiently rare or attractive to attract businesses and populations, its eventual decline will result from the disappearance of these local resources (exhaustion of a non-renewable resource, overworking of a renewable resource) or from them losing their attraction, because of what Maskell et al.[26] call *ubiquitification*, a process by means of which, due to the effect of the internationalisation of the economy, the lowering of costs of transport etc. local production factors which until then had been rare become easily accessible from anywhere in the world.

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[25] G. Chautard, G. et Olszak, E., (2000), “Développement durable et territories en reconversion : l’exemple des zones minières du Nord/Pas-de-Calais”, in Zuindeau, B., ed., D*éveloppement durable et territoire*, Lille : Presses Universitaires du Septentrion, 205-237, p.215.

[26] Maskell, P., Eskelinen, H., Hannibalsson, I., Malmberg, A., and Vatne, E., (1998), Competitiveness, Localised learning and Regional Development, London : Routledge.

Since local resources which used to be rare become accessible, the main competitiveness factor between regions can only be the cost of labour. This is the reason why current globalisation entails a movement towards a fall in salaries and working costs in general. Borinage experienced something similar when, because of the lowering of the tariff walls and reduction in transport costs, English, German and Campine coal started competing with it, including on its most traditional markets and those geographically the closest. The war of the coalfields was fought on the front of production costs and, above all, wages.

The sustainable development of a region therefore occurs via the creation and maintenance of local resources resistant to ubiquitification. It becomes increasingly clear that the decisive local resource in this respect is the stock of knowledge, of implicit know-how, of skills accumulated in this region, the depository of which is the workforce. The study carried out by Wright[27] into the origins of American industrial successes during the period 1880-1940 clearly shows that the existence of natural resources was only a factor of sustainable development when they were not worked as an element exogenous to society, a "natural" reserve, but as a socially construed endogenous element. It is only then that the use of the resource can become the generator of growing returns – while the activity of extraction alone is subject to falling returns[28] – and of positive feedback. Looked at closer, it is the human and social factors which play the main role in this process, rather than the natural resources. Other analyses, of mining regions in the United States[29], confirm that working the substratum is rarely a good starting point for sustainable development.

Because it is from the human capital that the innovations are born that permit a business or an industry to remain competitive in spite of possibly above-average production costs. These innovations are mainly technological in nature but can also be organisational or relate to marketing, management, etc. Likewise, not all technological innovations are confined to "high technology". Using Danish, Swedish, Norwegian and Finnish examples Maskell et al.(1998) clearly show that traditional industries, with average technology can become centres of innovation and, thanks to the latter, remain

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27 Wright, G., (1990), The origins of American industrial success, 1879-1940, American Economic Review, 80 : 651-668.

28 Cf. A. Coppé : "The coal industry is, in fact, one where the law of diminishing return stands out most sharply in the long run.", Coppé, A., (1940), Problèmes d'économie charbonnière, Bruges : Desclée de Brouwer, p.84, our translation.

29 Power, T.M., (1996), Lost Landscapes and Failed Economies. The Search for a Value of Place, Washington D.C. : Island Press.

competitive in spite of above-average production costs. It is to be noted moreover that tacit, non-formalised, propagated knowledge withstands the phenomenon of *ubiquitification* better than high level scientific and technical know-how which, being more abstract and more formalised, can be passed on and travel more easily.

The growth and preservation of this human capital depend, in turn, on the regional attractiveness, not only in terms of employment, income and quality of work but also at a level of general quality of existence, including residential and social aspects.

The identity of each region and its attractiveness are therefore the result of a particular combination of four forms of capital, forged by the geography and the history: a natural capital (resources and landscape), a social capital (institutions, transport networks, social relationships, culture, traditions), a human capital (know-how, skills, knowledge), a material capital (infrastructures, accommodation, productive tools). Sustainable development assumes the creation and maintenance of positive feedbacks[30] *between these four forms of capital.*

When examining the history of a region like Borinage, it can be seen at what point the four forms of capital interact and at what point each of them is important in the development : how, in fact, can a qualified workforce and enterprising individuals be retained in a devastated landscape, in decrepit and uncomfortable accommodation ? How can new businesses be attracted to a region known for the violence of its social relationships, the length of its industrial disputes? How can a social climate of cooperation and mutual trust be created when the inequalities and poverty are extreme?

Our study, still incomplete, confirms in full the conclusion of Zuindeau[31] regarding the implications for sustainable development of the adoption of a local, territorial point of view, namely that the number of variables to be taken into account is much higher than for a national or global approach. It also confirms the importance attached by Zuindeau to the landscape in sustainable development at local level:

"…if, at an a-spatial (but also global) level the ecological rules of sustainability only consider two types of variables: natural resources and pollution (…), at territory level other factors may become pertinent. This is particularly so for the landscape. If, clearly,

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30 Here positive should be understood in the sense of "favourable" and not in the technical sense of the theory of systems as the effect of the reinforcement, the maintenance of a growth or of a decline.

31 Zuindeau (2000), op.cit.

at global level the quality of various landscapes does not affect the sustainability of the entire system, at local, or regional, territory level the quality of the landscape will affect the economic development of the area. For example, areas of reconversion where past industrial growth and its implication through a major structural crisis have led to a substantial environmental liability, among other things characterised by the destruction of the landscape and the formation of industrial waste lands; the whole, in turn, forming an obstacle to new economic activities …"[32]

This could have been written about Borinage …Does that not mean, quite simply, that the landscape forms a genuine natural resource at local level even if it is an organised natural resource?

Another lesson which indisputably emerges from this study and which is obviously not unrelated to that which has just been stated is the importance of **diversity**, economic but also sociological, cultural and of the landscape… A number of authors have shown this and use it to explain the fact that the development of Borinage could not have been sustainable. Our own analyses confirm, in fact, that the region has always shown evidence of less diversity than its neighbours Charleroi and Liège. However, the status of this variable is uncertain: is it a cause of non-sustainability or an indicator? If diversity is a necessary requirement for sustainability, via what channel does it act, what is the principle of its action? It seems to us that more in-depth investigations should make it possible to settle these questions and, therefore, explain to us its exact role in the development, adaptability and resilience of regions[33]. If this role is to be confirmed it would be useful to attempt to show the factors which stimulate diversity and those which inhibit it. This question has more than just theoretical importance: today there are prosperous regions such as Silicon Valley in the Untied States the development of which relies on the domination, almost monopoly of a single industry which at present is flourishing. What will happen to them if, as for Borinage, the moving on to a new technological economic cluster should indicate the decline of this industry? Here even, in Belgium, are there not areas the prosperity of which relies almost exclusively on the petroleum industry and which perhaps risk becoming a disaster area if the price of crude oil passes a certain threshold?

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32 Zuindeau, op.cit. p 60.

33 Jane Jacobs (1969) was the first person to support the theory that diversity is a factor which encourages innovation, thus explaining the economic dynamism of the city. This theory was empirically confirmed for the first time by the study by Gleiser et al (1992). Moreover, biologists and ecologists have always attributed a certain intrinsic value to diversity.

As has been seen, it is not sufficient to commit to the dynamics of sustainable development, to be satisfied with the "think globally, act locally" of the pioneers of environmentalism. It is still also necessary – as the whole history of Borinage shows – to "think locally and act globally.[34]*"*

[34] We owe this conclusion to Philippe Van Parijs.

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RESIDENTIAL BEHAVIOUR OF HOUSEHOLDS WITHIN THE FRAMEWORK OF SUSTAINABLE DEVELOPMENT

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1. INTRODUCTION

Towards a sustainable development policy

The project forms part of the DWTC programme “Levers for a sustainable development policy”.

Causes of non-sustainable development

One of the levers consists of the study into the cases of *non*-sustainable development.

Reasons behind the non-sustainable nature of human behaviour

What are the reasons behind the non-sustainable nature of human behaviour?

Households = pressure sector

Households are one of the pressure sectors, alongside industry, agriculture, tourism, the energy sector etc.

Residence, living and travel Þ residential choice

It is a matter of revealing the mechanisms by which a sector functions. Both patterns of consumption and production and the ways in which people reside, live and travel are concerned.

Research project: “Residential behaviour of households within the framework of sustainable development”

Once the residential patterns have been surveyed, it is possible to move on to an analysis of the problem points and make an efficient study of the possible instruments which can be used in remedying these problem points and adjusting sectoral policy in the direction of sustainability.

2. OBJECTIVES

The research project is supported by various pillars in relation to the *stated objectives*.

a) Households determine the spatial patterns of the residential function through choice of residence. In Belgium, a decline in the urban residential climate to the benefit of urban-fringe residential zones has been evident for a considerable time. The process of suburbanisation is a significant factor in this:

   - *surveying the residential preference and residential mobility of today, paying particular attention to the process of suburbanisation,*
   - *determination of the profile of people moving house and their reasons for doing so.*

b) The process of urbanisation brings together large numbers of non-sustainable features which are experienced as problem points. This process in itself has a great space-consuming effect. The process of suburbanisation promotes the separation of the various functions, primarily of living and working, which implies an increase in mobility. An increase in energy consumption and numerous secondary problems for man and the environment can be linked to this. Another problem point consists in the costs associated with the process of urban expansion. It is not just the costs experienced by the individual households which are involved but in particular the additional costs to the community in putting in place the spatial structures of suburbanisation. Alongside these, significant financial disparities grow between the environments involved:

   - *examination of the significance of consumption of space and energy due to urbanisation and suburbanisation,*
   - *examination of where the costs and additional costs of the process of suburbanisation are to be found,*
   - *analysis of the role of the municipalities in relation firstly to the costs associated with suburbanisation and secondly to the increasing fiscal disparities between city and suburbs.*

c) The role and impact of policy and the Belgian attitude towards suburbanisation and urban expansion go some way towards explaining the present forms of

suburbanisation. The efficiency of the policy pursued is low in comparison with a number of examples from other countries:

- *performance of an international comparative study on the policy approach to urban expansion for the policy sectors directly involved: physical planning, land policy, housing and fiscal measures;*
- *comparison with and assessment of the Belgian situation.*

d) A properly substantiated basis is given to the formulation of policy recommendations within the Belgian context through knowledge and study of the approach to the process of suburbanisation in other countries:

- *the principal objective consists in drawing up policy proposals to check urban expansion and control it better in relation to the objectives of sustainable development.*

3. RESULTS

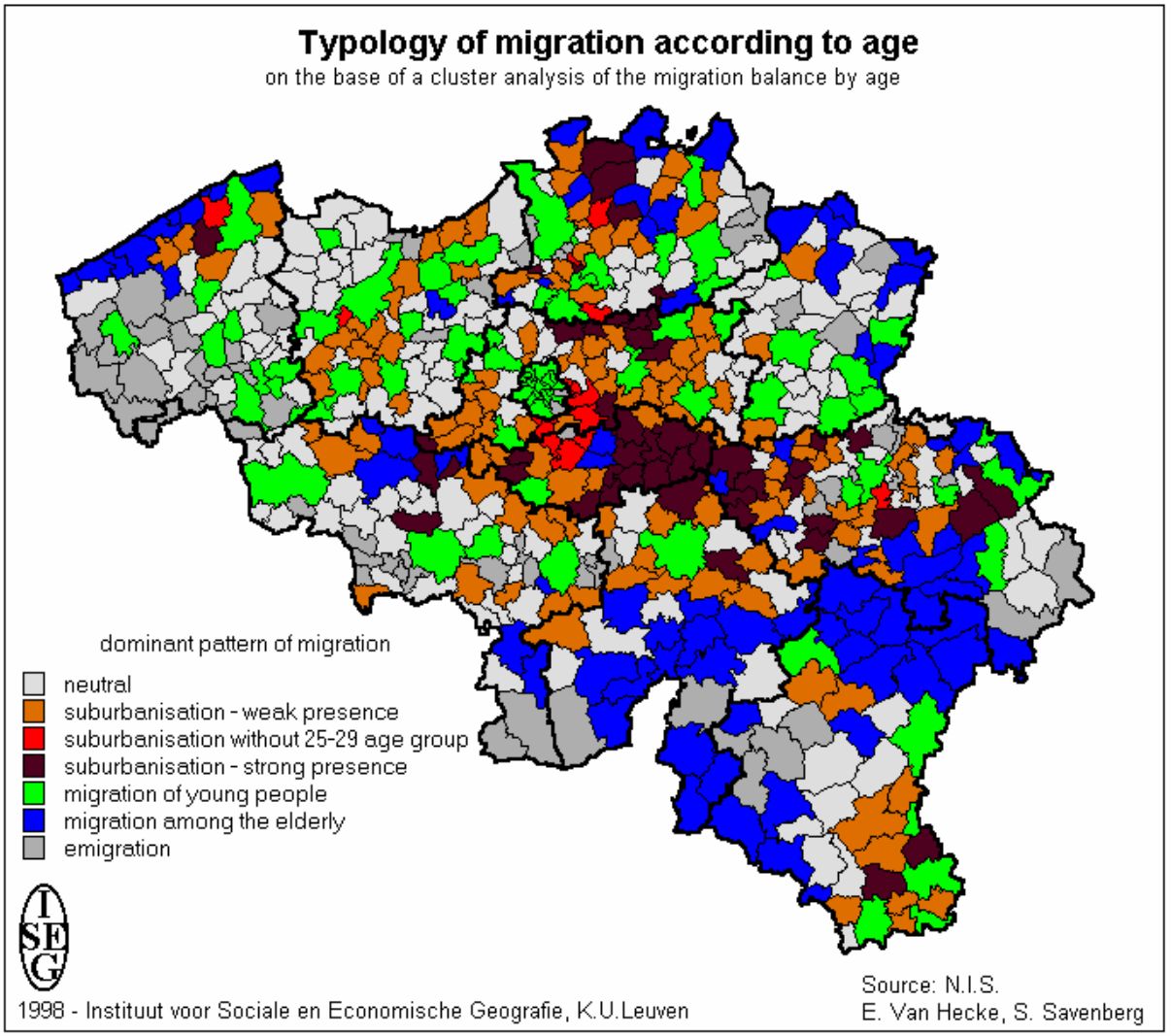
3.1 The residential choice of households

3.1.1 Patterns of migration

Residential migrations are age-related. Change-of-residence activity is noticeably greater in some age categories. This age pattern agrees with the various phases in the cycle of life. Some phases of life are inherently associated with a change of residence, while others often give rise to it: setting up home on one's own – marrying/cohabiting – expanding families – shrinking households – retirement – elderly.

Residential migrations are location-related. Areas of attraction and repulsion become apparent, which largely coincide with the classification of space according to the functional level. Municipalities are classified on the basis of their functional level, the city and town centres forming one extreme while the rural municipalities form the other.

Linking the two parameters allows three main types of migration to be distinguished: migration of young people, suburbanisation and migration among the elderly.

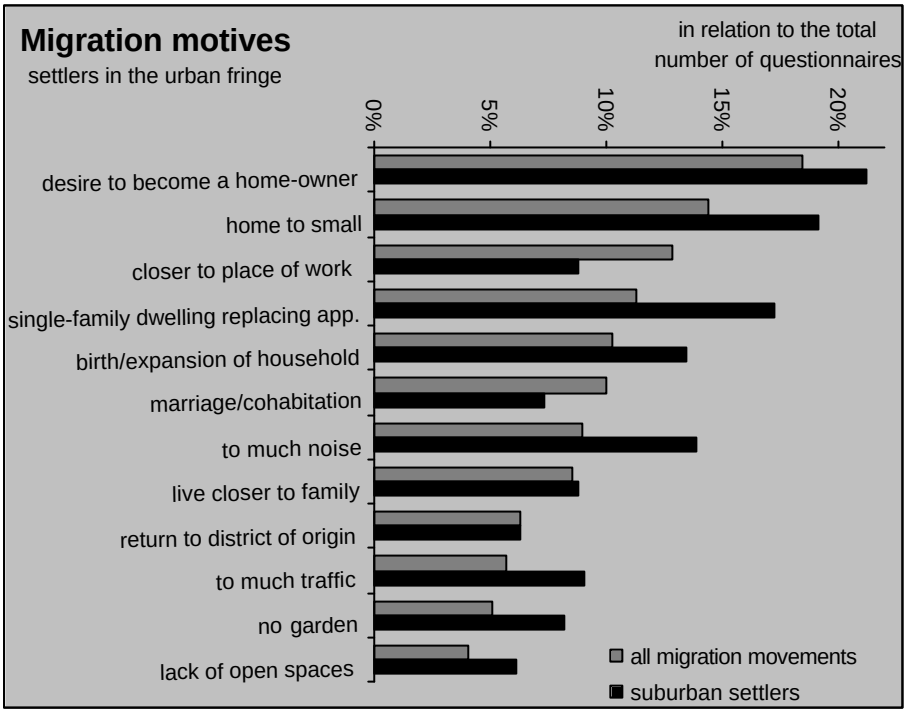


Residential migrations with the process of suburbanisation are dominant within the complete package of migrations. The city centres are left in exchange for a home on the suburban fringe. Most participants in the suburbanisation group are in their late twenties and, in particular, in their thirties. The children also differ, but they do not decide independently on residential migration and follow their parents. Migration of young people is concentrated in the cities, where 18 to 24-year-olds are the only age group with a positive migration balance. In migration among the elderly, Southern Belgium and the coastal municipalities are attraction zones.

Over a third of Belgian municipalities are characterised as suburbanisation municipalities. Since the pressure exerted by the households on the surrounding area depends principally on the choice of place of residence, there is heavy pressure on space in Belgium.

3.1.2 The migration motives of suburban settlers

The list of migration motives confirms the stereotypical and culturally determined picture attached to suburbanisation. Young expanding families look out for a home of their own with a garden in the urban fringe, with a view to settling in the long term. This comes after an initial phase in the urban centre, where traffic, noise and lack of open spaces come to cause too much disruption.

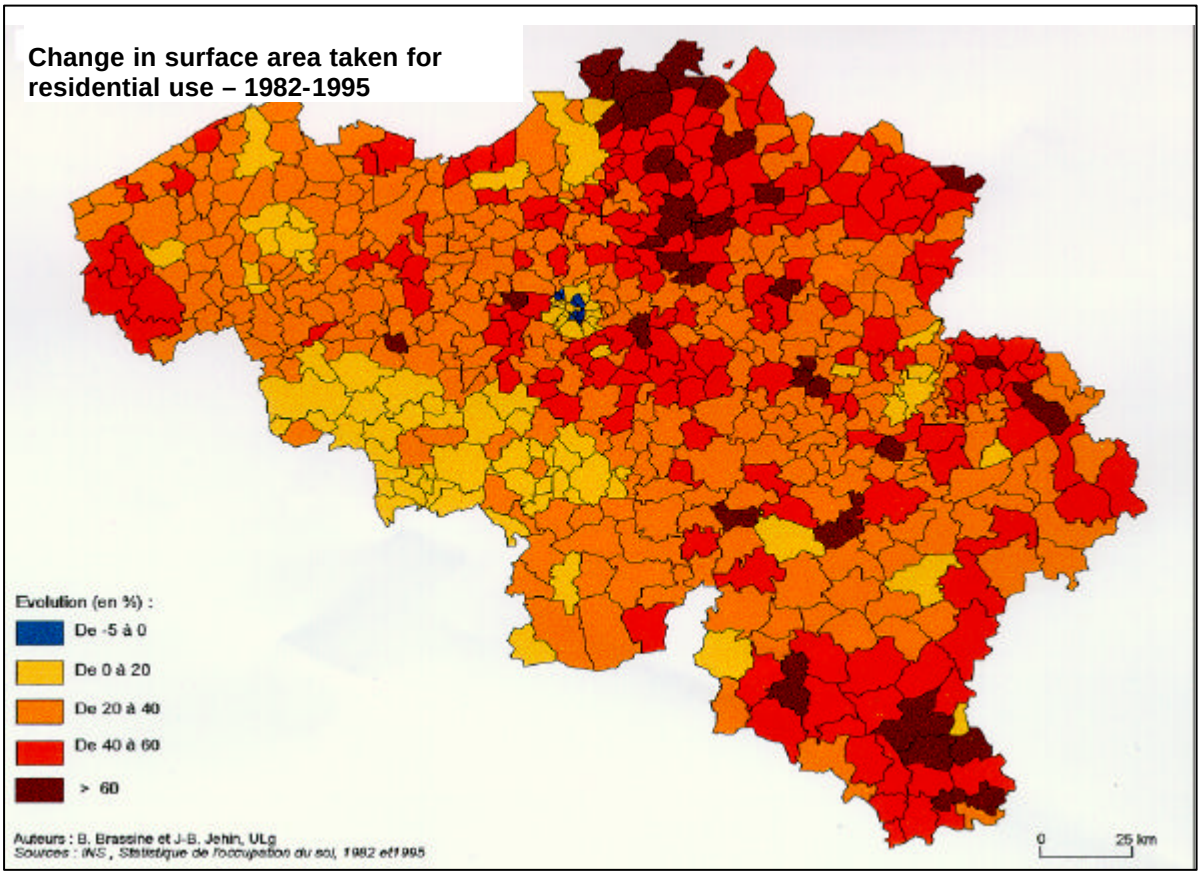


Acquisition of property is the crucial factor. A number of factors lead almost automatically to suburbanisation. In some periods, determined by fluctuations in rates of interest on mortgage loans, buying will be more advantageous in the long term than renting. Potential builders are almost immediately sent to the urban fringe, as building land forms little or no part of the urban landscape. Buyers can find what are looking for both in the city and at the urban fringe. If someone is on the look-out for a single-family dwelling with a garden which is sufficiently large for a traditional family, the supply in the city is more limited but above all more expensive. In combination with the picture that the city is there for working and shopping in and not an environment to bring children up in, it seems almost self-evident in the Belgian context that young people will choose the outskirts as a place to live in.

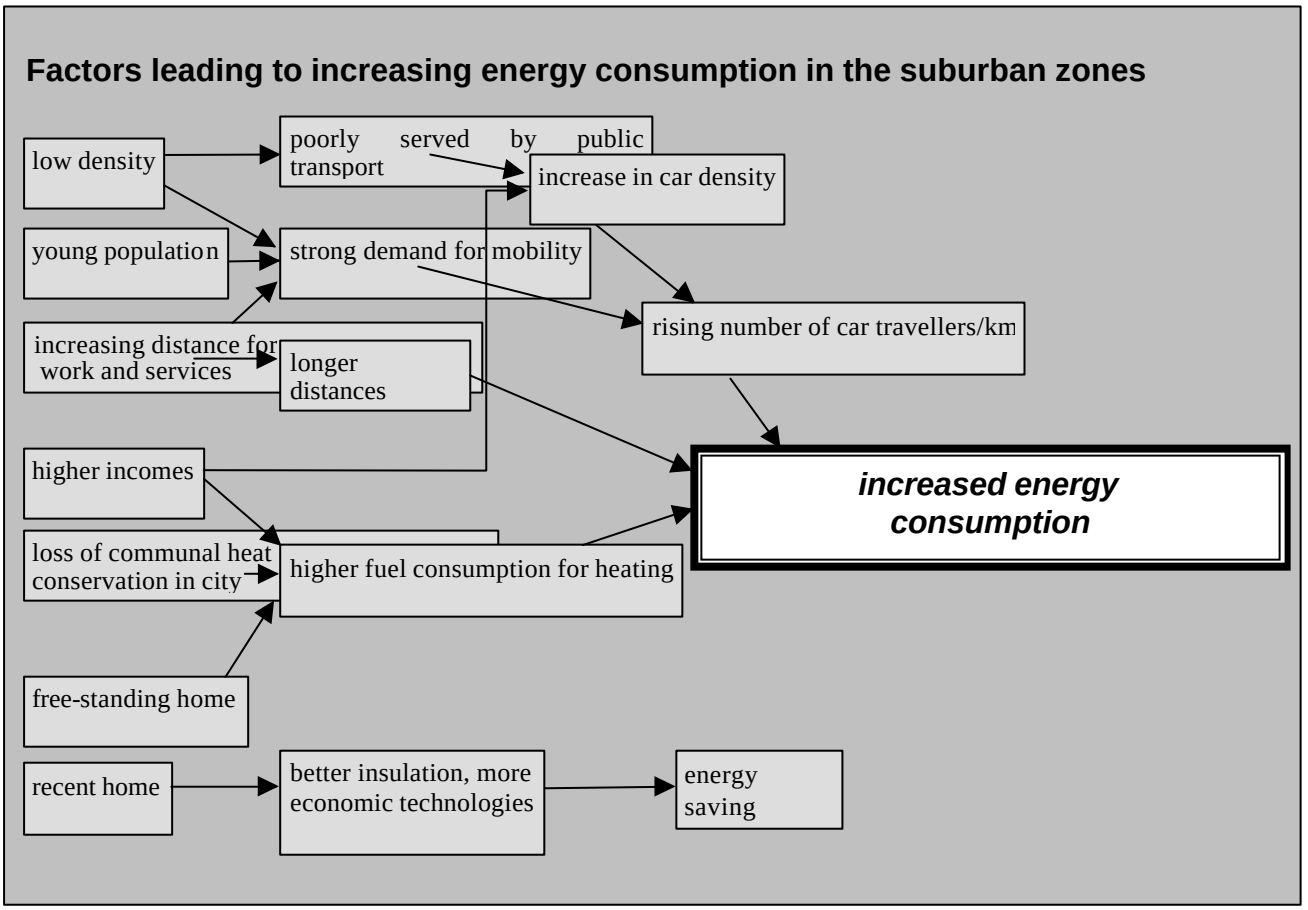
3.2 Problem points due to the suburban residential preference

3.2.1 Consumption of space and energy

A significant aspect of suburbanisation from the point of view of sustainable development is the development of the consumption of space. The increase in the population is at a far lower level than the increase in the consumption of space for residence. This means that the number of m² used by one inhabitant for residence has greatly increased. This growth is dependent on space and is greatest in the municipalities which are subject to the process of suburbanisation. It becomes clear again that the municipalities where the trend is more apparent are suburban municipalities which no longer directly adjoin the urban centres. An ever greater proportion of Belgian space is coming under pressure, particularly when it is borne in mind that there are municipalities where the surface area taken for residential use has doubled in 20 years.



It is not just consumption of space which is increasing in the suburban zones, so too is energy consumption. The consumption of energy for domestic heating is rising as these zones on the urban fringe are characterised by larger single-family homes without the benefit of party walls and the compactness of the city. In the area of transport, an increase is taking place in both the distance and the frequency of journeys.



3.2.2 The added cost resulting from suburbanisation

a. Costs due to urbanisation

A number of public facilities and infrastructure are linked to a home and its inhabitants, regardless of the location of the place of residence. Homes are served by the public road network and are connected to a number of utilities (water, gas, electricity, street lighting, communication, sewers, etc.). A number of house-to-house services are necessary, such as postal deliveries or refuse collection. In addition, there are a number of public facilities which are expected to be available locally: nursery, primary school, post office, police station and so on. As these facilities

become more specific, a larger area of action becomes necessary and they shift from the local to the regional level (hospitals, secondary schools etc.).

The growth zones of the population from the historical point of view have been associated for decades with the urban environment. The cities were the growth zones. It is in these cities, as the places where the population is concentrated, that the various utility networks systematically develop. From there, these are extended into the non-urban areas. The supply of public facilities has also developed over the years, both at the local level for the inhabitants of the urban districts and neighbourhoods, and at the regional level because of the function of the city as a centre.

The process of suburbanisation is growing in relation to this background. The process comes fully into its stride from the moment when the potential for this infrastructure and these facilities is also available in the urban fringe. Construction itself takes place as a function of the expanding residential heritage. In the case of new building on newly purchased building plots, this implies the complete development of a plot into land which can be built on with the construction of all the infrastructure.

Suburbanisation leads to a great expansion of utility networks. The expansion is further accentuated by the lower residential densities per hectare in the urban-fringe zones in comparison with the urban environment. More running metres of pipes are necessary for the same number of connections. The costs depend greatly on what networks have to be provided and what the plot width is. There is a variable cost of €455 per running metre of plot width to provide electricity, street lighting, water, fire provisions, gas and roads with complete drainage. In addition, there is a fixed cost of €2070 per plot (electricity boxes, sewage treatment, water gas). An annual sum of €11 to 15 million is required in Belgium to connect new suburbanisation homes to the networks.

The new residents in the fringe municipalities, the suburban settlers, show a distinct profile. They are young families with small children. The demand for nurseries or primary education, for example, will increase. The supply will need to be adapted to the changing demand.

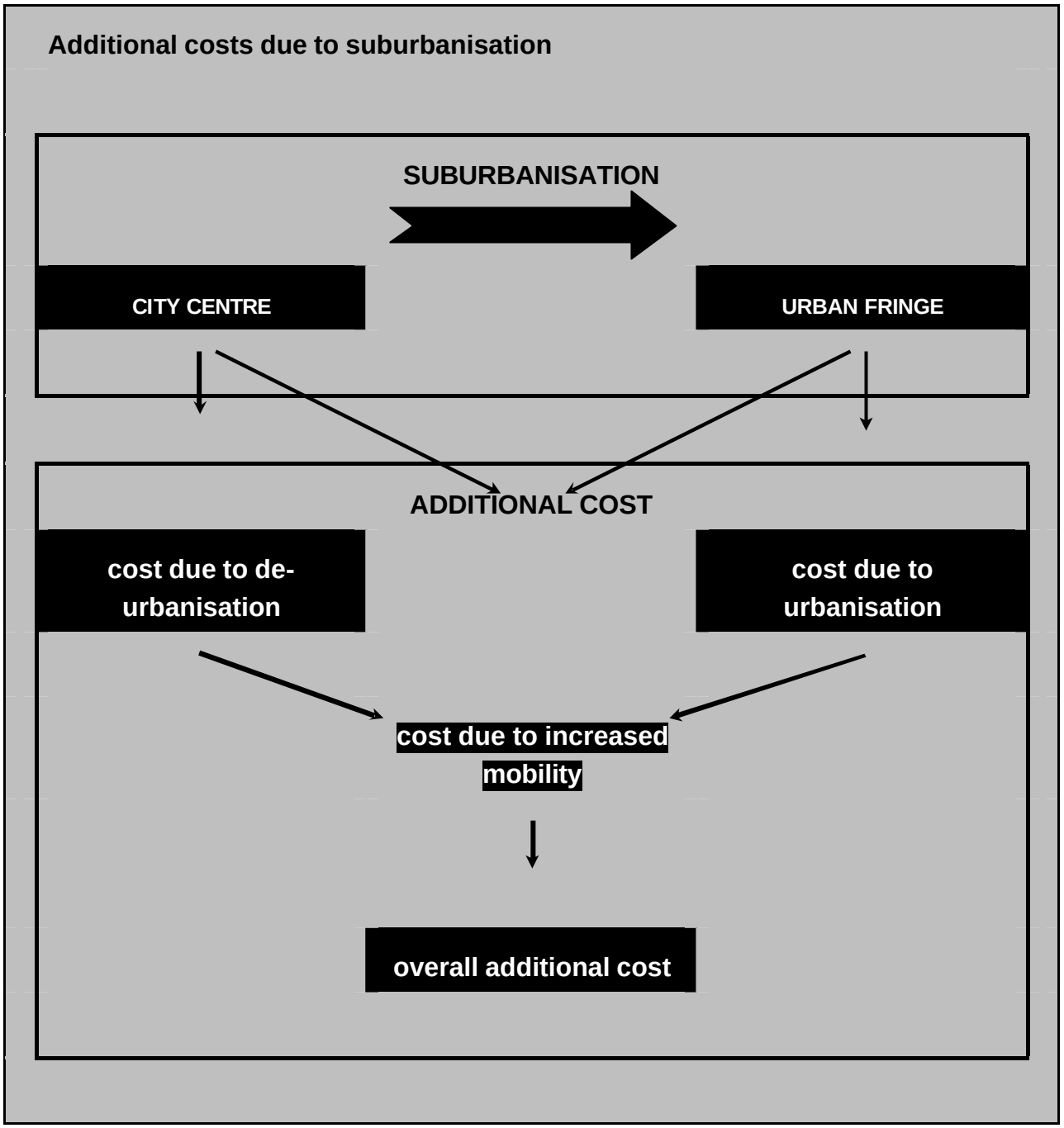
In brief, the suburban residential preference of households entails costs for the municipalities at the urban fringe: the costs due to urbanisation.

b. Costs due to de-urbanisation

When someone leaves a place of residence in the city for a place of residence at the fringe, one residential migration is made, with implications in two spatial environments. As a result of suburbanisation, a number of facilities will have to be provided for less inhabitants. It might therefore be said that costs can be reduced. Nothing could be further from the truth. The facilities themselves, and to a lesser extent the personnel in them, are tied to a place. This means that the possible saving on the costs in the cities where particular services have to start being provided for fewer people in reality is small or non-existent due to the under-utilisation of the infrastructure and facilities. These need to be maintained and will sometimes have to operate below "cost-effective" capacity. Because of their public nature, they nevertheless have to be preserved. These are costs of de-urbanisation in the urban environments.

c. Situation of the additional cost

Suburbanisation generates costs both at the place of departure and at the place of arrival. A mobility cost arises between the two spatial environments as a result of the increasing number of journeys made.



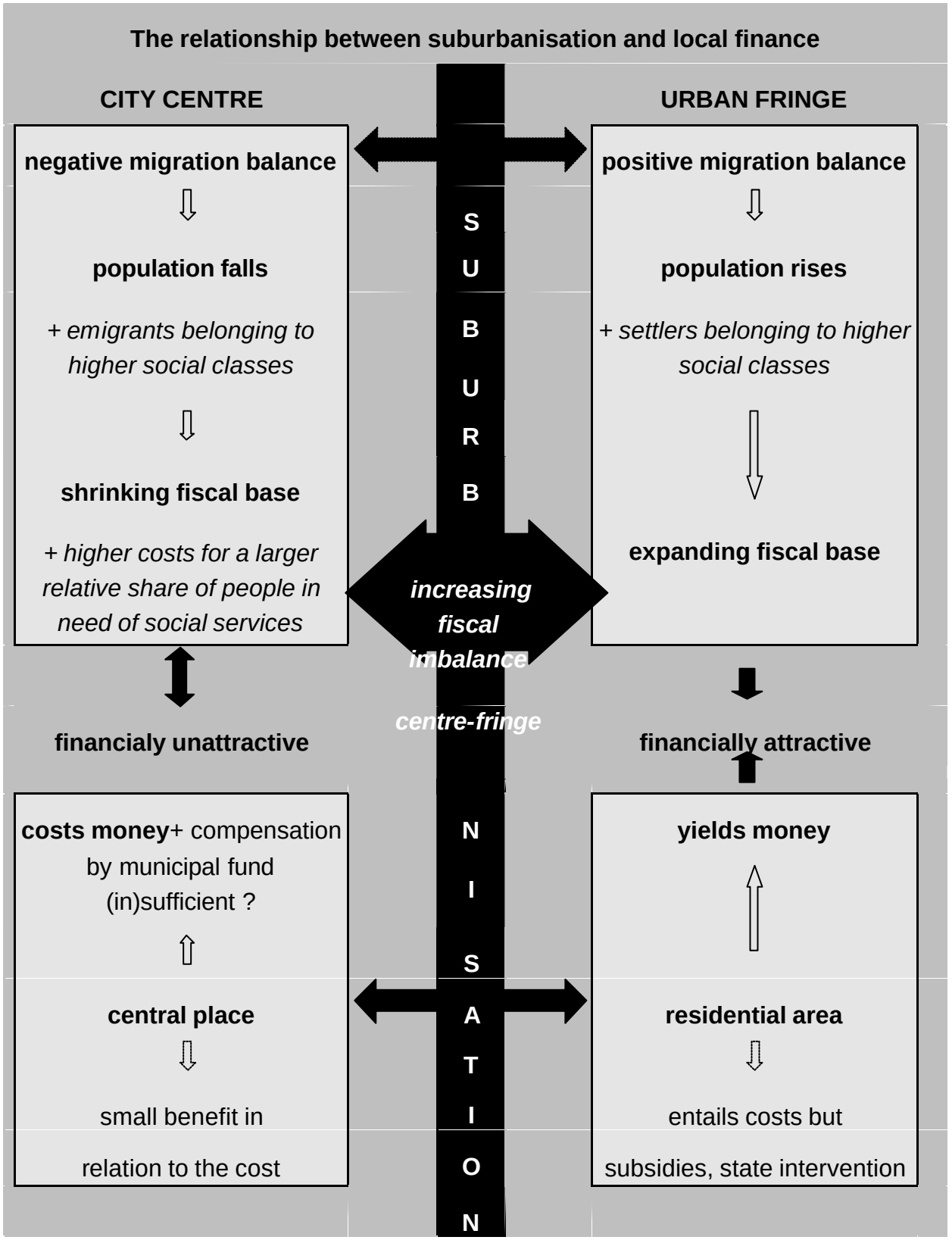
d. Who bears the costs?

The question of who bears all these costs is difficult to answer. Possible players are the households themselves, the initial owners of potential building land, the developers and those who divide up plots, the operators of utility networks, the taxpayer, the municipalities, the regions and finally the community as a whole. Both the private and public sectors are involved. A characteristic feature is that the costs constantly shift between the possible players. Estate developers pass on the costs of

starting up the division of land into lots in the sale price of the lots and shift a proportion of the costs onto the households. Distributors of networks pass on expansion costs in their unit price for the service they later provide, the cost in itself being collectivised as the whole community will pay the same unit price. Municipalities make use of all kinds of funds provided by higher levels of government where feedback is obtained at the highest level to the lowest level through taxation and charges and the costs are again collectivised.

e. The position of the municipalities: increasing financial disparities

The municipalities occupy a prominent position. They are responsible for providing public facilities and deal with the financing of these facilities (both the investments and continued operation), specified in the municipal pattern of expenditure. It is clear that this is determined differently for a city than for a non-urban municipality because of the centre function of a city. The cities fulfil their role as a central place, but providing urban centre functions costs a considerable amount of money, where income fails to match expenditure. The principal difficulty is that the centre functions are used by both the population of the city itself and by the inhabitants of a wider area, while the costs (because of the structure of municipal revenue in Belgium) can only be recouped from the city's own residential population. This is reinforced by suburbanisation. The number of inhabitants in the part of the area of activity outside the administrative boundary of the city increases and decreases in the city itself. The cities are compelled to recover their municipal revenue from a shrinking population, the economic characteristics of which are additionally becoming weaker because the flight from the city takes place selectively.



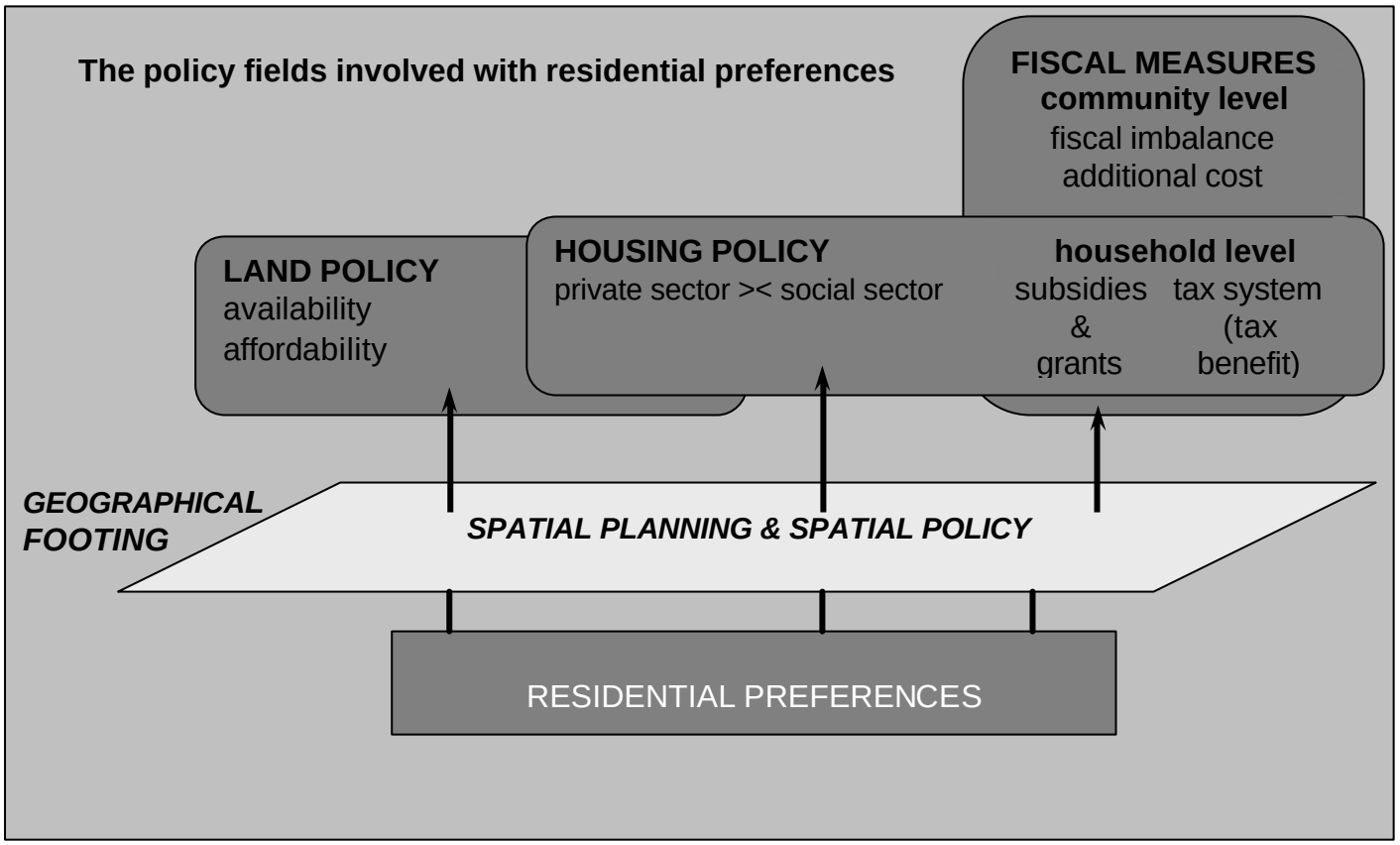
The suburban municipalities are seeing their fiscal base growing because of the same process. Most municipal revenue comes from local tax revenue on the basis of

income and property. Both are increasing because of the influx of new inhabitants and expansion of the residential heritage. These new inhabitants who are the party demanding new and/or additional facilities also generate costs. On the basis of quantitative figures based on interviews with municipal recipients, however, it is repeatedly found that revenue exceeds expenditure and the suburban municipalities regard suburbanisation as financially attractive. The cities receive compensation for providing centre functions through the Municipalities Fund. This compensation is inadequate. The whole process of suburbanisation results in increasing fiscal disparities between the city and the urban fringe. It is becoming difficult for the cities to conduct an effective policy which can slow down suburbanisation on the basis of a deteriorating financial situation.

3.3 The role of policy

Belgium has a long tradition of suburbanisation. The process began quite early on in comparison with countries around us, has taken hold over the years on a large part of Belgian territory and has actually never been impeded by policy.

A number of policy sectors are directly involved in the residence choice of households.



These sectors are closely interwoven. Spatial planning determines the geographical footing and has an impact on the availability of building land and therefore also on the determination of price in relation to supply and demand. There must be a clear vision through spatial planning on the arrangement of our space. What functions are desirable at what locations? The past plays a governing role. The building zones on regional plans represent, as it were, an invitation to live on the urban fringe. Present policy is grafted onto the heritage from the past where an overall vision on the spatial arrangement at national level was lacking. The desired spatial structure as the putting into practice of this vision must also be grafted onto the existing spatial entity.

The government has another directly involved approach through the housing policy conducted through both the public and private sectors. The private sector dominates in the Belgian context. Government involvement through the public sector is very limited, so that the suburbanisation-checking mechanism falls by the wayside. By using grants, subsidies and fiscal measures, the government through its residential policy supports private property, which is almost always associated with new construction. In this way, the suburbanisation model has been promoted since even before the great wave of suburbanisation after the Second World War. The emphasis on acquiring property was and is very great. In addition, there is hardly anywhere

discussion of spatial differentiation or dependence on location in the policy conducted.

Land policy can play a regulating role together with housing policy. The Belgian government disappears from the stage in the field of land policy. There has never been such a thing as active land policy in Belgium, and there is no potential mechanism regulating suburbanisation.

The field of fiscal measures is not just involved at the level of the households, where it is completely interwoven with housing policy. At the social level, there must be a policy for approaching the problems of additional costs and the fiscal contrasts.

The great autonomy of the tax system of the municipalities does not just result in growing fiscal disparities but also makes greater inward migration financially attractive. In many municipalities, financial aspects take precedence over spatial aspects. Belgian policy to date has fostered suburbanisation.

3.4 Policy recommendations

The government has become aware of the negative consequences which the flight from the cities can bring with it. The rate of growth of the area built on is high, social disparities are accentuated, the roads become clogged up and the financial situation of the cities becomes untenable because the financial footing is undermined, and so on. In order to limit the urban expansion and urbanisation of the outer area, measures which bring structural changes with them are required. The aim must be a sustainable development policy which is in harmony with the other functions. The policy recommendations are elaborated within this framework. They are linked to the policy sectors concerned.

f. Spatial policy

In the area of spatial planning, Belgium has conducted an inefficient policy for decades. In other countries where there is a stricter policy, it has never been possible to hold back suburbanisation, but it has been possible to structure and direct it. We retain from the approach in these countries the significance of the presence of a plan concept, going beyond the local level and operating on the basis of structural planning. Other elements are the speed at which it is possible to respond to new social dynamics and the putting into practice of plans and concepts. Spatial planning is also closely related to land policy and housing. As the input of the government is greater, so too is the potential for working in a regulating manner with respect to suburbanisation.

This means for Belgium that the residential need in the short and medium terms must be spread out. The line structures characteristic of Belgium in the form of ribbon development must be abandoned in favour of more compact concentric structures around central points. Inward expansion and deconcentrated bundling must be principles. This agrees in essence with the new orientation which, it is intended, will be given to spatial planning. The changes are such that the new approach and elaboration on the ground can only be put into practical form in the medium term. The challenge consists in retaining the lines set out and even strengthening them, not weakening them under pressure from lobbies. The transitional period must be kept as short as possible. At the same time, there must be an awareness creation campaign to make public opinion aware of, and familiar with, the new and tighter role spatial planning will play in our society.

This new and tighter role is essential, but it is necessary to be aware of the fact that spatial planning as a policy instrument actually plays a modest role itself in the decentralisation process. The outlines of spatial policy alone cannot greatly influence suburbanisation migration as the most important expression of the process of decentralisation. Households will always continue to migrate from the city to the fringe. Tighter spatial planning policy will merely guide them more strongly towards desirable sites.

In order to be able to influence suburbanisation migration in a positive sense, it is necessary to respond to the reasons for and attractiveness of the process. The push factors are concerned with features of residence and negative features of the environment at the place of departure. Among the motives for settling, everything turns on the fact that an *affordable* suitable home has been found at the urban fringe. There is a group of suburban settlers who wish to continue living in the inner city but move to the fringe because of the prices in both the purchase and rental markets. Today the urban residential climate in housing policy is not supported differently than in non-urban areas despite the decline in attractiveness.

g. Housing policy

Housing policy has never been of priority importance in Belgium. The market is determined by the private sector and by the property sector. The share of the social sector and therefore of government involvement is small and insufficient in comparison with surrounding countries. An attempt has been made in recent years to increase the supply in the social sector, and property acquisition in the private sector continues to be supported.

From the point of view of suburbanisation, subsidy policy is the governing factor. Work must be done on a spatial differentiation between the allocation criteria to make particular sites more attractive. Thought must be given in particular to property acquisition and renovation of urban homes.

The grants or subsidies acquire more of a motivating character in the residential pattern of choice if they are sufficiently high. Income remains the determining factor. This is in contrast to the subsidy policy conducted, where the granting of subsidies is aimed at a broad target group with low financial intervention per household. In this way, a large amount of money has to date ended up with households which actually do not need, it although there are income limits which determine access.

Households gain the greatest benefit not from subsidisation but from a number of fiscal measures linked to residence. All households with a mortgage loan are entitled to tax relief regardless of income. The higher the income or the investment, the greater the benefit. It is here that extra support is given to suburbanisation, particularly when it is borne in mind that transport between home and work can also be charged against tax. In Great Britain, tax relief linked to mortgage loans was abolished in 2000.

h. Land policy

The property sector has acquired a strong position due to the absence of a land policy and strong focus on the private sector of the housing market. Measures must be taken urgently so that the government itself has a sufficient say in the market. It is necessary to abandon the idea that open space is an inexhaustible stock of potential building land which can be developed provided the correct price is paid.

i. Public finances of the local boards

Housing policy does not provide for urban renewal subsidies or extra intervention for the purchase of a home in an urban environment. If the cities themselves want to, they cannot put any financial resources into measures to increase their attractiveness and weaken suburbanisation. Precisely because of suburbanisation, the financial position of the cities has greatly declined and no funds are left to provide extra support for the residential climate. This is the result of the high degree of fiscal autonomy of Belgian municipalities.

The Flemish government has plans to rectify the lopsided ratios between poorer and richer municipalities by a redistribution in the endowment of the Municipalities Fund. As long as the balance remains positive for the urban-fringe municipalities, the urban-fringe municipalities will not be inclined to weaken the influx of suburban

settlers. Another path towards a solution may consist in disconnecting the collection of the supplementary personal income tax (APB) from the municipality of residence to the benefit of the municipality of employment. Commuters then take their income with them from the place of employment to their municipality of residence, but through the APB leave a form of compensation behind for use of the services and facilities linked to their professional activity. The impact of a measure of this type is quite substantial.

Gain and loss in collection of the supplementary personal income tax (APB) in the municipality of work instead of in the municipality of residence		Large cities	Suburban municipalities
active residential population (1991)		659 052	526 977
population in employment (1991)		1 137 442	279 642
commuting balance (1991)		478 390	- 247 335
municipal revenue (ordinary service) (1994)	x 100 000 €	31 712	8 527
APB yield (1994)		2 910	2 048
hypothetical yield of APB according to employment		5 022	1 087
difference between real and hypothetical yield		2 112	- 961
proportion of difference in total av. revenue		**+ 7 %**	**- 11 %**

It can be seen from the above table that if the supplementary personal income tax was collected in the municipality of employment, serious shifts in budgets would occur. The suburban municipalities would see their revenue decline by around 11%. They have a great many commuters among their inhabitants who would contribute through their income to the municipal revenue, through their residence. The large cities would see their total revenue increase by around 7%. This increase in relative terms is less large in comparison with the decrease in the suburban municipalities

because the proportion of the APB in their total package of revenue is substantially smaller.

The idea behind these potential shifts is to reduce the increasing fiscal disparities and improve the financial position of the cities. By slowing down the financial drain from the cities, they gain a better basis for fulfilling their centre function but also for improving the urban residential climate and slowing down the flight from the cities.

j. Taxation system and land use

Financial and fiscal aspects are involved at different levels. They can weaken financial disparities but can also fulfil a regulating role depending on land use. Thought is being given in particular to registration fees and VAT rates.

Registration fees in Belgium are at a very high level. Many Belgians own their own home. A large proportion of them take part in the process of suburbanisation and acquire their own house at the urban fringe. When they afterwards plan a new house move, they face the fees which have to be paid on any sale and/or any new purchase. The high sums associated with this impede the mobility of migration. Certainly if it is borne in mind that the participants in the first waves of suburbanisation, who were around thirty years of age at that time, have now reached retirement age, the high registration fees are a limiting factor. These families where the children have left home continue living in homes which have become too large at the urban fringe which in this way do not become free for new suburban settlers.

It has already been found in the past that a reduction in VAT rates has an effect on the intensity of building. A VAT rate of 21%, 12.5% or 6% makes a great difference in the construction or renovation budget. This measure has never been linked to spatial location of the home. If this were to be the case, sustainable building sites or renovation could be promoted and spatial policy could also be supported where appropriate.

4. USER PERSPECTIVES AND APPLICATIONS - ON THE WAY TO A SUSTAINABLE SOCIETY

The policy options have been drawn up on the basis of the problem of residence and demarcation of residential zones in relation to sustainable development.

At some time, other functions and activities will be encountered. It is highly plausible that policy options drawn up on the basis of different fields and

approaches will have to be weighed up against each other in order to counteract opposition and promote cohesion.

The policy options within this project have been drawn up with clear objectives in mind.

It goes without saying that they must be examined by lawyers and other specialists for the practical feasibility within existing legislation.

The policy options must result in a re-orientation and adaptation of the instruments present in order to check the process of suburbanisation and guide the usual perceptions in the direction of a break in trend with the past. It is of great importance that this break with the past is fitted into the present time frame.

This is not simple when it is borne in mind that the idea of suburbanisation is a very strong element which is influenced particularly by economic factors. In times of economic recession, suburbanisation is not abandoned but deferred until the economic situation improves. Restrictions in the household budget are dealt with for example by cutting back on the size of plot or building at a greater distance from the city on cheaper sites. In addition, the present generation of builders was born when suburbanisation was already a general reality, and some of them will have grown up in a suburban environment.

It is of great importance to estimate correctly the social consequences of various potential measures.

Flight from the cities is a selective process on the basis of economic variables. Income position largely determines who can take part and who not. In this way, suburbanisation has contributed to social inequality between different spatial environments. That is the reason why positive discrimination is important in devising policy options. The positive trends must be emphasised rather than criticising the negative trends, and it must be ensured that the measures taken do not reinforce social inequality.

Political, social and economic relationships are very important for giving substance to the concept of sustainable development. Substantial changes only take place if changes occur in the value judgement and behaviour of those involved.

Those involved include not just the households with their residential preference but also the policy people who supported suburbanisation for years through the policy

which was pursued. Changes of value and behaviour are a very difficult step to take, where sufficient time must pass. It is often necessary to make an about-turn in policy and aim for a break in trend with the past. Today, many people are becoming aware of the importance of a healthy environment to live in, and perhaps change their shopping behaviour through increasing environmental awareness, but nothing essentially changes in their lifestyle. People appear to fall back on a kind of instinct to preserve their own environment even if it is at the cost of someone else's environment (the NIMBY or "not in my backyard" attitude). People are dissatisfied with the decreasing mobility but increasing traffic congestion is accepted as long as it does not affect the freedom and comfort of their own cars. Changes in behaviour and lifestyle are difficult to set in motion, not just at the level of households and individuals but at every scale level. Account must be taken of the social background in drawing up policy. It is often necessary to make an about-turn in policy and aim for a break in trend with the past. The changeover must not take place too abruptly, however, so that the process of acceptance will run smoothly. Social acceptance must form an essential part of the assessment process aiming for new lines of policy.

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DEMOGRAPHY, TOWN AND COUNTRYSIDE MANAGEMENT AND SUSTAINABLE DEVELOPMENT

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1. SUMMARY

This project is carried out by two coherent university teams which work in close co-operation - the Laboratoire de Démographie de l'Université de Liège and the GéDAP (Centre d'Etude de Gestion démographique pour les Administrations publiques – Université catholique de Louvain) -.

The main characteristic of our project is to turn demography into a tool to help decision-making in development policies and regional planning. In other words, to propose a demographic logic which allows to follow the sustainable development of a society at the regional, communal and infra-communal level. Our activities show that local demography is indispensable to identify situations of non-sustainability and put and end to them.

The greatest challenge in this sense, the invasion that has changed space in developed countries during the last forty years: peri-urbanisation. That is to say, the invasion of the countryside by wealthy urban populations which leave cities empty and impoverished. Urban population skaters through the surrounding countryside maintaining their attachment to the city by their jobs. Therefore, frontiers between the urban and the rural, between urban and rural citizenship are becoming increasingly blur. We can identify diverse factors causing peri-urbanisation; urban deterioration, an increase in living conditions, individualism, pro-ecological movements which promote the return to nature and a better quality of life, but above all, the increase in the amount of cars and motorway infrastructures. Cars have swept away the obstacle of distance and have greatly contributed in bringing cities and rural areas nearer. Cars can be considered as one of the main factors leading to the city bursting.

The process of peri-urbanisation has important economic and ecological implications but also generates a social selectivity which accentuates differences between cities and rural areas. Even if the peri-urban choice can be positive at the individual level, it is not so when approached from a collective perspective. It is undoubtedly opposed to sustainable development. A matter of juggling individual and collective interests.

Other works at the infra-communal level have underlined the extreme diversity and the deep social and demographic inequalities that exist inside the big urban agglomerations and within the neighbourhoods.

Many inquiries have also confirmed that at different life stages of a person’s life or at those of a household correspond different specific migration projects to which different habitats are associated to. However, the privilege of being able to chose the area of residence is only of the wealthy. It is also clear from the same point of view

that inequalities grow. Young generations have less options than those which have reached adulthood in the sixties and seventies. Intergeneration equality is menaced by peri-urbanisation and ageing.

2. AIMS

In the most classic and wide definition of sustainable development it is considered to be type of growth that responds to present needs without compromising those of the following generations. The idea of sustainable development was born when it was realised that non-renewable natural resources were being exhausted and that our society was becoming economically and socially stagnated. In other words, which is the way in which growth can be reintroduced allowing to reduce inequalities and poverty at the same time, without deteriorating the environment that is being left to future generations? The ecological motivation is accompanied of important economic and social stakes. However, the social dimension of this problem is often forgotten by scientific work, by the preoccupations expressed by politicians or by society in general.

Without neglecting the interactions between the three spheres– economic, social and ecological – that cannot be separated from sustainable development, our work concentrates on the social dimension of the problem. We are convinced to contribute to sustainable development of society means, in the present context, to fight against social disintegration and therefore favour a growth which carries solidarity, which tries to reduce inequalities, exclusion and the social fractures of society.

Knowledge of past and present demographic facts within their spatial dimension should contribute to develop an indispensable analytical tool to help decision-making and facilitate the elaboration of sustainable development policies for our society. We conceive the latter as a group of measures designed to ensure a harmonious equilibrium between, on the one hand, the needs and aspirations of the population and on the other, its environment, being defined as the daily space in which each individual lives, where both the strictly natural element (landscape, pollution, noise...) and the social, economic and cultural factors interfere (employment, habitat, conviviality, feeling of insecurity...). The integration of these two notions –the population and its environment- should attempt to develop sustainable regional planning. The latter will not be viable and efficient unless these two “spheres “ are developed in perfect harmony.

In our objective, the variable population is essential as an agent and denominator. From a more pragmatic position, it is necessary to integrate demography in the group

of tools aiming to help decision-making at the national, regional and the commune levels. It should guide political choices searching to develop or create, in the widest sense of the term, an environment which helps our society. But our role would be incomplete and insufficient if we limited our contribution to the “practice” of demography in the strict sense of the term. The demographic characteristics and components are not isolated from the rest of factors. Their evolutions, their diversity can only be explained in interaction with other social, economic and cultural variables.

Further ahead, our approach becomes specifically local. Sustainable development embraces all levels from that of the planet to the local one but the priorities and stakes for each of them are different. From our point of view, the local level – communes and neighbourhoods– is the correct level of analysis. Moreover, despite globalisation our planet is still that of cities, villages and neighbourhoods, that of the immediate environment of individuals. From a general perspective, the behaviour of individuals is inscribed in a context where he interacts with the people he has near, that is to say, those with whom he has established relationships as well as those which he is spatially near to. The space where he lives, all the places and persons with whom he has relationships with involve an element of distance. The intensity of ties will diminish as the distance grows. In summary, in order to reach a global objective, the local level is the nearest to human, social and economic realities and therefore the best level from which to mobilise all agents involved, whether they are local groups, firms, citizens. Finally, and this is not the least important argument, the commune and neighbourhood level is the only one that allows to detect “areas at risk” and crisis zones. A sustainable and harmonious development policy can not afford to ignore these differences and inequalities.

In this context, our studies have treated two specific problems:

- *Migrations, peri-urbanisation and sustainable development*

In Belgium, mobility is at the centre of most debates on sustainable development. However, in the political discourse and that of the media, mobility is essentially perceived as commuting. Problems such as traffic congestion caused by people trying to get in and out of big agglomerations, the increase of the energy bill and the environmental problems that are caused by them (pollution, noise…) are underlined. They forget that above this daily mobility there are residential choices that have been anchored in the mentality of people, in some cases for a century, in others for over 40 years.

These residential choices are integrated within the process of peri-urbanisation This type of movement consists of the depopulation or a diminution of demographic congestion of urban agglomerations while their green periphery wins population. In other words, urbanites spread among the surrounding countryside while keeping attached to cities through their work. The limits between urban and rural, between urbanites and people living in the countryside are becoming progressively blur. This disperse city with its malls, its housing states, its highways invading villages situated at the periphery of urban centres, corresponds, in some way, to what a part of the population wanted and still wants. Peri-urbanisation is not only a phase of the urbanisation process, it mainly reflects the evolution of the ways of life. This spatial dislocation of the city expresses the desire of a vaster and healthier space in which to live in, and that of having an individual house and to disassociate the work and living spaces. This is in contradiction with the idea, defended nearly everywhere, preached by urban planners and public powers, of the “sustainable city”. That is to say, that of the increased density of central urban tissues. This is because the model of the disperse city, which implies a over-consumption of space, due to the expansion of peri-urban areas and the multiplication and the increased duration of trips, is not really compatible with the set-up of measures that try to reduce the emission of greenhouse effect gases and other type of pollution (garbage, noises...) inherent to the growing urbanization.

The impact of peri-urbanisation is not only ecological, but also economic and social. Spatial redistribution of population caused by mobility is coupled with a residential segregation process, of the impoverishment of urban agglomerations and the enrichment of the peri-urban rings. In Belgium, with , the Registre National, we have an optimal data base to study spatial mobility. Our research brings innovative analyses of the social and economic dimensions behind mobility which allows to go beyond it in terms of causes and consequences.

- Multiplication of spaces in crisis (at the communes and neighbourhood levels)

The main idea is that the sustainable development of a society cannot be reached if social and economic inequalities are maintained and increased. Our role is to identify among the situations of marginality, difference and inequality, those that are “unsustainable” or that carry the risk to become so with time. Within this framework, the aim of demographic information should be to contribute to the need to give greater equity to all citizens and to direct the shape of the future of society in a way that it allows to share the well-being among all the citizens, without making any differences between them.

An optimal, sustainable local development should rest on an up-to-date knowledge of the social and demographic characteristics of a commune, but especially on that of the differences and inequalities that can be found in it. Do we realise that the "sacred" national and regional averages disguise an extreme diversity of structures and social and demographic behaviours that reveal the existing inequalities and tensions? To forget or not take into consideration these differences leads to reductionism and to a deceitful globalisation . For example, in the agglomerations of Charleroi and Namur fertility rates found within a commune can be triple from one neighbourhood to. There are 6 to 7 years of difference in life expectancy between certain communes.

In this sense, we have worked with the concept of **neighbourhood** that is based on the daily space of life of individuals and intends to regroup in the same spatial unit all the people that have a common large life space and are in this way confronted with the same spatial environment, and generally, to the same problems. The use of this level of analysis has not only geographical and statistical aims but is also key for the development of policies at the infra-communal level.

3. SOME RESULTS

3.1 Social, economic, demographic and cultural components of the process of peri-urbanisation

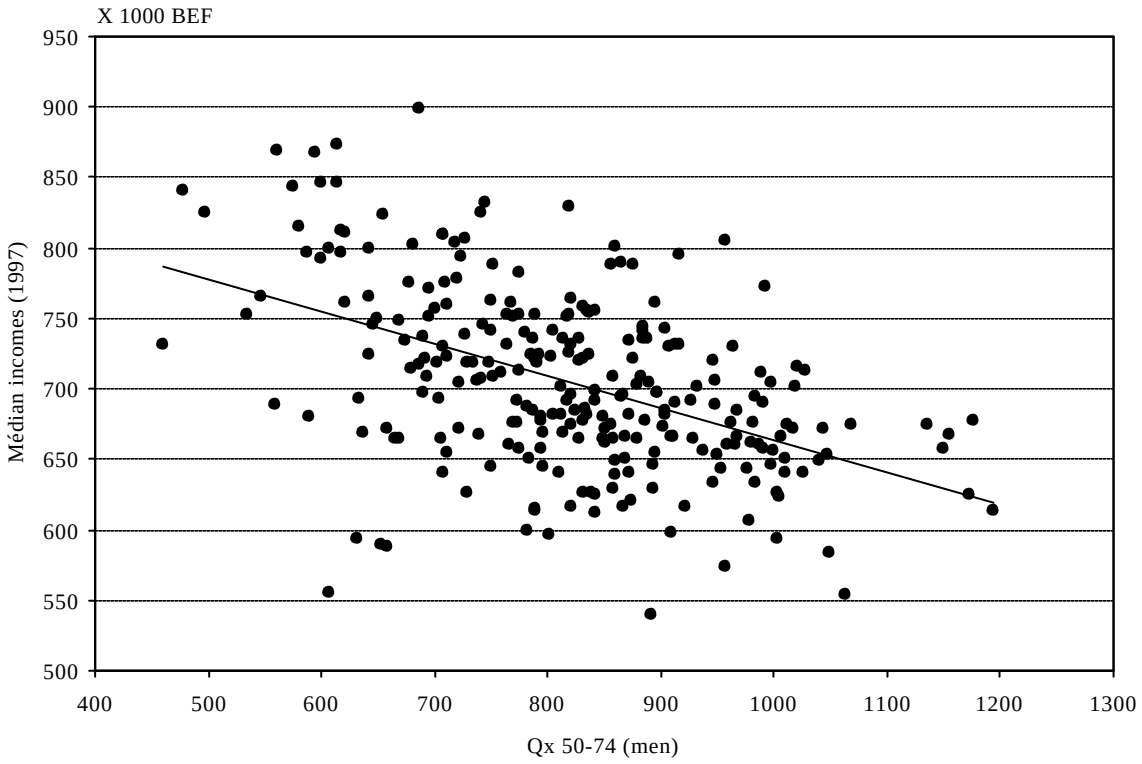
As we have already stated, an important part of this project has been dedicated to peri-urbanisation, and more specifically to the evolution of this process, to its consequences and to its social and demographic components. of this peri-urbanisation movement? Here, we have only introduced some of the main analytical results, i.e. those that show the role of péri-urbanisation within the process of social and demographic radicalisation of differences between cities and rural areas.

The peripheries of agglomerations grow through the immigration of relatively wealthy households, where adults remain linked to the city through work. This is the classic and simplistic image of the social and demographic content of peri-urbanisation. A social choice is done through residential strategies. This choice reinforces social and economic contrasts between privileged peri-urban areas and poor neighbourhoods of big agglomerations where the images of exclusion, poverty, isolation, ageing, family fragility, dwelling degradation and under usage of collective facilities are strengthened. This way, "Registre National" data has allowed us to show that:

- Peri-urban communes can be characterised by an specific fertility model, that is to say, a relative over-fertility at high ages which reflects a higher female instruction level and a higher activity level, characteristics leading women to postpone their fertility projects until late in their fertile life. .

- Peri-urban communes have a much higher life expectancy at birth than that of urban agglomerations. This differences do not only underline boisterous inequalities in relation to death and illness, but also the delay of certain habitats or sub-regions in terms of health resources, of illness prevention, facilities…

Relation between the mortality quotient of men between the ages of 50 and 74 (1993-1998) and the mean annual incomes(1997) : r= -0.49)

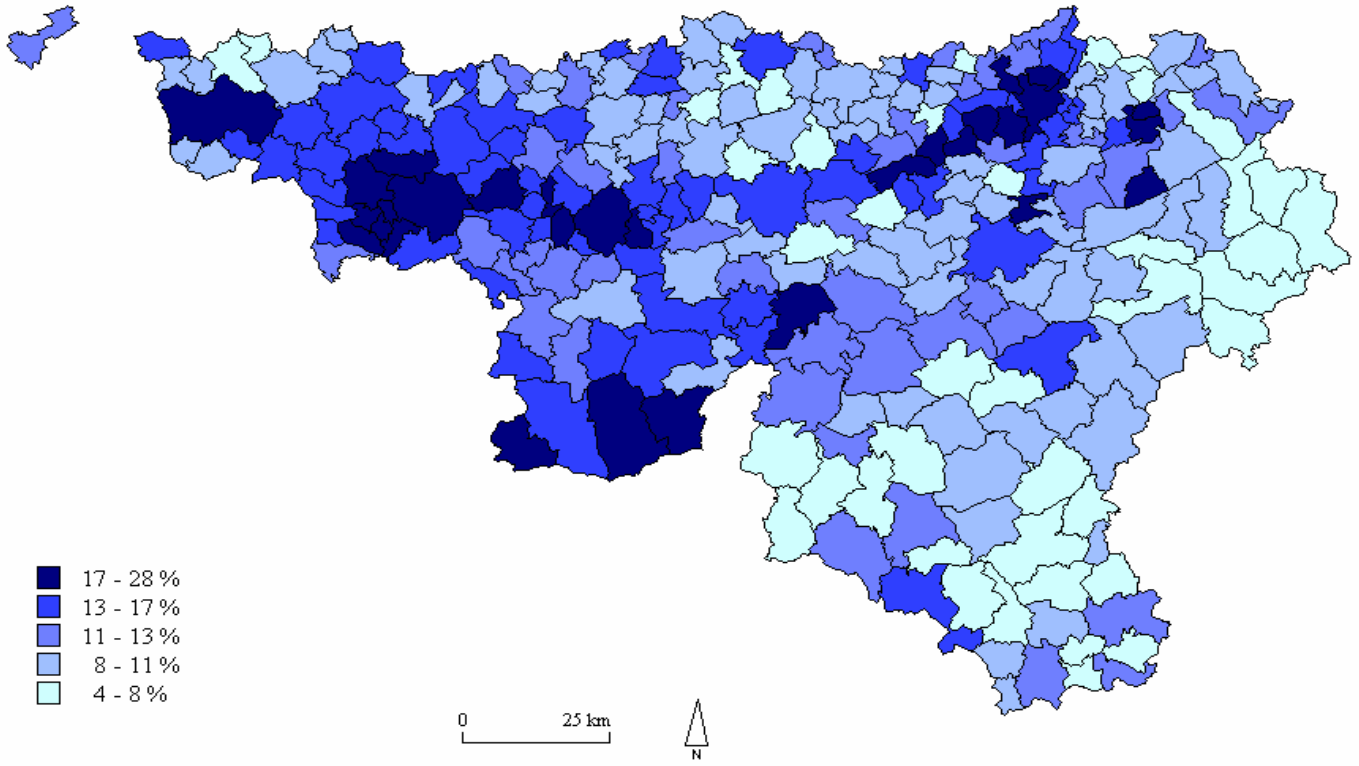


- Different types of households are not regularly distributed throughout the territory. There is also a very clear segregation of space at this level. In peri-urban communes, households are generally bigger and those that are at risk (one-person, one-parent or recomposed households) are less represented. (51 % one-person households in Liege and 25 % in peri-urban zones). 22 % of the children under 15 living in the urban centres of Wallonia, do so in a one-parent household. However, the proportion is slightly above 10 % in the peri-urban area. In Liege, 44 % of the women aged between 25 à 39 live on their own, whereas they are 21 % in the peri-urban area. Moreover, our original study of household transitions

(where households were followed between to dates) has shown that households were much more stable in peri-urban areas. However, the debilitation of the family and the rapid development of new family models- and therefore the multiplication of the number of households- has evident social and economic implications, but also environmental ones that reflect an increase in the demand of dwellings, an increase in mobility and in the consumption of certain goods (car, water, electricity…)

On the other hand, we can observe an opposition, a social selection process in peri-urban habitat caused by the pressure put on housing by the demographic growth, caused by migrants coming to this kind of communes, and by the dominant cultural habitat model –detached house with garden in the countryside- This is what we have been able to verify in the Walloon Brabant.

Proportion of children less than 15 years old living in a lone parent household (1998)



Source : Registre national - I.N.S. *Realization : GéDAP - UCL*

In the first place, there are contrasts between the ancient inhabitants and those that have just arrived. The former group's age structure is much older than that of the latter one and this had had repercussions on the composition of households and on the social and professional structure of both groups. Therefore, non-natives largely dominate the so called "active" category and this does clearly not go without consequences on the evolution and transformation of the cultural, social and political life of villages. In other words, this quantitative "domination" is coupled with a "qualitative" differentiation. The latter showing both trough the employment structure- there is a high number of workers among the native and a high amount of private sector employees amongst the "neo-rural"- and also through the education level- the non-natives have a much higher level than natives. Finally, this social opposition between the "ancient" and the "new" is also reflected in space through housing in general and more specifically in housing states.

Secondly, we can name the inertia factors which have transformed a de facto situation into a vicious process. As neo-rural settlers flock in, house prices explode and a social selectivity process is started and ancient households emigrate to villages surrounding the Walloon Brabant which are capable of "offering" decent prices. The latter have very similar demographic characteristics to immigrants coming into the Walloon Brabant. The dominant model in both cases is that of a young couple with one or more children. However, couples leaving the Walloon Brabant to settle in its periphery are generally slightly younger and have slightly less children. Differences between these two "sub-populations" are reinforced by their social, professional and education level. There is an over representation of workers and people with low or average education amongst out migrants. On the other hand, private sector employees and people with high education are, in relative terms, better represented among immigrants. The different analyses carried out also show those leaving the Walloon Barbant -for a peripheral commune or one of another part of the country- are not those making part of unemployment list of the province nor belong to the C.P.A.S. In other words, the social choice is made among "middle and working classes" and not among the most socially deprived, reinforcing in this way the duality between the base and the tip of the social pyramid and therefore highlighting the lack of social and rental housing which exists in this province.

3.2 The great Walloon agglomerations: heterogeneity of structures and of social and demographic behaviour and precarious spaces

The social choice performed by peri-urbanisation contributes to strengthen social, economic and demographic contrasts between privileged peri-urban areas and the

disadvantaged neighbourhoods of the major agglomerations where the images of exclusion, poverty, isolation, ageing, family fragility, deterioration of dwellings, under-utilisation of collective facilities are strengthened...

Within the framework of our research on impoverishment of urban environments, we analysed in detail the case of Liege. Liege has known an impoverishment process which is closely assimilated with its territory. The wealthiest city residents left the city in mass to establish in the periphery. It is a well-known phenomenon: as a direct consequence the abandonment of the city by the wealthiest population there is an urban crisis. Using neighbourhoods as an analytical grid, we measured inequalities with two simple indicators: income and dwellings. A first analysis took place within the neighbourhoods to measure internal tensions, the second examines the frontiers of neighbourhoods to locate fractures, the borders of urban space. In other words, the points of contact between poor neighbourhoods and rich ones.

Results reveal:

- A net gentrification process. Neighbourhoods located in high areas of the city are taken by assault by a young aged middle class seeking habitats in relatively pleasant neighbourhoods that are not too expensive, while poorest people do not have another choice than to live in the centre.

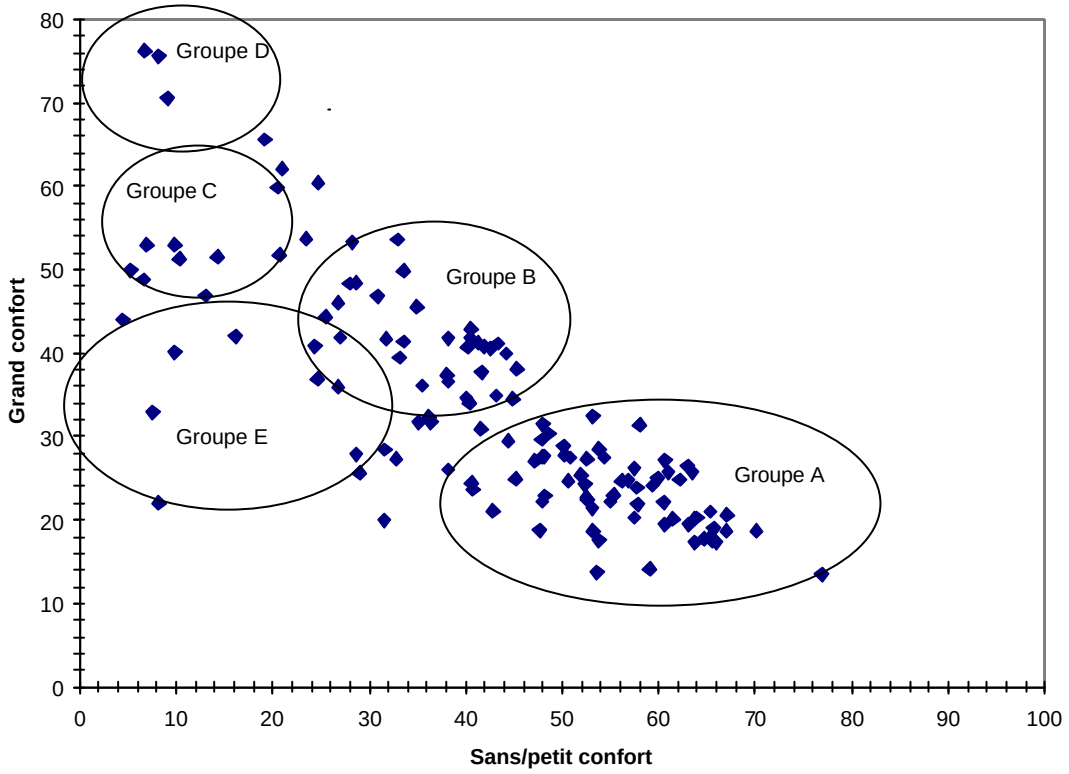
- It is moreover in the urban centre where borders between rich and poor neighbourhoods can be observed. But the rich neighbourhoods of the centre are not free from inequalities. The most uneven neighbourhood is that of Mount-Saint-Martin (historical heart of the city) where exceptional buildings as well as a slum compound can be found.

This shows that the city is not only a dual space but one that has “exploded”, which has been de-homogenised. . The study we have made in 55 neighbourhoods of Charleroi confirms it and allows to verify, thanks to use of more demographic data, that:

- Differences are stronger with than between communes. The city is diverse and any policy to be undertaken, should take it into account. These heterogeneity also shows the existence of crying inequalities. We can put male life expectancy at birth as an example. There is 12 years of difference between Charleroi neighbourhoods that are situated at the extremes of the distribution while the separation is only of 8 years between the maximum and minimum value of the 262 Wallon communes for which we have calculated life expectancy. Though maximum values are nearly the same, slightly more than 76 years, the minimum

life expectancy is much lower for the Charleroi regions (63,6 years) than for the Wallon communes (68,6 years). The delay cumulated by the former populations cries out the existing inequalities in relation to access to health services, illness prevention, particularly harmful behaviour (tobacco, alcohol, diet...) but probably also those related to a degraded environment (pollutions, unhealthy houseing...)

Proportion of those without small nor big confronts in their houses by statistical sectors, Liège, 1991



Group A = « disadvantaged and homogenous». Second reading: profoundly unequal

Group B = Tension zone: big % without small nor big confronts in their houses. Small number of mean houses. No transition

Group C = « wealthy and heterogeneous».Inequalities linked by strong % of mean level houses

Group D = « wealthy and homogenous»

Group E = Zone without friction. Great part reserved to mean confort

Source : I.N.S. (1991), *Recensement de la Population et des logements Commodités combinées à l'intérieur des logements privés occupés par secteurs statistiques* (Population and housing Census. Commodities that can be found in private houses by statistical sectors).

- Certain social and demographic categories are more concentrated within urban space than others. The most socially marking categories (benefit receivers, non-EU foreigners, managers, university students...) tend to by located in certain neighbourhoods, while the greater mobility of and, specially, the lower internal cohesion of intermediate categories translate into a higher spatial dilution.

- By mapping the different indicators we have been able to see that urban space is divided in three parts. Globally, social problems are concentrated in a central area which goes from east to west embracing the more urbanised neighbourhoods bordering the Sambre river which were those in which the 19th century massive industrialisation took place. It is also here that the most unhealthy housing can be found. On the other hand, the unemployed population, that receiving benefits, non-EU foreigners, people with low education are clearly less found in northern or southern neighbourhoods. In addition, it is in the southern part of the city where there is the highest concentration of people above the age of 60, that is to say where non built and green spaces are bigger, and where the peri-urban communes are nearest.

3.3 Life trajectories in regional and local frames: demographic evidences and components of non-sustainability

The study of life trajectories at regional and local scales can stress several evidences of non-sustainability. A first observation is that mobility evolves along the life course. Different phases of life correspond to different migratory projects, and different urban as well as regional spaces: they are segregated, often in a variety of spaces, and this variety permits to meet the aspirations which evolve along life course.

Our event-history analyses on the city of Namur, carried out at a local scale, stressed the importance of the psychological and financial costs of mobility. It appears that the rapid impoverishment of the cities is largely due to a dynamic of immobility. Analysing the departure of the children from the parental home in the 1990s, we detected the numerical importance of what we called « downwards migrations ». So, some sons and most of the daughters accept to leave beautiful peri-urban neighbourhoods for having their autonomy ! It contributes to the process of ageing of the rurban areas.

It confirms what we detected at a more regional scale, that the space is largely segregated. People's wishes of mobility are strongly blocked by the process of periurbanization : the high demand in dwellings in the rurban areas brings about an explosion of the prices…Young families have not the financial means to find a place in the local land market, and they are 'rejected' from the peri-urban rings.

In a word, differential access to a variety of spaces according to age poses the question of inter-generational equity that is crucial in the social, economic and political management of the ageing process.

4. APPLICATION AND USE EXPECTANCIES

Apart from our scientific work, our two teams also aim to make decision makers, at any level, aware of the present demographic realities so that they can introduce them into their actions. It is a process of helping in decision making aimed at those responsible of public management at any level, from the commune to the international one. However, this aid can only be beneficial if it is based on adequate, rich, up to date and reliable data.

One of our main assets is a unique database which has resulted from matching the Belgian "Registre National" with the last population census (1991). The quality of information which can be found in it is extraordinary and allows to put an enormous amount of questions and the carry out relatively new approaches – longitudinal and between generation analyses, household transitions, housing demography...- and relatively sophisticated methodologies- factor analysis, cluster analysis, event history analysis…This individualised but anonymous database can be also supported by a statistical database of the Walloon communes (Bdcom) which has several million datum coming from the 1981 and 1991 censuses, the property register, the unemployment and revenue statistics and those of house sales and of population movement. The work we are carrying out for public administrations allow us to continuously enrich these databases.

Our efforts we made operational and concrete in an interactive computer program CYTISE which includes the "Registre National"-census match. This computer program which has several dozen million datum is specially adapted to the comparison of local populations and their demographic management.. A more complex version of this computer program, which will include Bdcom as well as more "environmental" data and indicators built from original data collected for this project, will soon be developed always with the aim to aid decision-making. This is for example the case in the *living standards barometer* of Wallon communes which we

built by crossing demographic, social, economic and environmental (in the “classical” sense of the latter term: green areas, atmospheric pollution, etc.).

A final innovation will be introduced by adding to the map an aggregation function which will allow to add up different spatial units (communes, neighbourhoods...) between each other. This function should help decision makers and managers conciliate their decisions, for example in relation to the definition of the extension of urban communities. This tool also has a didactic, amicable intention. It should be flexible enough to take into account both scientific and more pragmatic requirements, in for example, the choice of indicators and that of spatial divisions.

Our data bases and computer tools want to be above all pedagogic and interactive. One of our main roles as scientists in sustainable development is to ring politician’s alarms with the help of the most reliable and adequate tools. The latter have to lead to reflection, to reasoned choices which have to juggle scientific advice, public management and citizens constraints and the population’s individual aspirations. As we have shown, both measures already taken and those to be taken in the future for our society’s sustainable development cannot be forced into it but have to count with the population’s co-operation, they have to be part of a collective project. Or isn’t that the price of sustainability?

HL/B9/020

TECHNOLOGICAL INNOVATION FOSTERING SUSTAINABLE DEVELOPMENT

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1. OBJECTIVES AND METHODOLOGY

The purpose of this research project is to study under what conditions technological innovation can foster and promote sustainable development. It considers all forms of technological innovations that are potentially conducive to sustainable development: process innovations, product innovations, organisational innovations, market innovations. It also looks at the entire chain of innovation and gives particular attention to the existence of many innovation schemes.

The project has five scientific objectives corresponding to operational concerns:

– studying the ambivalent role of technological innovation, analysed as one of the causes of non-sustainable development and as a key factor of a new means of production, compatible with sustainable development;

– characterising the innovation technologies and processes conducive to sustainable development, taking account not only of their environmental aspects, but of the other dimensions of sustainable development as well;

– using case studies to investigate the social-economic aspects of these innovation technologies and processes conducive to sustainable development;

– situating technological innovation in relation to other instruments to promote sustainable development;

– studying the obstacles and the incentives to setting up policies for innovation and dissemination of technologies conducive to sustainable development; putting the conclusions into perspective in the Belgian context.

By enrolling the FTU Work and Technologies Research Centre in social-economic research networks on innovation, we were able to situate the objective of sustainable development with reference to a more general analytical context – R&D policies. This is one of the original aspects of the study.

Each objective requires the use of the appropriate working methods. Consequently there is no uniform methodological approach. Several working methods were used:

– In the theoretical approach, based on the discussion of current literature, we give priority to a *confrontation of sources* from different fields, particularly confrontation between social studies on innovation and studies on sustainable development.

– To characterise the technologies conducive to sustainable development, an inventory of innovations was taken on the basis of a sample of articles in the

specialised press, and a *method of classification* was developed.

– For the *case studies* in innovating companies and in industrial research centres, *a semi-directive interview guide* and check list were developed, to take account of all aspects of the process of disseminating innovations, as well as the incentives and obstacles for decision takers and companies in adopting sustainable development criteria.

– A *comparative analysis grid* was drafted to review some 20 programmes to stimulate or support innovation, in Belgium and elsewhere, from the standpoint of sustainable development.

One aspect common to all the methods used, is that we have favoured a multidisciplinary approach, which takes account of technological, ecological, economic, institutional and social aspects. This multidisciplinary approach was furthered by the broad range of qualifications represented in the research team.

2. PRESENTATION OF THE RESULTS

2.1 Innovation strategies in companies

Three approaches were used to study innovation strategies in companies with regard to the objective of sustainable development. Initially, a survey was done on a sample of environmental innovations, to identify the characteristics of these innovations. The results showed, however, that very often it is difficult to characterise a technology as favourable or unfavourable to sustainable development as such, insofar as the innovation process is a criterion which is much more relevant than the technology itself.

In a second stage, a series of case studies were done in innovating companies, particularly to apprehend the various aspects of the innovation processes and to identify any specific characteristics of innovation that foster sustainable development. Alongside these case studies, we did a comparative analysis of various surveys on innovation objectives and procedures considered from the standpoint of sustainable development.

2.1.1. The survey on the environmental innovation "shop window"

The objective of the survey is to test a grid characterising technologies conducive to sustainable development. The method consists of observing the way

communications on technological innovations serving sustainable development are worded, the “shop window” so to speak, during a given period (eight months in 1997-98). The inventory includes two types of information sources:

– advertising sources: articles, brochures, company activity reports, presentations at conferences or specialised trade fairs;

– environmental reports published voluntarily by companies located in Belgium. This source of information concerns companies which, a priori, are more sensitive to environmental problems and are concerned with their internal and external communication. They therefore provide a specific subgroup in the sample.

In both categories of sources, innovations consist on one hand of *offers of technologies*, which are presented on the market by their designers or suppliers, and on the other hand *investments in technologies*, as they were described by the companies that implemented them. The financial aspect of the investments is not taken into account. The chosen sample reflects the shop window, but not the markets, of innovations favourable to the environment.

Three categories of criteria are used to classify and characterise the findings.

– The first series of criteria considers the *objectives of innovations*: prevention, end-of-pipe processing, rehabilitation, monitoring, substitution, saving resources.

– A second criterion concerns the distinction between *add-on technologies* and *integrated technologies*. Add-on technologies are added to existing processes or products in order to reduce the environmental damage associated with production or consumption. Conversely, in the case of integrated technologies, the environmental characteristics are incorporated in the concept of the process or product itself.

– A third criterion refers to the distinction between *incremental innovations* and *radical innovations*. Incremental innovations are improvements made to products or production techniques, in order to improve quality, productivity or diversity. Radical innovation, on the other hand, constitutes a breach in the evolution of processes or products, involving a transformation production or marketing methods, and of professional skills.

An analysis of the results showed predominance of add-on technologies over integrated technologies (table 1). The proportion of integrated technologies is nevertheless higher in the sub-sample of innovations found in environmental reports.

This may be an indication that companies showing greater awareness of the environment also give higher priority to integrated technologies.

Table 1
Proportion of add-on technologies vs. integrated technologies

	Advertising sources		Environmental reports	
	Offers	Investments	Offer	Investments
Add-on technologies	76 %	61 %	32 %	53 %
Integrated technologies	24 %	39 %	68 %	47 %
	100 %	100 %	100 %	100 %

Table 2 shows the breakdown of the sample in terms of the various environmental objectives. End-of-pipe technologies are more common in all parts of the sample. These attempts to reduce environmentally harmful aspects can be considered as a response to environmental regulations. Technologies to save energy, water or raw materials come in second place. These innovations lead to a direct reduction in production costs for companies so the investment pays for itself fairly rapidly. Compliance with regulations and cost reductions therefore appear to be the main incentives for innovation.

Table 2
Innovations according to their environmental objectives

	Advertising sources		Environmental reports	
	Offers	Investments	Offers	Investments
Prevention	9.6 %	8.2 %	2.0 %	5.8 %
End-of-pipe	49.3 %	52.3 %	49.0 %	49.0 %
Rehabilitation	5.3 %	2.1 %	1.3 %	4.0 %
Monitoring	19.6 %	4.8 %	0.0 %	5.8 %
Substitution	3.3 %	6.6 %	19.6 %	9.2 %
Saving resources	12.9 %	26.0 %	28.1 %	26.2 %
	100.0 %	100.0 %	100.0 %	100.0 %

As concerns the third criterion (incremental or radical innovations), it is almost impossible to assess this on the basis of secondary sources, without knowing anything about the concrete conditions of implementation of the innovations in the firms in question.

The criteria used to characterise the “shop window” for environmental innovations are therefore not sufficient to understand the paths that lead to innovations conducive to sustainable development. For this reason, other methods were used to apprehend

these pathways.

2.1.2. Case studies in innovating companies

The sample of case studies includes both companies producing innovative technologies and user companies (or both at the same time). In both cases, the *innovation process* is at the heart of the case study. Innovations to be targeted concern environmental aspects as well as energy, raw materials and transport, and generic technologies, like building material technologies or information and communication technologies. The indices of the "sustainable development" aspect are concern for the long-term on one hand, whereas many environmental technologies are short-term solutions, and, on the other hand, awareness of the North-South problematic (transfer of technologies, cooperation, etc.). Another possible index is the business ethics aspect.

On the basis of various secondary sources (directories, activity reports, articles), 11 companies were chosen for the final sample of case studies, using pragmatic criteria of feasibility, availability of preparatory documentation, and a favourable predisposition in our first contact with these companies. The case studies were done on the basis of semi-directive interviews, with an interview guide and an analysis grid.
Table 3 proposes a summary of the main characteristics of the innovating behaviour of these 11 companies.

Table 3
Case studies – main characteristics of innovating behaviour

Type of company	*Type of innovations*	*Characteristics of the innovation process*
Paint	– Substitution of products and raw materials	– Incentives: stricter regulations, competition, health and safety. – Collaboration with collective industrial research centres
Colourings	– Substitution of products, new processes. – Waste water treatment, saving resources	– Incentives: quality of products, viability of the company, quality of the environment and quality of work, mobilisation of the personnel. – Laboratory geared to developing new processes rather than monitoring; collaboration with universities. – Participatory approach to seeking technological solutions (working groups, vocational training, social dialogue).

Pharmaceutical products	– Products and processes – Services associated with products – Developing methods of analysis of product life cycles and impact.	– In the top 20 worldwide for the R&D/turnover ratio. Laboratories with 1500 researchers. – "Sustainable performance management" pilot project. – Business ethics code, including environmental responsibility; member of the World Business Council for Sustainable Development.
Solar energy panels	– New techniques to reduce the price of products	– European R&D partnerships – Partnerships for the transfer of technology to southern hemisphere countries.
Assembling windmills	– Design, electronic control, control of installation conditions	– Creation of joint-ventures to design and implement new sites using windmills.
Electro-mechanics	– New, single product (hydro-electric mill)	– Innovation led by an inventor-entrepreneur, internal organisation to promote creativity.
Transformation of metals and new materials	– Photovoltaic cells in flexible materials	– Innovation of products for market niches with high value added. – System of suggestion of innovations via intranet. – Award of ethic certificates: Ethibel and Dow Jones Sustainability Group Index. – Proactive, demanding attitude with regard to the authorities and support to R&D.
Tannery	– Processes, waste management	– Incentives: quality of products, reducing damage to the environment. – Partnerships blocked by protection of manufacturing secrets.
Spinning mill	– New products	– Little internal potential for innovation, seeking partnerships with suppliers. – More recent R&D partnerships with collective industrial research centres.
Waste processing	– Computerisation, electronic control, soil treatment	– Developing high level expertise for the entire waste management industry. Maintaining an "engineering culture". – Acquisition and adaptation of technologies. – Taking steps to obtain environmental certification.

Generation of electricity	– Rational use of energy – Renewable energies	– Incentives: evolution of markets, environmental challenges, cost reduction. – Defining a new internal strategy of long-term innovation. Synergy with a design and engineering subsidiary. – Setting up an internal environmental management system and audit.

Three groups can be identified from the characterisation of companies in terms of their approach to innovation and impact of innovation on sustainable development:

1. *Large companies*. These are not defined exclusively by their size, but also by their membership in an international group or commercial network. Sustainable development is an element of the long-term strategy, because economic and environmental aspects are increasingly interdependent. The companies generally adapt the concept of sustainable development to their activities, making it an "ad hoc" concept.

   Large companies generally have R&D structures or sufficient financial resources to have access to technologies developed by others. For them, technological innovation is a means of standing apart from competition, by proposing new products, improving performances, decreasing production costs, while reducing the harmful aspects associated with production.

   In the perspective of dematerialisation of the economy, several companies have decided to combine services with their products or to increase the service content of what they offer. This policy helps them reduce production of goods, which creates waste, and increase production of services, so as to better meet client demand, and to increase client loyalty. This additional contribution requires skills which are not easily standardised, so it becomes simpler to circumvent competition than for simple manufactured products. The environment is clearly an argument of this strategy.

   The implementation of communication strategies is a marketing innovation. Not only does the company inform the general public of its efforts to reduce its environmental impact, but in addition, it listens to its clients and tries to gain acceptance of its employees. A sophisticated form of the communication strategy consists of taking part directly in the development of restrictive measures (emission standards, branch agreements, etc.). This effort seems to show a proactive approach to companies on the environmental question, but on the other

hand, it could be a way to impede environmental progress by means of a lobbying policy.

2. *Small innovating companies*. They are often in fairly small niche markets (in any case in Belgium to date), but they are convinced that their products correspond directly to a sustainable development perspective. They are impatient with the slow progress of the public authorities' implementation of a real global strategy to fight the greenhouse effect and enact environmental protection. Their small size prevents them from having an effective lobbying policy. But this does not mean they are passive – they develop strategies to ensure their maintenance or growth on the current market.

   Although they are aware of their small size on the world market, these companies do not feel self-conscious about technological innovation. They consider that they can develop sufficient know-how to remain in competition, at least in certain, very specific niches. They pay great attention to their employees and create a favourable climate for R&D. Innovation is their credo.

3. *Other companies*. Harmful environmental effects do not threaten their activities in the short run. Sustainable development is not a strategic component, but one aspect among others to be taken into account.

2.1.3. Analysis of the results of existing surveys on innovation

The comparative analysis covers the results of three recent surveys, which provide helpful information on innovation processes, new forms of management, including knowledge management, and on the contribution of technological information to sustainable development. These consist of the partial results – concerning Belgium – in the second Community Innovation Survey (CIS-2), done on a European scale in 1997-1998, the survey done in 1998 by the "Fondation de l'Entreprise" (FDE) on new forms of management and finally the public survey done in 2000 by the World Business Council for Sustainable Development (WBCSD).

The Belgian part of the CIS-2 survey shows that the reduction of harmful effects on the environment, energy savings and the reduction of consumption of resources are not among the major incentives for innovation. The size of companies is a factor that discriminates to the benefit of large companies.

From the FDE survey we retain that the practice of R&D is the most common means of access to technologies. As concerns the dissemination of technologies, the findings of the FDE survey show limited participation of companies in technology fairs. Finally, the discriminatory effect of the size of the company must be retained

with regard to many aspects: practice of an R&D, organisation of an R&D department, the existence of a formal procedure for following up suggestions made to the R&D manager, the establishment of partnerships, access by computer to outside information, internal distribution of information collected outside, the appointment of a training manager, formal follow-up of training courses, launching projects from several departments, using multidisciplinary teams. This effect disadvantages small companies, except as concerns computer access to outside information.

In small businesses, more limited formal training courses and less frequent implementation of projects across several departments entailing multidisciplinary teams have an effect on management skills. From this perspective, the authorities must take this into account by developing policies targeting small business, to avoid a growing gap between large and small companies.

From the standpoint of measures to be deployed in public policies to accompany innovation, the results of the WBCSD inquiry show:

– the need for public intervention given the difficulty for managers of convincing shareholders of the profitability of sustainable development strategies;

– the advantage of technological forecasting to pinpoint the most promising technologies, from the standpoint of their sustainability, their acceptability for the public and as well as their economic perspectives (market size, growth rate, field and intensity of competition);

– the challenge for companies of managing skills in order to enact sustainable innovations.

2.2 Incentives to technological innovation conducive to sustainable development

2.2.1. The challenges of sustainable development for innovation policies

Sustainable development poses many challenges for collective monitoring systems and incentives to innovate:

1. Filling *market gaps* as concerns technologies conducive to sustainable development, by using various schemes to narrow the gap between the private return and the return to society, between the current and future generations.

2. Supporting *dissemination of clean technologies*, low on consumption of resources, by favouring the dissemination of information and knowledge.

3. Promoting *technological diversity*, to avoid getting locked into technologies which may present long-term risks.

4. Reinforcing the *long-term innovation capacity* by favouring the development of skills and strategic prospecting.

5. Laying down procedures to *improve coherence of the various agents*, to encourage appropriation of technologies by users and by society.

6. Encouraging *citizen participation* in developing effective scenarios for a social-economic assessment of technological choices.

2.2.2. The main instruments for stimulating technological innovation

The "Trend Chart on Innovation" launched as part of the European Commission innovation programme refers to three major categories of instruments for stimulating technological innovation:

1. *Promotion of an innovation culture*. Promoting an innovation culture includes measures to stimulate creativity, initiative, taking calculated risks and accepting a certain social, geographic and professional mobility. The promotion of the culture of innovation also has to do with developing skills. Likewise, it targets the capacity to anticipate needs and sensitivity to public opinion.

2. *An incentive framework*. Setting up a favourable context for innovation targets promoting of the development of innovations, by stimulating both competition and cooperation, and providing better protection for intellectual and industrial property.

3. *Reinforcing the ties between research, innovation and markets*. Various measures can be adopted to improve the way the fruits of research are transformed into the products and services: exercises in strategic planning in order to develop long-term objectives, the creation and spinning off of innovating companies, stimulation of cooperation with the public sector, private sector and education.

Using the frame of analysis of the "European Trend Chart on Innovation", we have done an analysis of 20 programmes to stimulate innovation, in Belgium and elsewhere, that each illustrate one of the lines of action of the trend chart. Table 4 indicates the programmes chosen to illustrate these action lines.

Table 4

Objectives of the Trend Chart on Innovation and illustrative programmes to illustrate it

Objective	***Illustrative programme***
Developing an innovation culture	
Training, awareness	National action plan "Environmental education for a sustainable future", 2000.
Negotiation, mediation	European research project called "Strategies towards the Sustainable Household" (SusHouse), in five countries, 1998-2000.
Technological forecasting	Workshop OCDE "Technology foresight for sustainable development", 1998.
Regional prospecting	Regional sustainable development plan for Baden-Württemberg (Technology Assessment Academy, Stuttgart), 1994-1998.
Technology assessment	Long Range Research Initiative (LRI), European Council of Chemical Industries (CEFIC) and the corresponding bodies in the USA and Japon (1999-2004).
Objective	***Illustrative Programme***
Information for professionals	Kenniscentrum voor Beste Beschikbare Technieken, VITO (Mol), Flemish Region (since 1995)
Clustering	Environmental Cluster Research Programme, Finnish Ministry of the Environment, 1997-2000
Support to local authorities	Programme d'intervention des délégations régionales de l'Agence pour l'Environnement et la Maitrise de l'Energie (ADEME), France, depuis 1990.
International cooperation	Programme of research and liaison between universities for development (PRELUDE), since 1985.
Reinforcement of a framework conducive to innovation	
Financing	SOLTHERM Programme (promotion of solar water heaters) in the Walloon Region, 2000-2010.
Taxation	Investment bonuses and fiscal incentives for small business, Walloon Region
Public orders	Committee for ecological and sustainable public supply contracts, Sweden, 1998-2001.
Management contract	Management contract with a technological operator between WIN (Wallonie Intranet) and the Walloon Region.
Cooperation between research, innovation and markets	
Support to design	ADEME programme for the eco-design of products (1999).

Support to research	Programme “Strategische Technologieën voor Welzijn en Welvaart” (STWW), Flemish Region, 1998-2000.
Support to technological development	Prométhée Programme, DGTRE, Walloon Region, with the support of the European programme, “Regional Innovation Strategy” (1998-2001)
Support of demonstration	Environmental Technology Verification Programme, US Environmental Protection Agency. since 1990.
Support to recycling	Recywall, economic interest grouping, Walloon Region
Technical-economic guidance	Industrial Assessment Centres Programme (IAC), Office of Industrial Technologies, Federal Dept. of Energy, USA.
Venture capital financing	Ecotech Finance SA, Wallonie.

2.2.3. The role of sustainable development in collective industrial research centres

To complete this approach in terms of schemes to support innovation, it seemed useful to have a look at an aspect which has been specific to the Belgian innovation system for quite some time: collective industrial research centres. Five institutions were analyzed: two collective research centres in the strict sense, one public research centre in the Walloon region, a technological centre created under Objective 1 in Hainaut and a sectoral centre belonging to the private sector.

Collective research centres are highly sensitive to the problem of sustainable development and their level of skills enables them to imagine original solutions. They regret not being able to develop them sufficiently, particularly for lack of sufficient public resources made available for their generic research projects on preventive solutions, upstream of production processes.

2.2.4. An emblematic technological field: generation of electricity from renewable energy sources

The energy sector is a good illustration of the whole range of instruments that the authorities should deploy to stimulate the development and distribution of technical innovations. The relationship between the requirements of sustainable development, the need for innovation and the role of the public authorities is illustrated on the basis of two concrete cases: the results of the European project ATLAS in which both Flanders and Wallonie took part, and the case of the renewable sources of energy in the generation of electricity.

The ATLAS project, carried out in the context of the European program Joule -

Thermie, gave a broad summary of energy technologies. This summary includes a state-of-the-art report on various technologies, an analysis of obstacles to dissemination and the review of incentive measures to be adopted. The results show:

– differences in technological maturity, underlining the importance of the demonstration phase;

– obstacles to dissemination: notably the lack of information on the degree of technological and commercial maturity of innovations, a lack of confidence of investors, including institutional investors, and the price of traditional energy which is too low and does not take account of negative external effects;

– the need to simultaneously deploy technical and non-technical measures (financial, environmental and organisational).

In its report of October 2000, the Commission for analysis of electricity production modes and energy conversion (Commission AMPERE) assesses the potential of renewable energies for generating electricity at 10 percent of current consumption. This potential could be reached at the 2010-2020 horizon.

The main obstacles to their dissemination, already mentioned in the ATLAS project, are the poor price ratio compared to conventional electricity, and the economic, political and institutional weight of conventional electricity generators. Other obstacles have to do with the environmental impact assessment, competition for use of space and administrative measures of various types which can have distorted or contradictory effects. Three types of measures can be envisaged to promote development of renewable sources of energy for the generation of electricity: actions on cost, administrative measures and demonstration initiatives. R&D can play a significant role in reducing costs.

2.2.5. General assessment schemes to stimulate innovation

Generally speaking we see a very broad range of interventions intended to direct and stimulate innovation on a collective basis, including the three major families of instruments presented in the European Trend Chart on Innovation. These instruments must be envisaged in combination, rather than separately. An important aspect is the acceptance of sustainability among other criteria currently applied (applicability, technical performance, job creation) in the various types of intervention of public authorities. Working in a network – research consortiums, strategic clusters, development of new public/private partnerships, voluntary negotiations, communication actions – constitutes the dominant emphasis of collective actions to stimulate innovation conducive to sustainable development.

The main difficulties encountered in supporting sustainable innovation are found in highly monopolistic sectors, which are not inclined to innovate, or scattered sectors where it is difficult to disseminate innovations. The major challenge lies with small business, not only in terms of financial support, but also in the form of technical-economic guidance, providing information and independent assessment, aid to marketing and export of new sustainable products or processes.

The collective procedures to channel innovation also vary with the degree of maturity of the technology in question. At the emerging stage, collective intervention will concentrate on supporting fundamental research, anticipating future technology and technology watch, assessment of long-term risks. At the stage upstream of technological development, collective intervention will target sharing the cost of material and immaterial investments required for innovation, taking account of market needs, and thinking about economic valorisation at an early stage. Downstream, collective intervention is not limited to technical measures, non-technical measures can also play a role. The challenge downstream mainly consists of initiating a market in order to enable large-scale distribution of new sustainable products or processes.

3. CONCLUSIONS AND RECOMMENDATIONS

3.1 Main conclusions of the research

Making technological innovation serve sustainable development is a complex challenge, because the concepts of innovation and sustainable development both cover several aspects. This research report has tried to identify those aspects and to explore the ones which seemed most determinant.

One of the objectives of the research project was to characterise technologies serving sustainable development, while realising that the characterisation cannot cover the technology itself exclusively, but should also refer to the development and dissemination process. This is an important distinction and a major observation. The distinction between add-on technologies and integrated technologies proved to be significant, but less pertinent than we would have thought. In addition, technologies serving sustainable development cannot be limited exclusively to environmental technologies. Case studies show that companies which innovate in a sustainable development perspective must implement a combination of process innovations, product innovations, organisational innovations and market innovations among which priorities are established pragmatically, in view of opportunities and constraints.

Obstacles to the distribution of technologies conducive to sustainable development are not principally due to a deficit in available technologies. These technologies have very different degrees of maturity. The maturity, demonstration and validation phases have an important weight on factors which explain the success or failure of the dissemination of innovations.

The effects of environmental policies on innovation are undeniably positive, but the responses of companies are very flexible. On one hand, technological responses that the companies develop depend on many factors in the context, related to the industrial structures, the general state of the environment, institutional and social factors. In addition, effects such as a given environmental measure on certain types of innovation are very diverse – at times favouring radical innovations and at others incremental innovations or the dissemination of existing technologies.

Case studies show a large variety of innovation strategies. Size is important: a large company can define a long-term strategy, mobilise its R&D resources, improve its internal and external communication and lobby, whereas a small company will prefer to invest in the most up-to-date innovations or market niches and mobilise the creativity of all its personnel.

Policies to stimulate technological innovation conducive to sustainable development must take account of the flexibility of the responses to environmental constraints and the diversity of strategies. A strong point of innovation policies is that they can play an integrating role with regard to industrial policies and environmental policies, and they can influence urban planning, employment and vocational training policies. Another strong point is their capacity to induce anticipation of future technologies.

Transformation of policies to stimulate innovation can be seen from two standpoints. On one hand, criteria on the quality of the environment and sustainable development have made a significant, but still insufficient, breakthrough in the traditional schemes for supporting innovation: aids and subsidies, financial incentives, guidance systems. In addition, new types of actions are appearing or being reinforced: clustering, consortiums of R&D across several sectors, voluntary agreements, public/private partnerships, communication actions, organisation of interaction between researchers and users. Conversely, it seems that human resource and skill management, particularly the development of skills, and the mobility of R&D personnel and the capacity to communicate, are still weak links in the chain of the innovation process conducive to sustainable development. As for the missing links, these are essentially in the dissemination of innovations. This aspect is treated in more detail in our recommendations.

3.2 Recommendations

The reasonable use of innovation policy instruments will have the effect of triggering change, but technological change can be ranked on a scale beginning with the status quo for a firm that is already in compliance with a new requirement, the dissemination of existing technologies, continual improvement, incremental modification, and ending with the radical modification of products and processes. The degree of change needed to cope with sustainable development requirements is certainly not limited to the status quo, nor to the dissemination of existing technologies nor even to incremental modifications. Radical innovations are necessary if technological development is not going to compromise the needs of future generations.

3.2.1. Meeting the challenges of sustainable development

To *fill the market gap* and the difference between private return and the return to society of investments in R&D, the following measures should be envisaged:

– financing fundamental research and basic technological research to give impetus to the development of clean, resource-efficient technologies;

– partnership policies can broaden the perimeter within which knowledge is voluntarily shared and reduce the problem posed by the imperfect appropriation of the results of R&D;

– policy to support demand by means of public orders, by reinforcing regulations and developing innovating financial schemes.

As concerns the *dissemination of clean, resource-efficient technological innovations*, the most urgent initiatives to be enacted, particularly for small business, are:

– amplifying demonstration programmes;

– providing independent information to the public authorities responsible for legislation or subsidies in a technological field;

– implementing programmes for certification and verification of improvements in performance;

– constituting “shop windows” to facilitate access to the internal market or the export market;

– supporting technological transfer particularly by means of technological guidance;

– training courses for graduates in applied sciences, putting increasing emphasis on the analysis of the life-cycle, eco-design, eco-efficiency.

To *promote technological diversity*, a critical mass of fundamental and basic industrial research must be reached and the constitution of research consortiums should be promoted. Research on generic technologies should be encouraged in cooperative research centres. Technological transition should be planned in consultation with all agents of technological development, in order to identify polluting technological systems on which rehabilitation technologies are simply being grafted, so as to move into integrated sustainable technologies.

To organise *reinforcement of skills in the long run,* we need to understand how skills are coded, renewed and managed within companies: this requires financing of studies on how learning is organised. As concerns continuing training, initiatives by the sector or across several sectors can promote methods that generate more sustainable industrial behaviour patterns (analysis of the life cycle, eco-efficiency, mastering environmental quality). From a longer standpoint, and at a more collective level, strategic anticipation of future technologies should also be done, in consideration of the economic stakes of developing a given technology, its social and cultural acceptability, and its competitive position and capacity for local dissemination.

Special care should be given to small businesses. Measures intended to increase their innovation capacity should enable them to develop promising technologies inside the company, to acquire technologies and know how to adapt them to their own needs, or to ask the pertinent questions in technological cooperation schemes.

As concerns *citizen participation*, this can be encouraged on various levels: when scenarios are determined for anticipating technologies, for early detection of risks, for a social-economic assessment of technological choices, and finally for the design and experimentation of products or processes with a technological component. This citizen participation should also concern acceptance of a cyclic economy which needs a change in production methods but also and above all in modes of consumption.

Developing *coherence among the agents* takes place on several levels. This requires integrating the criterion of sustainability in public decisions to support innovation, in import/export of technologies and in adopting regulations concerning technologies. It also requires increased consultation among different levels of authorities and different fields of competence, to reach a better integration of incentive instruments, whether they concern innovation culture, the creation of framework conditions

conducive to innovation, or improving the way the fruits of research are transformed into products and services.

3.2.2. Intervening throughout the innovation process

Accompaniment schemes can be deployed all along the technological innovation process—by the public authorities, by the private sector (at the level of the sector, across several sectors, or at company level), and by associative organisations. The scheme should be adapted to the degree of maturity of the technologies supported:

– early detection (technology watch, risk assessment, technology assessment, forecasting);

– financing basic research and interdisciplinary research:

– dissemination of design methods including an analysis of the life-cycle, eco-efficiency;

– development and demonstration;

– putting on the market: aid to technological verification, certification;

– dissemination: organisation of promotional events for sustainable technologies, adaptation of specifications of public supply contracts.

A *combination of accompanying measures* is desirable for coherent action on the many parameters that can influence technical change: combination of macro- and micro-economic measures, short-term and long-term measures, general measures and measures targeted to specific technologies.

Technological dissemination should be a major concern in supporting innovation conducive to sustainable development. Although there is a relative consensus on the identification of the technologies that promote sustainable development, there is total uncertainty about the delays within which these technologies will be on the market and how to distribute them on a large scale. Clearly, acceptance of technological development is the main problem at this time in steering technological change to effectively promote sustainable development.

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DEVELOPMENT AND APPLICATION OF INDICATORS OF SUSTAINABLE DEVELOPMENT IN BELGIUM: SECTORAL APPROACH (AGRICULTURE AND TRANSPORT)

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PART I: TRANSPORT INDICATORS

A. Drawing up a set of indicators for a sustainable development of transport in Belgium

The indicators of sustainable development can be defined as tools for **quantifying, simplifying** and **improving** communication. The objective pursued by the set of indicators submitted in this document is to give a summary and overall view of the **sustainability** problems **linked to the transport sector**. The general objective is to promote a common understanding of what is at stake, of the factors at play and of the key trends in this sector at the national level.

This set of indicators, which will be regularly updated, can be used as:

- an aid to reach decisions;
- a tool for informing and raising the awareness of the various stakeholders in society (communication);
- a medium to help structure and standardise the evaluation reports (evolution of the transport sector, state of development or state of the environment);
- guidance for drawing up data collection and analysis programmes.

The approach chosen to structure the set of indicators corresponds to a **«Driving force - Pressure - State - Impact - Response» type approach**.

According to this model, there exists a chain of causal links starting with the driving force and moving on to pressure, then state, then impact and, in turn, the impact brings about a societal response oriented towards these various links. Without claiming to offer an exhaustive modelling of the interactions existing between the various social, economic and environment components of development, the DPSIR approach shows the connections between the causes of environmental problems, their impact and the responses they generate in society.

The development of the reference framework and of the preliminary set of indicators was based on three large complementary axes that were pursued in parallel, i.e.:

Developing a «vision» of sustainable transport. This involved four main steps: approach of the concept of sustainable development, characterization of non sustainability sources in the transport sector, approach of the concept of sustainable

transport, characterization of tools for a sustainable development of the transport sector.

- **Analysis of action programmes and reference texts concerning transport and mobility.**

- **Basic elements concerning systems of indicators of sustainable development, analysis of existing work concerning indicators.**

Once the set of indicators was drawn up, the project started working on the development of thematic sheets concerning the application and evaluation of the indicators selected, as well as their methodological presentation.

The set of indicators submitted takes into account the **various modes of transport** (transport by road, rail, waterway, maritime transport, air transport, non motorized transport and intermodal transport), both for **passenger transport** and for **freight transport**. However, priority is granted to the road sector due to the predominant impact of this mode of transport on the environment and on public health.

The indicators developed and assessed mainly concern the sustainability problems generated by the **movements** proper (emissions, noise, etc.) as well as **accessibility** issues (duration of journeys, access to various places, share of transportation costs in the budgets of households, etc.)

Taking into account the objectives of the research work, the indicators are drawn up at the **level of Belgium,** and most of the time with a regional breakdown and, when relevant, a breakdown according to other geographical criteria. In the case of many indicators, **international comparisons** are also carried out. Inasmuch as possible, and according to the availability of data, the temporal trends observed over the last two or three decades are analysed (**retrospective indicators)**

To guide our choice of indicators, we took into account a series of criteria - based on the work carried out at the international level, and more particularly, by the OECD - linked to the **general relevance and analytical soundness** of the indicators, to their "**measurability"** and, to a lesser extent, to their **communication potential.** On the other hand, in order to reach a certain degree of harmonisation at the international level (for reasons pertaining to the efficacy of data collection and processing and the possibility of effecting comparisons), the choice of indicators **also takes into account the work on indicators conducted at the international level.**

Several indicators pertaining to a same subject were regrouped on a same **thematic sheet.** The latter gives, on the one hand, *the methodological presentation of the*

indicators and, on the other hand, their *application and evaluation***.** We established a corpus of 21 thematic sheets for this report, which represent 120 indicators **(see tables pages 136 to 139)**.

Each thematic sheet relates to a generic topic (e.g. traffic accidents, trends in passenger transport, structural characteristics of the road vehicle fleet, etc.). This topic is developed through 73 *«main indicators»* enabling to characterize the topic dealt with and through 47 *«related indicators»* which provide additional information or deal with a related problem. This kind of presentation is justified by the fact that it would be quite cumbersome and not very useful to create a complete sheet for each indicator (redundancy of information).

The set of indicators on sustainable transport proper is made up of three sections, to which a fourth section grouping together contextual data is to be added:

I. MEASURING TRANSPORT ACTIVITIES

This section aims at giving a general idea of the transport ***activities*** which are ***directly responsible for the pressure exerted*** on the environment and on health. It enables to ascertain whether the trends observed regarding journeys and vehicles (trend of traffic volume, modal trends, characteristics of the vehicle fleet) are evolving towards greater viability or not.

The indicators concerning the measurement of transport activities can be described as **driving force indicators**. The thematic sheets in this section deal with:

- *«trends in road vehicle traffic»,*
- *«trends in air traffic »,*
- *«modal trends regarding inland passenger transport », - «modal choices linked to commuter traffic»,*
- *«modal trends in the area of inland freight transport », - «stock of road vehicles»,*
- *«structural characteristic of the road vehicle fleet», - «annual consumption of road fuels»,*
- *«efficient use of transport means (occupancy rates and load factors, empty running)».*

II. MEASURING TRANSPORT-SUSTAINABLE DEVELOPMENT INTERACTIONS

This part makes a concrete evaluation of the tangible progress (or setback) achieved with respect to the final objectives of a strategy for sustainable transport (in terms of accidents, pollution, accessibility, etc.). It answers the questions concerning the ***consequences of transport activities or of the management of transport issues*** for the environment, public health, the quality of life, both in terms of the pressures exerted and of environmental or social and economic conditions.

The thematic sheets *«Transport emissions of air pollutants »* and *«Final annual energy consumption by the transport sector (intensity and breakdown per mode)»* contain **pressure indicators**. The thematic sheet *«transport noises»*, for its part, has more to do with **state indicators**. Finally, we felt that the thematic sheets *«number of fatalities and injuries in road accidents and intensity»*, *«average duration of commuter journeys»* et *«household expenditure devoted to transport costs»*` contained **impact indicators.**

III. MEASURING «ACTION TOOLS» (MANAGEMENT)

The objective pursued by the indicators of this section if to highlight the ***societal reactions*** so far as transport preoccupations are concerned (pricing policy, transport services offer, speed regulation and control, etc.). Moreover, they enable us to analyse ***the parameters for which the public authorities could take action*** to achieve more sustainable transport services (proximity of transport offer, etc.).

On the one hand, they reflect determining elements of the journeys which are the major levers on which one can intervene to modify transport trends (traffic volume and modal distribution) and which can be measured with indicators (spatial planning, transport infrastructure and transport services offer, pricing policy, etc.) and, on the other hand, other measures adopted to reduce the negative impact of transport (controls, management of communication routes, etc.).

This section mainly contains **response indicators** but also indicators that could be classified as **driving force or response indicators** depending on the perspective in which you place yourself (distance between home and the workplace, access to basic services, etc.). They are distributed in the 6 thematic sheets dealing with the following topics:

- *«average distances of commuter journeys»,*
- *«evolution of population volume per type of space»,*
- *«access to basic services»,*

- *«offer/quality of rail transport and public transport », - «price of road fuels and tax differentiation»,*

- *«price indices for passenger transport and variabilisation».*

IV. CONTEXTUAL DATA

In parallel to the set of indicators proper, we thought it would be useful to provide an annex with "contextual data». The latter provide **important additional information - mostly quantitative information - and help interpret the indicators.**

Thus, the approach adopted here combines a sectoral conceptual framework with a framework based on what is at stake (air pollution, safety, noise, etc.) and on causality (cause-effect relationships).

B. Evaluation of the situation and of the major trends with respect to transport and accessibility in Belgium

I. MEASURING TRANSPORT ACTIVITIES

1. Traffic, journeys and modal choices

a) Road and air traffic

The overall evolution of road and air transport is an important determining element of the pressures exerted by the transport sector on public health and the environment (accidents, congestion, noise, air pollution and water and soil pollution, energy consumption...). This evolution is of course closely correlated to the transport demand and to the transport offer.

Current trends show that **road traffic** is becoming unsustainable. Its growth over the past twenty years has been dizzying (1970-1997: +223%). Also, its growth was more important than that of the road network (+154%), thus bringing about a densification of road traffic with all its corollaries. However, these past few years were characterized by a trend towards a slowing down in the growth of the traffic volume, which seems to stabilize around 2% per year. As for the intensity of traffic per surface unit, in the Brussels area, it is tenfold that of the Walloon region and fivefold that of the Flemish region.

The increasing demand for mobility which materialised through this spectacular increase in the volume and intensity of traffic is ascribable to numerous economic, demographic, geographical and social factors.

The evolution of **air traffic** in Belgium is also following a definite upward trend. The growth rate in the number of passengers at Brussels-National airport was the most important one in Europe in 1996-1997 (+18%). The number of airplane movements on the Belgian territory - for all airports - grew by 67% from 1980 to 1997, the number of passengers grew by 210% and that of tonnes of transported freight by 270%.

Night traffic at Brussels-National airport reached an average of 67 movements per night, thus between 8% and 9% of total movements on the major airport of the country.

Freight traffic also increased quite significantly in 1996 (+6%), thus placing Brussels-National in the 5th position among the airports of the EU.

b) Inland transport of passengers and freight

• **The mobility of Belgian people** is steadily increasing, whatever the mode of transport considered.

Between 1990 and 1995, the average distance covered by a Belgian increased by a further 10%. In 1996, over 80% of his motorized journeys were done by car or motorbike, as compared with only 6% by train and less than 1% by tram or underground. Walking and cycling add up to only 6.4% of total journeys.

However, the growth in *car traffic* has been slowing down since the beginning of the nineties to the benefit of rail transport. This tendency to stagnate is also displayed by a more limited increase in the average distance covered per inhabitant and per year, and also by a relative status quo with respect to the average annual numbers of kms covered by Belgian cars.

As mentioned above, *rail traffic* slightly recovered since the end of the eighties. This is chiefly ascribable to longer distances covered on average per journey, with the number of passengers being less and less constant.

Journeys by means of *public transport* (tram, bus, underground) have, on the whole, not benefited much from modal transfer. Trends in the Flemish and in the Walloon regions have been oriented towards a stagnation since 1990, and even decline in the case of Wallonia. Only the Brussels region is characterised by a strong increase in the utilisation rate of public transport (1990-1998 : +9%).

While the European Commission believes that promoting the use of bicycles could reduce by 4% the CO_2 emissions caused by transport, between 1970 and 1995, bicycling has been constantly decreasing in Belgium. Estimates indicate that

Belgians cover an average of 325 km per year , far behind the Danes (almost 900 km) or the Dutch (about 850 km).

• **Freight transport** of course reflects the economic growth of a country. The latter brings about an increase in economic trade and thus an increased need for transport. The globalisation of the economy, the completion of the European internal market, the reduction in real transport costs, the resiting of enterprises or the shift of production processes towards "just in time" only increased the demand for freight transport

In Belgium, as in the rest of Europe in fact, the growth in the traffic of goods took place exclusively to the benefit of *road transport* which has been growing 4% per year since 1970. As for the number of tonne-km transported by rail or waterway, it decreased respectively by 4% and 9% since 1970, while road transport was achieving a 165% increase ! And to the contrary of passenger transport by road, there has been no indication of a tendency towards a decrease in the growth of goods transport by road over the past few years.

However, the ongoing congestion of road infrastructures and the development of combined platforms hold the promise of a future breakthrough for the transport of goods by waterways. Since 1993, we can in fact note a recovery of transport activities by waterways.

In Belgium, freight transport is also characterised by a strong tendency towards *internationalisation* . The international traffic indeed accounts for 70% of the traffic by waterways, 65% of the rail traffic and 45% of the road traffic: in fact, the latter is markedly expanding as, in 1970, international road traffic only accounted for 29%.

If we dwell some on the *efficiency of freight transport by road,* which can be expressed in tonne-km, measured by referring to GDP, we note that the latter practically doubled from 1980 to 1997, which really highlights the growing dependency of our economy on road transport.

Indeed, so far as the *average distance covered per tonne* in the internal road transport is concerned, it practically doubled over a period of 30 years but it is still inferior to 60km, a distance for which road transport does not have much competition.

Thus, it is quite clear today that such trends are not sustainable and that efforts must be made to achieve a lower circulation of goods, a modal transfer from road transport towards rail transport or transport by waterways or maritime transport, or combined modes of transport benefiting from the advantages offered by the various types of transport.

Multimodal transport indeed is the sustainable route to which Belgium seems more and more committed. In 1997, combined transport accounted for 25% of freight traffic by rail, thus three times more than in 1985. As for the «Rolling Road», although not much developed yet, it had an encouraging start, especially with respect to the loading of lorries on trains which more than doubled its performances between 1996 and 1997.

c) Modal choices linked to commuter traffic

The phenomena of periurbanization et de rurbanization brought about a significant increase in **commuter traffic between the home and the workplace and the home and school.** Over the past few years, the share of the car in these journeys increased markedly and a decrease in the number of non motorized journeys was noted.

Between 1970 and 1991, the only mode of transport which grew is the car: its use practically doubled and increased from 37% to 70%. All the other modes of transport decreased dramatically. At the regional level, the Brussels Region is characterized by a rather high use of public transport and walking (33%); The Walloon Region is characterized by a proportionately higher use of the car (69%) and the Flemish Region by a significant use of the two-wheels (12.5%).

2. Characteristics of the vehicle fleet and use efficiency

The **stock of road vehicles** is a primary indicator of potential pressures exerted by the transport sector on the environment and on public health. Of course, the scope of certain pressures can be modulated by factors linked to the characteristics of the vehicles and fuels and also to the type of driving.

Since 1980, the stock of cars has been growing by 2% annually. As for the fleet of lorries and vans, the average annual growth rate has been 3% since that same date.

The ongoing increase in the stock of vehicles brought about a important increase in the **motorization rate** in Belgium. It has practically doubled since 1970 and, in 1997, we had 43 cars for 100 inhabitants and 111 cars for 100 households. Regional disparities point to a lower rate of motorization per household in the Brussels-Capital Region which has better public transport services and where daily journeys are often shorter than in the two other Regions.

Moreover, the development of motorization was accompanied by an ongoing increase in the **consumption or road fuels.** From 1986 to 1997, consumption rose from 5.6 million toe to 7.3 million toe, i.e. a growth of practically 30%.

However, this trend has been slightly slowing down since the beginning of the decade, a trend which is in fact parallel to that of the volume of road traffic. The average annual growth rate in the supply of road fuels in Belgium was only 1.0% in 1996-1997 as compared with an average of 2.4% for the 1986-1997 period.

Moreover, it is interesting to note that between 1986 and 1997, the share of diesel oil in fuel consumption (in terms of energy) grew by 15%. As for unleaded petrol, in 1997, it accounted for 79% of the total energy consumption of petrol. As for LPG, it only accounts - in terms of energy - for 1% of the fuel consumption of the road sector.

If we compute the consumption of road fuels (all fuels considered) per inhabitant, we note that it has been steadily increasing (90-9 : +11 %) due to the increase in car traffic and in the carriage of goods by road, more particularly. Luckily, thanks to technical progress, among other things in the area of motors, it has been possible to somewhat control this unbridled growth. This is demonstrated by the fact that the ratio between energy consumption and distances covered declined by 10% between 1986 and 1991. Since then, the strong increase in the average age of the fleet and the increase in the share of lorries in the vehicle fleet, as well as the new regulations are that many factors that have contributed to limit the downward trend in the specific consumption of fuel over the past few years.

Assessing the scope and the nature of the pressures exerted by road transport on the environment and on public health can be approached not only by analysing the trend of journeys but also by examining the **structural characteristics of the vehicle fleet** (type of fuel, engine capacity, emission standards, average age of the fleet).

Between 1981 and 1998, the fleet of *cars equipped with a diesel motor* was practically multiplied by six (+585%!). This infatuation with diesel is linked to the better quality of motors but also, to a large extent, to the differences in excise duties applicable to diesel and to petrol, all the more so as the number of kilometres travelled by the vehicles has been steadily growing.

In 1998, 37% of the car fleet were equipped with a diesel motor, and so were 83% of the lorry and van fleet and 98% of the bus and coach fleet. The share of diesel for the whole motor vehicle fleet grew from 16% to 58% between 1983 and 1998, while that of petrol vehicles was dropping from 81% down to 41%. We also note that vehicles using alternative fuels only occupy a very small share of the market. For instance, the share of vehicles using LPG, has been steadily decreasing since 1983 and, in 1998, they only accounted for 1% of the stock of motor vehicles.

On the other hand, the *engine capacity and the average age* of the fleet tend to steadily grow. The average engine capacity indeed increased by 12% since 1989 (1656 cc in 1997) while the average age was increasing by 30% over the same period of time. However, the latter grew more since the introduction of the road tax encouraging the purchase of second-hand, older cars. This average age has now reached 7 years and 3 months.

A means of reducing the demand for journeys and thus the energy consumption would be to **use transport means more efficiently.**

So far as *passenger transport* is concerned, it involves, among other things, an increase in car occupancy rates (which was 1.2 persons in 1998) and in the use of public transport, more particularly during off peak hours. Now, we note that whatever the mode of passenger transport, the average occupancy rate has been tending to decrease strongly and steadily since the fifties. E.g. minus 35% for cars and minus 51% for trains.

So far as *freight transport* is concerned, a significant reduction in the incidence of lorries involves an improvement in loading methods and a decrease in empty running thanks to a better organisation of freight transport. Now, the indicators show that, on average, in 1991, a lorry was transporting less than half its capacity and that the share of dead load in commercial vehicles was still 25%. These not very sustainable trends are still more obvious when we observe transport by waterways. Since the sixties, we note a marked increase in empty running (about 50% of barges in 1996) and a steady decrease in the load factor (about 50% in 1996). However, one should point to the good health of freight transport by rail which has been steadily increasing since the fifties ((+60%).

II. MEASURING TRANSPORT - SUSTAINABLE DEVELOPMENT INTERACTIONS

These interactions are numerous and varied. This report analysed four main groups:

- Evolution of the environmental impact of transport linked to energy consumption;

  Evolution of the impact on the ecosystems, public health and the quality of life;

  Accessibility and equity;

- Economic sustainability.

1) Evolution of the environmental impact of transport linked to energy consumption

The analysis of the transport **emissions of the major air pollutants** ($C0_2$, NO_X, COV, CO, $S0_2$) allows for a better approach of the evolution of pressures.

In 1997, transport was responsible for 18% of the total anthropogenic emissions of CO_2 in Belgium. Thus a growth of 11% as compared with 1990, ascribable to the steady growth in the volume of traffic. However, despite the increase in heavy goods vehicles and medium-size vehicles, thanks to technological progress, it was possible to have a growth of $C0_2$ emissions (+11%) inferior to that of the volume of road traffic (+15%).

The emissions of *NO_x* (-12%), of *CO* (-14%), of *COV* (-19%), of *SO_2* (-69%) and of lead (-79%) produced by the transport sector have been regularly declining since the beginning of the nineties. However, this decline at national level is counterbalanced by local increases in pollutants (mainly urban).

2) Evolution of the impact on the ecosystems, public health and the quality of life

Road accidents and **the noise** caused by transport are undoubtedly two important corollaries of mobility needs..

• In 1998, there were 72 260 road casualties with about 2% of fatalities.

However, statistics point to a marked general downward trend: indeed, between 1970 and 1998, the number of fatalities on Belgian roads was down 51%. It is mainly in urban areas, that the number of fatalities and serious injuries decreased over the past few years whilst the number of casualties on motorways was increasing by 16%.

Analyses also show that alcohol and HVL are two important vectors of road insecurity and that they are on the increase: indeed, in 1996, 11% of the accidents with fatalities or serious injuries involved at least one driver under the influence of alcohol and 21% of the victims killed on the road had been confronted with a lorry.

• The noise caused by transport (especially road transport) has now become a major nuisance for public health, the quality of life and the ecosystem, especially in urban areas. It is generally considered that the threshold of 65 dBA is the level beyond which there can be a serious impact on health.

Now, both in the Flemish Region and in the Brussels Region, estimates show that about 30% of the population is submitted to similar noise levels caused by road traffic. On the other hand, the noise caused by rail traffic only affects 5% of the inhabitants in the Flemish Region and 2.5% of the inhabitants in the Brussels

Region. As for air traffic, it is a noise nuisance (> 65 dBA) for less than 1% of the inhabitants in Flanders and in Brussels. However, due to the specific nature of the noise caused by airplanes (high frequencies and amplitudes) and due to its highly localized nature, noise problems linked to air transport are a major nuisance for people living alongside airports.

3) Accessibility and equity

A large number of variables intervene in the accessibility and equity of the transport sector. We pinpointed the majors variables in the various thematic sheets and here are the major trends:

So far as **modal choices** are concerned, we note that there is a slightly higher proportion of men than of women who use the car to commute. Moreover the latter resort more to urban transport and to walking for this type of journeys.

However this trend must be qualified: whilst the number of cars belonging to men is stagnating, or even slightly declining, the motorization rate of women has practically doubled from 1986 to 1997.

So far as **commuter journeys** between the workplace/school- home are concerned, which could be termed «constraint time», we note that this time is lengthening the workday and tends to increase for quite an important proportion of the working and school population, thus increasingly reducing the time devoted to leisure or rest. In fact, whilst in 1981, the average duration of commutes (one way) was 23 minutes, it had reached 30 minutes in 1991, thus the equivalent of one month of work per year.

As for the speed of these commutes, it tends to stagnate. Nowadays, all transport modes considered, it is about 35km/h. On the whole, cars and trains are the fastest transport means (~40km/h) whilst urban transport means are much too slow (~22km/h). In fact, under these conditions, urban areas appear to be favourable places where to use bicycles, since the latter's average speed, during rush hours, is comparable on the whole to that of cars. However, as indicated above, bicycles do not enjoy much recognition yet in Brussels (in fact only one commuter out of 200 is using a bicycle), nor - this being the cause or consequence thereof - do the public authorities devote much attention to this means of transport..

On the other hand, in terms of equity between genders, it is interesting to note that the average speed of the women's home to workplace commuter journeys (31km/h) is significantly lower than that of the men's (39km/h). The former indeed resort more to walking and to urban transport which, in the rush hours, have rather low average speeds.

As for the average distance of commuter journeys, due, more particularly, to the relocation of housing from the cities to their outskirts and to rural areas, it increased quite strongly as most of the time these «migrants» kept their jobs in the large conurbations. This also led, to a wide extent, to a considerable lengthening of the duration of the above-mentioned commutes. From 1981 to 1991, the average distance covered during home-to-workplace journeys rose from 13.7km to 17.5km. More specifically, the last three censuses (1970-1981-1991) indicate that the share of persons working at distances inferior to 5km strongly declined (-35%) whilst that of persons working at a distance of 30 to 50km and more than 50km respectively increased by 97% and 116%.

It should also be pointed out that, in 1996, the ownership of a least one bicycle was 87% in the Flemish Region as compared with 58% in the Walloon Region and scarcely 37% in the Brussels Region, thus a marked increase as compared with 1991. However, the first part results of the first national enquiry on the mobility of households, which was carried out in 1998-1999, tend to indicate a contraction so far as the ownership of bicycles in the Flemish Region and in the Walloon Region is concerned.

On the other hand, a little less than one Belgian household out of twenty does not own a car (this figure goes up to 30% in the Brussels Region) and about the same proportion owns two cars or more (this figure drops down to 8% in the Brussels Region). A Flemish survey also highlighted the fact that below an monthly budget of 40 000 BEF, very few families own a car.

Now, in a society which is strongly organized according to individual transportation means, giving up the purchase of a vehicle for lack of sufficient financial means can, in some case, increase social inequalities (reduce the choice of possible jobs, limit the choice of schools and social and cultural activities...).

In Belgium, the share of transport costs in the budget of households has been steadily increasing since the end of the seventies and, in 1997-98, it accounted for an average of 12%. But over the past 20 years, this share particularly increased for the weakest households from a economic point of view, thus reinforcing social inequities.

Indeed, dependency on cars increased unequally in the various income quartiles. Whilst, at the end of the seventies, the poorer households were only devoting - exclusive of insurances - 3.8% of their income to transport, this share rose to 8.2% in 1997-98. On the other hand, the share of income devoted to transport did not increase - or practically not - for the richer half.

Moreover, transportation is one of the expenditure items where consumption gaps between the 1st and the 4th income quartiles are the highest (a ratio of 7). We should also note that the households with the highest incomes spend four times more money to purchase petrol than those with the lower incomes. As a result, on average, the richer households contribute much more to car pollution than the poorer households. Such a situation is highly inequitable insofar as the costs paid for car mobility are far from reflecting the global external costs concerning this type of traffic, and all the more so as, generally speaking, the poorer households suffer more from the nuisances of car traffic.

A source of inequity for non motorized persons, deriving from what has just been said, is due to a significant decrease over the last decades in the *access to basic services »* (schools, neighbourhood shops, small hospitals, banks...).

The increased centralization of services coupled with the growing scattering of settlements increase the need to travel, increase the dependency on the car and tends to reinforce social inequalities since the persons who do not have a car or another means of motorized transport most of the time depend on public transport where the services offered are not always sufficient.

Indeed, over the past decades, there were no really encouraging signs of improvement in *the offer and accessibility of rail transport and public transport.* From 1970 to 1998, the length of the *Belgian rail network* decreased by 18%, the number of train stations, outbuildings and stops by 33%. However, as indicated above, trains move at an appreciable speed and the efforts achieved by the SNCB to further increase the swiftness of these journeys are significant.. From 1979 to 1998, the number of kilometres of railway lines where the speed is 120 km/h or 140 km/h grew by practically 35% and accounts for about 60% of the current network.

So far as *public transport* is concerned, although the STIB and TEC networks have been significantly developed (+14% and +5%), the De Lijn network, for its part, was reduced by about 10% between 1992 and 1996. As for the number of stops, it increased by about 16% in the Brussels Region but declined by almost 30% in the Walloon Region, taking into account the density of stops now under the mark of one stop/km^2. However, over the past few years, the TEC have been devising new actions to improve mobility (Rapido bus, bus 105, TEC shuttles...).

Moreover, it is interesting to note that, despite the significant increase in the volume of road traffic, the weekly average commercial speed in Brussels did not experience the decline which might have been expected. This is probably ascribable to the

development of exclusive lanes and to the setting up of remote-controlled traffic lights.

4) Economic sustainability

Transport systems, and more particularly road transport, are widely responsible for the utilisation of oil, for the associated emissions and for the environmental impact linked to the oil industry. On the other hand, **the energy consumption of transport means** grew more rapidly than that of the industry or of the "domestic-tertiary and related sector". From 1979 to 1997, the share of transport in the final energy consumption grew from 16.8% to 24.4%, while there was a marked decrease in the other two sectors.

During the same period of time , final energy consumption increased by 56%, reaching 9.2 million toe in 1997. That same year, 79% of the energy in the transport sector were absorbed by road transport, 15% by air transport, 4% by rail transport and 2% by inland waterways transport

Transport generates considerable costs so far as the deterioration of the environment and of buildings and damages to the quality of life and public health are concerned. Part of these costs is supported directly by the users in the form of internal costs which they pay in exchange for their journey. However, a significant part of these costs is borne by society as a whole (some costs linked to accidents, part of the congestion costs, damage to buildings, to human health…). The insufficient price paid for transport, which characterized our society for half a century, is probably the chief cause for current and future problems linked to mobility.

As long as motorists will only support part of the costs they cause (i.e. as long as the external costs are not charged to road users), the sector of road transport will remain economically ineffective.

III MEASURING ACTION TOOLS (MANAGEMENT)

In order to develop an effective policy in the field of sustainable transport, one needs to understand **the evolution of population volumes per type of space**. Data collected through the 1981 and 1991 censuses shows:

- a decrease in the number of people living in large cities (more than 50 000 inhabitants),

- a marked process of periurbanization towards the suburbs and the residential area of exurbanites,

- a significant increase in the number of people living in small and very small towns (except in the Flemish Region),

- a significant increase in scattered population.

However, some of the data available also shows a slowdown in the exurbanization process, particularly in towns of more than 40 000 inhabitants. The 2001 census, if it takes place, will possibly confirm some of these trends.

The consequences of these choices are a spreading out of inhabited areas, an increase in the population living in areas where public transport and proximity services are less readily available, as well as an increase in average commuting distances. All this leads to increased travelling needs. Moreover, as far as commuting is concerned, people living in suburban areas resort more to road transport than the national average and than exurbanites who live farther away from their workplace and thus tend to resort more to rail transport.

A more consistent regional planning policy will not yield results if it is not accompanied by a policy that effectively **encourages people to make more environment-friendly transport choices**.

We will not deal here any more with the availability of rail and public transport, discussed earlier, but rather with the quality of said services.

Generally speaking, *the SNCB customers' level of satisfaction* has decreased since 1994 (except for 1997), to reach 70% today. It is primarily the level of satisfaction concerning train stations which has driven down the general index.

Train punctuality, which remains one of the priority criteria for users, has decreased slightly since 1988 (when 96% of trains arrived with less than 5 minutes delay), to reach 91% today.

As far as *safety* is concerned, rail transport remains one of the safest means of transport. In 1998, in Belgium, the risk of being killed while driving a car was 30 times higher than while travelling by train.

As far as public transport is concerned, the *STIB satisfaction barometer* reveals downward trends for stations and vehicle safety (-12,5%) and comfort (-9,5%). Journey duration is rather satisfactory for nearly 70% of the users, but only 30% of users are satisfied with evening transport availability and price.

Developing alternatives to road transport, as well as reducing the impact on health, quality of life and the environment also requires the **effective adjustment of existing transport infrastructures**.

Defining *areas where speed is limited to 30 km/h* appears to be a good way to promote cycling and walking. It also improves road safety and the quality of life, and contributes to a reduction of pollution levels. However, even if the number of such areas has increased regularly since 1989 (especially in the Flemish Region), they remain little used. In 1999, there were only 138 such areas in the Brussels and Walloon region, and 256 in the Flemish region.

Inland waterways, on the other hand, have undergone structural changes in the 90s. The overall length of the network has evolved very little, but an increasingly significant part of the network has been reworked to accommodate heavy ships. In 1995, almost 20% of the network was accessible to boats with a capacity of 2,500 T and more, against hardly 8% in 1980, and 34% to boats of between 1,000 T and 1,500 T, against 19% in 1980.

The maritime and harbour infrastructure has been extensively developed between 1983 and 1996. The surface of basins available in Belgian harbours increased by 64% during this period, while the length of quays increased by 20%.

Based on these significant developments and the liberalisation of waterways freight transport, one can foresee a development of intermodality in the years to come. Indeed, since 1993, this type of transport has increased its share in freight transport.

Choosing more environment-friendly transport modes also requires fair transport prices. Indeed, cost is still a key issue as far as transport is concerned. Accessible and attractive price levels, compared to the costs associated with private vehicles use, can be established in order to encourage citizens to use more viable transport modes.

All in all, for the 1981-1998 period, the increases in *public transport costs* (rail +89%; tram, bus, underground +134%) have been significantly higher than the increase in the cost of living (+70%). If we examine the evolution of the average income per capita, only the costs associated with urban public transport have increased in proportions significantly higher than that of the average income.

On the other hand, the *fuels price index* has evolved very little if compared with other price indices. Once the vehicle has been purchased, car transport is now more accessible for the average household than it was at the beginning of the 1980s.

For the same period, *fixed costs* have increased by more than 100% (purchase prices for new cars and road taxes) whereas *variable costs* (fuel, maintenance and repair) have only increased by 32% and 98% respectively.

The way transport prices have evolved in the last two decades has sent out signals that have rather encouraged people to travel by car. However, a growing consensus seems to appear in favour of asking users to cover part or all of the marginal social cost that transport generates.

Based on the principle of "*internalisation of external costs*", discussed above, one could imagine to variabilise rates according to circumstances (time and place), to the type of vehicle and fuel, but also to variabilise taxes so as to increase variable costs vis-à-vis fixed costs.

The *variabilisation principle* can be applied in different ways:

- reduction of fixed costs and increase of variable costs, with possibly no impact on tax and budget,

- unilateral increase of variable costs,

- introduction of a universal transport allowance (increasing fuel price so as to take into account external costs, then redistributing this income equally amongst all citizens). In this system, infrequent users or those who own no car are rewarded.

Increasing fuel taxes, provided measures are introduced to accompany the process and avoid multiplying inequalities within society, is thus an action tool that would both be easy to use and could be used to promote more sustainable types of transport.

IV CONCLUSIONS

The analysis of the indicators dealt with in this report shows relatively little positive evolution. Indeed, except for some positive trends, such as the improvement of road safety, a slight decrease in the growth of road traffic, a decrease in the emission of pollutants (except CO_2) or a slight increase in rail and inland waterways transport, the situation is rather bleak. Except for some local exceptions (cities like Bruges, Hasselt or Mons) and in spite of the announced programmes, no strong voluntarist policy has been implemented yet in order to promote public transport, to integrate cycling in urban centres, to actively work on car parking and limiting car use, to slow down the scattering of inhabitants, to produce new tax provisions, etc.

However, most of the action tools that can positively affect the sustainability of transport seems to have been identified and agreed on, even if they are not

sufficiently used yet. Actually implementing them will inevitably require a more integrated approach to mobility, which in turn will imply establishing a functional body for consultation and co-ordination integrated by all the ministries that can contribute to the development of a more sustainable transport model (regional and town planning, tax, transport infrastructure, environment, road regulation, education, etc)

Belgium seems to be moving in the right direction. It should soon adopt a federal plan for sustainable development, part of which deals with transport. Hopefully this plan will be one more step in the implementation of an integrated mobility policy which provides a space for each mode of transport and takes into account its economic, environmental and social impacts.

The present report should also spur a debate on the relevance of some indicators and be used to encourage people to propose new indicators (PM_{10}, N_20, VOC, % of municipalities having adopted charters of mobility, implementation of company transport plans, etc).

Lastly, ideally, the set of indicators developed in the present study should be regularly updated, so as to create a permanent observatory of sustainable mobility in Belgium.

Summary of the thematic sheets and developed indicators		
Trends in road traffic	• Total volume of road traffic • Intensity of traffic per capita • Intensity of traffic per surface • Intensity of traffic per length unit of network • Intensity of traffic per unit of GDP	• Composition of the traffic
Trends in air traffic	• Number of flights by planes registered in national airports • Distribution of air traffic at Brussels-National airport per daytime/night-time period • Distribution of air traffic at Brussels-National airport by noise level of planes	• Number of transported passengers • Number of transported tons of freight • Number of passengers-km managed by main EU companies
Modal trends in inland passenger transport	• Number of passengers-km per main mode of inland passenger transport • Average distances travelled per mode of transport, per capita and per annum	• average annual mileage travelled in Belgium by Belgian personal cars • total annual number of travellers for train and public transport • Number of journeys by train and public transport per capita and per annum • Average duration of a train journey • % of journeys by bicycle in various European cities
Modal choices linked to commuter traffic	• Share of the various modes of transport in commuter journeys related to work and education	• Share of the various modes of transport in home-to-workplace journeys, per gender • Evolution in the modes of transport used for home-to-workplace journeys • Main modes of transport used for home-to-workplace journeys per place of residence
Modal trends in inland freight transport	• Freight transport by main modes of land transport • Structure of freight modal distribution • Intensity of freight transport per unit of GDP • Total annual mileage travelled by all Belgian lorries on the national territory	• average distances travelled by a ton of freight for main modes of inland transport • Share of combined transport in freight transport
Stock of road vehicles	• Stock of road vehicles • Rate of vehicle ownership • % of households having 0, 1, 2, or more than 2 cars • % of households having 0, 1, 2 or more than 2 bicycles	• Fleet of personal cars, per gender • Fleet of company cars
Structural characteristics of the road vehicle fleet	• Structure of the road vehicle fleet per type of fuel • Registration of new cars per type of fuel • Share of vehicle fleet that respects given emission standards • Average cubic capacity of vehicle fleet • Registration of new cars per average power Average age of vehicle fleet	

Annual consumption of road fuels - Intensity and structure per type of fuel	• yearly fuel consumption • Structure of road fuel consumption • Intensity of fuel consumption per capita • Intensity of fuel consumption per volume of traffic • average fuel consumption of new vehicles fleet	
Efficiency of transport use: occupancy and load rates, empty running	• Average car occupancy rate • Average number of passengers per train • Average plane occupancy rate (national company) • Road transport: share of total distance (in km) carried out with a load • Road transport: average lorry occupancy rate • Inland waterways transport: share of total distance carried out with a load • Inland waterways transport: average ship occupancy rate • Rail transport : average tonnage per train	
Transport emissions of air pollutants	• Total emissions of CO2, Nox, COV, CO and SO2 by transport sector • Intensity of CO2 emissions due to road traffic, per unit of traffic volume • Intensity of CO2 emissions due to road traffic, per capita • Intensity of CO2 emissions due to road traffic, per unit of GDP expressed in tons of CO2 per million standard of purchasing power	• Relative contribution of total CO2, Nox, COV, CO and SO2 emissions to total anthropic emissions
Number of fatalities and injuries in road accidents and intensity	• number of killed in road accidents • number of injured in road accidents • Intensity of death in road accidents by volume of traffic • Intensity of death in road accidents per capita	• Seriousness of accidents • Distribution of the number of fatalities per type of road user • Comparison of the number of fatalities and serious injuries per billion of travellers-km for cyclists and car users • Comparison of the number of fatalities per million of pass.-km for train and car users (UE15) • Evolution of the number of fatalities and serious injuries per category of users • number of fatalities according to the age and nature of the user • Comparison of road safety on motorways, regional roads and municipal roads • Evolution of the number of deaths according to the type of road and user • Evolution of the number of personal injury accidents per type of road • % of accidents where one or more drivers are under the influence of alcohol • % of accidents resulting in death or severe injury where one or more

		drivers are under the influence of alcohol • Evolution of the number of personal injury accidents, victims, seriousness of accidents for accidents involving lorries, and comparison with the volume of lorry traffic • Distribution of accidents factors for all accidents and accidents resulting in death
Traffic noise	• Percentage of the population exposed to road traffic noise, in the Flemish and Brussels regions • Percentage of the population exposed to rail traffic noise, in the Flemish and Brussels regions • Percentage of the population exposed to air traffic noise, in the Flemish and Brussels regions	
Average duration of commuter journeys	• Evolution of the average duration of home-to-workplace journeys	• Distribution, by class of journey duration, of commuter journeys related to work and education • Average speeds of home-to-workplace journeys, per mode of transport • Average durations of home-to-workplace journeys, per mode of transport and for different types of inter-urban journeys • Average durations of home-to-workplace journeys, per mode of transport and for different types of inter-urban journeys, in the Brussels region • Time, distances and average speeds of home-to-workplace journeys, per gender • Evolution of home-to-workplace journey durations • Distribution, by class of duration, of home-to-workplace journeys per place of residence
Household expenditure devoted to transport costs	• International comparison of the share of household budgets taken up by transport and telecommunications • Comparison of the importance of household transport expenditure at international and regional level • Average annual household expenditure, broken down by quartile of income and structure of the expenditure • Evolution of average transport expenditure, compared with average household income available at national level, per quartile of income	
Final annual energy consumption by	• Final consumption of energy by the transport sector • Intensities of energy use by the transport sector, compared to the number of inhabitants • Intensities of energy use by the transport sector, compared to	• Share of the transport sector in the total final consumption of energy (all sectors considered) • Share of the various energy vectors in transport

the transport sector - Intensity and breakdown per mode	GDP	final energy consumption
Average distances of commuter journeys	• Evolution of the average distance of home-to-workplace journeys	• Distribution, by class of distance, of commuter journeys related to work or education • Evolution, by class of distance, of home-to-workplace journeys per place of residence
Evolution of population volumes per type of space	• Evolution of population volumes in clustered (by class of importance) and scattered residential areas	• Evolution of the surface and the volume of population, in the different areas of urban residential spaces • Evolution of population volumes per category of municipality, according to their degree of functional urbanization
Access to "basic services"	• Evolution over time of the number of certain basic services (shops, banks, post offices, kindergartens and primary schools, hospitals)	
Price of road fuels and tax differentiation	• Price of the fuels and taxes • Difference between taxes and fuels selling prices	
Price indices for passenger transport and variabilisation	• Evolution of the various price indices related to personal transport, compared to the evolution of the consumer price index, the health index and the average income per capita • Evolution of indices related to fixed and variable costs associated with vehicle use	
Supply / quality of rail transport and public transport	• Evolution of the accessibility to the Belgian railway network • Evolution of the network's service supply • Evolution of the punctuality of journeys on the Belgian network • Evolution of the speed of journeys on the Belgian railway network • Evolution of the satisfaction level of rail transport users • Regional evolution of the accessibility to the Belgian public transport networks • Regional evolution of public transport supply • Evolution of the commercial speed of public transport in the Brussels region • Evolution of the satisfaction level of public transport users (Brussels and Flemish regions)	• Evolution of rail transport safety • Evolution of rail transport comfort • Evolution of public transport safety and comfort

PART II: AGRICULTURE INDICATORS

Today, the information systems Belgium disposes of are little satisfactory as decision support instrument or as evaluation instrument of policies for sustainable development. Efforts which have been undertaken on different levels were realised independently. There is a need for the evaluation and decision processes to be able to rely on global and coherent information systems, which reflect the different aspects of development in a global approach.This need for information exists as much on a local as on an international level, as much on a policy-making level as on the level of individuals.

Without losing sight of their limitations, indicators accomplish various functions in the policy process. First, they quantify information, which, accompanied by more detailed analyses, helps policy-makers in their choice of prior issues, in the policies needed to be pursued and in the evaluation of policies already pursued. Secondly, they simplify information. Indicators summarize complex statistical information, but they also give a simplified representation of certain interrelations between economic, social, environmental and institutional spheres. In this way, policy-makers gain a holistic perspective of the problems they deal with and are encouraged to integrate sustainable development objectives in their management in the long run. Thirdly, indicators improve communication. Indicators simplify the communication process by which the information is transmitted to different users and therefore have to be established in function of the needs, expectations and capacities of the users.

With a regular and standardized character, indicators allow an evaluation in time of the realised progress. In this way, they can play an important role in informing the public (alerting and sensitizing, improved comprehension of the consequences of actions undertaken on the individual or collective level). This is of major importance to the extent that an awareness process forms a *conditio sine qua non* for the implication and participation of the public to the establishment of strategies for sustainable development. This communication, if succeeded, can promote certain attitudes or choices needed to direct society towards more sustainable production and consumption patterns.

In most cases, the sets of sustainable development indicators want to give a global indication, a kind of instrument panel reflecting the more or less sustainable character on a local, national or supranational scale. Following these approaches, indicators are organised in function of “issues” that are prior in terms of sustainable development (pollution, health, habitat, poverty, education, etc.). These initiatives usually do not involve sectoral indicators. Impacts different sectoral activities can have on sustainable development are difficult to trace when starting from these sets,

considering the relative desaggregation of the information and, on the other hand, the diversity and sometimes indirect character of the impact. In a way, one can say that thematic as well as sectoral indicators follow complementary objectives: the former enable global performances of a country or a region to be evaluated in the perspective of sustainable development, whereas the latter stimulate a better integration of sustainable development concerns in sectoral policies.

Considering the growing human population and the accompanied growing need of food, fibers, fodder crops and raw materials, the global agricultural sector faces a difficult assignment. This problem has to be dealt with in spite of less acres agricultural land and a reduced supply of fossil fuels. Scientific and educational environments are looking for a more input-efficient and sustainable food production system exerting a less negative influence on the environment.

In many definitions, three dimensions of the concept of sustainable agriculture are present: economic, ecological and social sustainability. Economic sustainability implies that agriculture should be viable in economic terms and should be able to cover costs in the long term. Today, many agriculturers, especially within the European Union, are dependant on measures protecting the market to guarantee their economic survival (through tariffs on imports or other price supporting mechanisms or through subsidies to inputs). Ecological sustainability refers to the interactions between agriculture and natural resources. Social sustainability implies an equitable distribution of costs and profits between generations and between the different societal communities, among whom the farmers.

This does not imply that a general sustainable agriculture concept would be summarized. The optimal synergy between economic and ecological sustainability is the main key of the different viewpoints. Their practical implementation and definition needs the use and establishment of indicators. Sustainable agriculture indicators are able to address problems, state and progress towards stated goals.

There is a need for a detailed and structured approach, a frame of mind to study sustainable agriculture indicators in a uniform way, instead of a series of case studies. The methodological framework used in this project combines a top-down approach (indicators derived from general principles linked with the concept of sustainable agriculture, an analysis of the existing situation in terms of agriculture in Belgium and a study of international literature concerning methodological frameworks and already developed indicators of sustainable agriculture) with a bottom-up approach (taking account of the different actors who are relevant in the field of sustainable agriculture).

The indicators are structured within the Pressure-State-Response (P-S-R) framework of the OECD and the Driving Force-State-Response model of the Commission on Sustainable Devolopment. Driving Forces quantify the processes, activities and practices that have a beneficial or adverse impact on sustainable development. In this way, the quantity and quality of natural resources is changed (state). International, national and sectoral society reacts to these human-induced changes through environmental, social and economic policies (response).

Application of the DF/P-S-R framework to the agricultural sector leads to a set of questions, including:

- What is causing environmental conditions in agriculture to change (beneficial or harmful impact of agricultural activities on the environment) (driving force)?
- What effect is this having on the state or the condition of the environment in agriculture (state)?
- What actions are being taken to respond to changes in the state of the environment in agriculture by society groups (farmers, consumers, etc.) and policy makers (response)?

These questions are situated in the environmental field, but socio-economic questions also need to be asked, such as:

- How does environmental relations affect the economic conditions of the agricultural sector?
- What is the evolution of the agricultural sector with respect to the number of farmers, the area cultured, etc.?
- To what extent farms are dependent on market protection for their economic viability, via import tariffs or other price-supporting mechanisms or via input subsidies?

The identification of prior themes on the base of which indicators for sustainable agriculture in Belgium need to be developed, results from a combination of working methods. On the one hand, a survey was addressed to different actors active in the field of agriculture, sustainable development or indicators (federal and regional administrations, scientific environments, interest groups), in order to select prior themes. On the other hand, a study was done of the articles concerning the agricultural sector that appeared in the Flemish press in the period January 1998 –

December 1999. This press survey gives an indication of topical themes vivid in the public opinion.

Based on national and international literature, existing experience of ECOLAS in the agricultural field as well as the prior core elements of the Belgian agricultural sector, a preliminary list was set up of 121 indicators of sustainable agriculture. This list was reduced following certain selection criteria. First, the indicators have to represent core problems within the Belgian agricultural sector, such as they are revealed in the study of prior themes. The indicators need to be relevant, for they are able to evaluate progress or regress in relation to a sustainable agriculture and they can support existing actions and programs. Furthermore, the indicators need to be sensitive to changes in the environment or in the socio-economic conditions that the indicator characterises. The scientific validity and measurability of the indicators is also important, in a way that well funded concepts are used that are subject to a certain consensus.

Data needed for the application of the indicators need to be readily available or accessible at a reasonable cost-benefit analysis, reliable and updated on a regular basis. The indicators need to be clear and comprehensible, which improves the communicative quality. In order to interpret the indicators correctly, they better be tested to reference values (existing standards or goals on a national/regional/communitary scale, critical values, etc.).

The selection of 22 indicators was also based on interviews with different actors active in the field of agriculture, sustainable development or indicators (federal and regional administrations, scientific environments, interest groups). Certain relevant indicators were admitted, although data are not yet disposed of within a reasonable cost-benefit relation. These indicators can stimulate the development of data sources and standardised measuring methods, in order to assure the application of these indicators in the future.

The themes within which indicators were developed, are food security, food quality, genetic modification, subsidy regime, importation/exportation, financial situation of the farm/job satisfaction (2), employment, education of the farmer, social perspectives of the farmer, position of the farmer in the production chain (2), organic farming (3), pesticides, contribution of agriculture to environmental problems on a small scale, erosion of the soil, manure problem, landscape aspects, acidification and animal well-being. Nine indicators are of the state-type, seven of the driving force-type and six of the response-type. Eleven indicators reveal mainly environmental aspects, nine reveal economic aspects and two reveal social aspects. The indicators

within the subsidy regime theme, reveal not only economic but also institutional aspects (table).

The Commission on Sustainable Development structures the application of its indicators following methodological sheets containing information concerning the concept, importance, measures and information sources in order to simplify the collection of data as well as analyses. In the light of a possible harmonisation in the future, the structure of the methodological sheets of the CSD was chosen for the application of the selected indicators for sustainable agriculture in Belgium. The following pages give an overview of the 22 selected indicators and their values after application.

A general conclusion on the sustainability of the Belgian agricultural sector would give little indication, considering the complexity of the themes concerned. The selected indicators point at the still non-sustainable situation of the agricultural sector in its socio-economic, environmental and institutional context. On the other hand, the tendency within the indicators suggests the changes going on in the sector in order to build a more sustainable future.

Overview of the results concerning the application of Indicators of Sustainable Agriculture in Belgium

Theme/Indicator	Measuring unit	Target value	Value (starting year)	Value (end year)
Food security				
Ratio of the balances of trade of animal fodders in relation to animal products	%	100%	450% (1994)	247% (1997)
Food quality – Public Health				
Excess of the public health standards for agricultural products	%	0%	3,18% (1995)	3,64% (1997)
Subsidy regime				
Share of the direct income support in the price and market policy	%	as large as possible	17% (1995)	34% (1998)
Genetic modification				
Number of admission requests for the use of Genetically Modified Organisms	-	n.a.	-	135 (1999)
Importation/exportation				
Self-supporting rate of Belgium for animal and vegetable products	%	n.a.	A: 173%	A: 167%

			and V: 144% (1994)	and V: 172% (1997)
Financial situation of the farm/job satisfaction				
Real index of the mean farm income of the independant farmer	(1993 = 100)	n.a.	98,9 (1994)	109,37 (1997)
Yearly labour income per labour unit in relation to the yearly income in a different sector	%	as large as possible	72,48 (1994)	81,05 (1997)
Employment				
Number of persons employed in the agricultural sector in fully employed labour units (L.U.)	L.U.	n.a.	115.571 (1980)	76.016 (1997)
Theme/Indicator	Measuring Unit	Target value	Value (starting year)	Value (end year)
Education of the farmer				
Mean education profile of the starting farmer	code	n.a.	5 – higher sec. agric. (1995)	2 - B-course or equivalent (1998)
Social perspectives of the farmer				
Number of persons choosing their profession in the agricultural sector / Number of farmers wishing to make use of the Early Retirement Regulation	-	as large as possible	0,7 (1995)	2,0 (1998)
Position of the farmer in the production chain				

Share of the employment in the agricultural sector in relation to total employment per industrial column	%	as large as possible	see indicator	see indicator
Share of the turnover in the agricultural sector in relation to total turnover per industrial column	%	as large as possible	see indicator	see indicator
Organic farming				
Share of the organic farm land in the total farm land - Share of the organic animal production in the total livestock	%	as large as possible	0,07% (1987) – 0,04% (1997)	0,84% (1998) – 0,09% (1998)
Market share of the big department stores for organic products	%	as large as possible	-	65% (1998)
Yearly premium for organic production in relation to the lesser income of the organic farmer	%	as large as possible	-	see indicator
Pesticides				
Sum of the yearly distribution equivalents per pesticide for agricultural use	S_{eq}	as little as possible	5.784.136.204 (1979)	12.196.894.452 (1998)
Theme/Indicator	Measuring unit	Target value	Value (starting year)	Value (end year)
Contribution of agriculture to environmental problems on a small scale				
Share of complaints concerning odour resulting from agricultural activities	%	0%	24% (1979)	16% (1997)

Erosion/Condensation of the soil				
Number of farms enjoying subsidies for green cover with grass or rye	-	as large as possible	-	-
Manure problem				
Total manure excess per region, per year	kg	n.a.	see indicator	see indicator
Landscape aspects				
Acres of farm land per region for which a management agreement is closed	ha	as large as possible	-	-
Acidification				
Mean deposition by the farmer of NO_x, SO_2 and NH_3 in number of acidification equivalents per acre per year	A_{eq}	as little as possible	4.996 (1990)	4.122 (1997)
Animal well-being				
Mean living space per animal in m²	m²	n.a.	see indicator	see indicator

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THE ENVIRONMENTAL UTILISATION SPACE, CAPABILITIES AND LIMITATIONS OF A CONCEPT

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1. SUMMARY

The economy extracts materials and energy from the environment, uses and transforms them and finaly emits much of these materials as waste (low entropy) back into the environment. Considering the needs of future generations and the unfulfilled needs of the worlds poor, the pressure on the environment should be limited. Resources are scarse and emissions can have irreversible impacts on the quality of the environment. The funtions or services of nature by which the needs of living beings are fulfilled are at stake. The Environmental Utilisation Space is a quantitative estimate of acceptable pressures exerted by material flows on the environment. Acceptable means: 'consistent with the principles of sustainable development'.

The research focussing on the operationalisation of this concept, was conducted at the Centre for Sustainable Development of the University of Ghent, by three researchers with different scientific backgrounds: Jo Van Assche (sociology), Walter De Jonge (biochemistry) and Bernard Marzijn (agriculture).

The calculation of the Environmental Utilisation Space includes risk assessments. Furthermore questions about the allocation of scarce resources under current and future generations have to be answered. Two basic principles have to be applied: the precautionary principle and the equity-principle.

Given the generaly accepted opinion that sustainable development should build upon the participation of all stakeholders in decision making, the conclusion was that the Environmental Utilisation Space should be an **intersubjective construction**. In a more formal sense the space is modeled with **fuzzy sets**, quantifying the possibilities that the environmental pressures and allocations of material flows are more or less sustainable. **These sets are the result of measurements of preferences, risk perceptions and ethical choises of the stakeholders**. Methods were developed to guide the participatory process that should lead to the construction of these fuzzy sets. Backcasting was identified as an interesting tool to support this process.

2. OBJECTIVES

2.1 What's at stake

Sustainable Development needs to be guided by indicators which make it possible to evaluate policy and actors, and support decision making in order to make the optimal or satisfying choises. Some indicators should point out whether the use and allocation of natural resources (extraction of materials, emissions of waste) are acceptable, considering the needs of current and future generations. Quantifying the acceptable (what is sustainable) means that tools are needed to handle uncertainties, lack of knowledge, differences in perceptions of risks and the preferences of the stakeholders.

In order to organise and guide sustainable development one needs measurable variables that make it possible to evaluate policy results (ex-post) and policy-choises (ex-ante). These so called Indicators for Sustainable Development (ISD) can or should focus on the ecological, economic and social aspects of the society and its interactions with the environment.

The Environmental Utilisation Space was launched as a performance indicator, quantifying the acceptable pressures on the environment, pressures like extraction of scarse materials and emission of wastes which can damage the quality of the environment.

The concept focuses on the use of the environment, use for the satisfaction of human needs. This use should be constrained, given the fact that the resources are limited and secondly by the fact that they have tot be shared by all people, including future generations. Sustainable development includes a fair (re)distribution of wealth, which means that the Environmental Utilisation Space of a certain economic sector, a population (country, city) or individual, is also constrained by equity-concerns.

Basically the Environmental Utilisation Space is an indicator that must help to evaluate human actions, specifically concerning the use of scarse resources and emissions. However it is not strictly an environmental indicator, while at the same time it focusses on the equity of resource-allocations, which means that socio-economic needs of actual and future generations have to be taken in consideration. Furthermore the results can be influenced by other ethical values, for instance the opinions concerning the rights of living beings other than man.

It should be noted that the concepts like carrying capacity or eco-budget are often but not always operationalised in a manner that comes near to the Environmental

Utilisation Space, This confirms the need for such an indicator. The Ecological Footprint is another concept wich focusses attention on the fair distribution of scarse resources. However, while the Ecological Footprint is based on the assumption that different pressures can be aggregated under one denominator – land use- an assumption which can be critisised, the Environmental Utilisation Space is generaly operationaled as a vectorspace whose dimensions represent different material flows (or impactcategories). Aggregation is not really the first concern, although one has to consider the fact for the application of the concept in decision making it might be necessary to weight the different environmental impacts (dimensions).

The Environmental Utilisation Space was introduced in the literature of Sustainable Development by Dutch scientists at the beginning of the nineties. The Western European environmental movement spread it among a broader audience. Generally the calculations are kept relatively simple and are based on a selection of assumptions concerning the pressures nature can stand and some targets considering the equity of resource-distribution.

It is accepted that uncertainties, differences in risk-perception and different viewpoints on equity can alter the results. If these facts are taken into consideration, the result is mostly a calculation of an interval that represents the lower and upper bounds of the estimations of acceptable environmental pressures.

In many cases the interval can be very large. If no indication is given about the probability, possibility or likelyhood that a certain pressure within that interval is more or less acceptable or sustainable, these data can support decisions only to a certain extend. One could say that such an interval would only confirm the fact that the limits are indeed uncertain and that the fairness of distribution depends on many basic assumptions (which demographic projections will be used? Do the rich countries have a historical debt to the poor countries?…).

The researchers involved in this project focus on the uncertainties, differences in preferences and opinions about equity. These concerns however should not result in the frustrating conclusion stating that 'the Environmental Utilisation Space can not be known'. The Environmental Utilisation Space is indeed a product of human perceptions and ethical or political choises. Measuring the Environmental Utilisation Space than means: measuring the perceptions and ethical choises or preferences of the stakeholders. This approach supports the generally accepted idea that sustainable development should be based on decisions made with participation of all stakeholders or there representatives. At the same time the Enviromental Utilisation Space, like other indicators, forces the decisionmaker to make targets explicit, developments measurable and the choises more rational.

2.2 Goals

All aspects adding to the uncertainty when calculating an Environmental Utilisation Space, should be identified and demonstrated: lack of knowledge, differences in riskperception, differences in preferences concerning the satisfaction of needs, different perceptions of equity…An epistemoligical background is needed to facilitate the confrontation with these aspects that complicate the use of this indicator in decision making. An indicator should make sustainability measurable, so a formal (mathemathical) tool is needed to quantify the Environmental Utilistation Space and the uncertainties about it.

Although scientists can support the calculation of the Environmental Utilisation Space with the input of empirical facts (observations, simulations), during calculation many subjective choises have to be made. Basically the assessment of the Environmental Utilisation Space is a risk assessment and an assesment of the equity of resource-distributions.

The aim is to measure the sustainability of material flows (extractions, emissions and distributions among people). Considering all kinds of uncertainties, there is a large international aggreement that sustainability includes the application of the so called precautionary principle. This principle should be operationalised in the calculation of the Environmental Utilisation Space. Accepting this principle does not give a final answer to which risks ar acceptable. It only stresses the need for carefull consideration, and warns us for dangerous technological optimism.

The same goes for equity. Accepting this principle is not enough to know what is fair or not.

What is acceptable are not, what is fair or not, remains a question that should be answered by the stakeholders themselves. It is a matter of political choices.

If the stakeholders are asked to make their choise, at least they should be able to assess the consequences of there opinion. This means that such consultations should be supported with tools that make assessments of choises and there consequences possible, including the many uncertainties that are linked to these assessments. For this project, such a tool was sought for the case of greenhouse gas emissions.

Considering the fact that stakeholders are confronted with uncertainties and the necessity of political choises, the researchers concluded that one must confront the stakeholders with some basic theories about decision making which might help them in tackling these problems. Those theories (epistemology, cognitive sciences) can

indeed help us. They offer concepts like **intersubjectivity, bounded rationality, satisfying solutions**, etc. These abstract concepts at least give a name and definition of the problems we are confronted with and the answers we should look for. It should be noticed that these concepts are often mentioned in the context of **integrated assessment**, especially by those experts that choose for participatory assessment-procedures.

Building on these theoretical epistemoligical considerations, one can look for the best mathematical (formal) concepts to quantify the Environmental Utilisation Space and the uncertainties that make it difficult to assess.

2.3 Targets

In order to support the assessments of material flows by a broad group of participating stakeholders, simple models for the screening of different options (assumptions and political choises) and there consequences are needed.

Fuzzy sets and fuzzy logic should be considered as formal tools to quantify the Environmental Utilisation Space.

Basically one can stick to a simple model to focus on the environmental pressure exerted by material flows, as well as on the distribution of these flows among economic sectors and/or, populations. This model is known as the formula:

Impact = Consumption x Production x Population

Many variants exist (the variables kan have different names), however they all share the general message that the pressure on the environment depends on three factors: the number of people, there (material) wealth and the technology used to create this wealth. Starting with this formula, that can only quantify a state of a certain population or sector at a certain time, a model can be build that focusses on the distribution of the exerted impact among different sectors or groups. Furthermore the same formula can be used to explore future developments. This investigation of the future however should not look for all possible developments (like forecasting models generally do), but should look for the acceptable, wanted and possible developments (backcasting).

Considering the precautionary principle and the fact that subjective ethical or political choises have to be made, one generally assesses the possibility or belief that a certain environmental pressure or material flow is sustainable, and not the probability as is defined in frequentistic statistics. Baysian statistics could be an interesting tool to calculate and quantify the Environmantal Utilisation Space. However the

researchers have selected fuzzy set theory (fuzzy logic) to quantify posibilities. This choise is not a statement against Basian statistics. Fuzzy sets were satisfying, so no other mathematical concepts were tested. One of the basic arguments in support of fuzzy sets is the fact that it immediatly focusses on the fuzzyness of properties like 'sustainable', 'acceptable', 'fair', etcetera. So it points to the core of what indicators actually do: measure the extend to which things satisfy certain properties.

2.4 Developments

The basic ambitions of the research project were largely based on the assumption that the fundamental aspects of this concept were already investigated quite well, so that work could focus to a large extend on the practical application and popularisation of the Environmantal Utilisation Space.

However it became clear that fundamental research was not complete. These findings let to the conclusion that more time had to be invested in this basic research, reducing the resources spend on practical application and popularisation.

3. ACTIVITIES AND RESULTS

3.1 Activities

Year 1: Starting with a screening of the existing literature on the concept itself. It was clear that the Environmental Utilisation Space focusses the attention on the human needs and values, how these needs are satisfied and values are operationalised in terms of material flows and use of natural resources.

Needs, wealth, equity, risk, effectivity, efficiency, scarcity, sufficiency, values, attitude and other relevant items where studied in different scientific contexts (ecological, economic, technological and constructivist research-tradition).

The constructivists view brought the attention on epistemological questions. How do we handle uncertainty and the differences in risk-perception and preferences of the stakeholders?

The relation between man and nature can be described in physical terms (material flows): physical pressures of man on nature and physical effects of nature on man. However the relation between man and nature can be conceived in sociological terms (informationflows): man giving a meaning –functions- to nature and percieving risks. Although the relation is quantified in terms of material flows, it is the latter

(functions appointed by society and riskperceptions) that steers the calculation of the Environmental Utilisation Space.

Year 2: The importance of these aspects was confirmed by a screening of the literature about climate change.

Attention shifted to risk assessment and the precautionary principle, which – in combinantion with the problem of equity - let to the conclusion that a calculation of the Environmental Utilisation Space is in fact the calculation of some possibility-distribution, which quantifies the sustainability of material flows. These possibility-distributions could take the form of fuzzy sets.

Year 3: The fuzzy sets have to be the result of a participatory proces (co-design), which allows different stakeholders (or there representatives) to feed in there opinions, perceptions and preferences.

In a practical sense the researchers focus on the development of a practical frame that could facilitate the consultations of the stakeholders. This frame should garantee that all relevant aspects are highlighted, while participants must be able to translate there opinions in a way that is quantifiable. Some basic facilitating tools were developed. Concerning climate change (greenhousegasemissions) backcasting proved to be a good support for this participative proces. Backcasting is probably a tool that can be used for the assesment of other problems and material flows related to them.

The study of literature took most of the time, followed by consultation of experts. After year one a report of 300 pages was produced, and experts from different disciplines were invited to read it and give hints for further research.

The experts had no fundamental critique on the content of the report, but often made the right conclusion that in this phase the problems were clearly defined but not really solved.

The research on climate change, risk assessment and the precautionary principle brougt two important tools under attention: fuzzy logic and backcasting.

While for backcasting good basic literature was found quickly (research at the University of Groningen), for fuzzy logic the expertise was available on the University of Ghent. During the last years regular contacts were taken with the mathematicians of Ghent.

However it was clear that the work undertaken was rather unique. Although fuzzy logic has many succesfull practical applications in process control and decision

support in business, its use in the domain of sustainable development is at this moment only rare. One can only build on expertise in other domains.

It was decided that the project should not become a mathematical researchproject, but that it should open the dialogue between mathematicians and researchers in the domain of fuzzy logic.

The final report aims to support this dialogue explaining what brings fuzzy logic and sustainable development together. The Environmental Utilisation Space is probably the ideal concept to demonstrate this fruitfull combination.

It should be mentioned that fuzzy logic is already being applied in risk assessment and life cycle analyses.

The study of literature and the consultations of experts were complemented with confrontations with the broader public, in order to test the way in which our findings should be communicated.

3.2 Results

3.2.1 Intermediate results (working papers and lectures)

April 1998: Lecture seminar DWTC (Indicators for Sustainable Development):
'Environmental Utilisation Space and indicators for Sustainable Development'

July 1998: publication of a report with the results of the study of literature (300 pages)

October 28, 1998: Seminar:
'Environmental Uitilisation Space & Energy Efficiency: a Factor 4?'
With lectures of B. Mazijn and W. De Jonge (see 4.1.5.6 in this paper)

Januari-april, 2000: Cycle of lectures:
'Sustainable Development, Environmantal Utilisation Space and Satisfaction of Needs'. With lectures of W. De Jonge, B. Mazijn and J. Van Assche (see 4.1.5.6 in this paper)

May 2000: Publication of book ' Sustainable Development, a variety of views' (in Dutch) edited by B. Mazijn, with contributions of W. De Jonge, B. Mazijn and J. Van Assche, focussing on the Environmantal Utilisation Space.
(B. Mazijn (ed.), Duurzame Ontwikkeling, meervoudig bekeken, Academia Press, Gent, 2000)

3.2.2 Final results

Final report (target public: decision makers): "Decision making in the Environmental Utilisation Space" (in Dutch), 80 pages

Report and website for educators: "Environmental Utilisation Space and other indicators for Sustainable Development"

November 2000: Workshop with educators: see 4.1.5.6. in this paper

Report and website: The fuzzy logic of sustainability (focussing on methodology of calculating an Environmantal Utilisation Space)

December 2000: Workshop with mathematicians and experts from the domain 'sustainable development'

With contributions of prof. B. De Baets (expert fuzzy logic), prof. E. Kerre (expert fuzzy logic), W. De Jonge. Other contributions were still uncertain at the moment this paper was written.

Workshops and websites have to be considered as a launching platform for propagation and application of the results of the research in decisionmaking and education.

It is difficult to evaluate the impact of the research at this moment. A whole new approach has been developed and as a consequence satisfying mathematical tools were selected to operationalize this approach.

The final result is a methodology that is more complicated, but on the other hand consistent with basic theoretical findings. It is clear that this makes it more difficult to 'sell' to the community. People prefer userfriendly tools. However the researcher think that the method developed is not too complex. Some 'tests' (confrontations with people involved in decisionmaking) have demonstrated that they can indeed learn how it works within one or two hours.

It is clear that decisionmakers and stakeholders should not become mathematicians, but only need to know the basics of the procedures in order to participate in the construction of the Environmental Utilisation Space. It is the dialogue between mathematicians and stakeholders that has to be developed, where the stakeholder must learn what can be calculated and how the results must be interpreted. Which means that they do not have to know in detail how it is calculated.

It took many years before fuzzy logic was accepted as a good instrument to support decisionmaking in business. The problem is always that it is impossible to judge mathematical techniques. One can only judge the way they are used. Statistics is not good or bad, its the application that is sometimes good, sometimes bad.

4. EVALUATION AND PERSPECTIVES

4.1 History and Perpectives

The research on indicators for sustainable development has become a important part of the activities of the centre. Combined with experiences in chain management, life cycle analysis, and recently resource management the research is *focussing more on decision support in general* (ex-post, ex-ante evaluation of policy and early warning).

This does not only include a greater interest in tools from *operations research, simulation or artificial intelligence* like multicriteria evaluation, linear programming, backcasting, expert systems, etc. The fundamental problems with uncertainties, lack of knowledge, differences in human preferences and values brought the attention to epistemological issues.

With the conviction that sustainable development should build upon participatory decisionmaking, the centre focusses more and more on learning organisations and integrated assessment that is based on co-design (with participation of the stakeholders).

The research on the Environmental Utilisation Space and Core Indicator Sets for cities have played a crucial role in this evolution of interests.

As a consequence the centre is building up contacts with specialists is decision support and integrated assessment, in Belgium and abroad.

4.2 Place and meaning of the project for the other activities of the researchers

The results of this project – the methodology developed- can be applied in a situation where the calculation of the Environmental Utilisation Space is the final goal. However this 'space' can be the starting point for further research in the field of resource management. One could consider the space as a discription of the constraints one has to respect when looking for an optimal or satifying allocation of resources. Furthermore it is possible to use the Environmental Utilisation Space as a

performance indicator to estimate the potential of technological innovation. These extensions are now investigated by the centre in a researchproject with the title 'Resource Management in the Environmental Utilisation Space' (funded by the Flemish government).

This project links the use of this concept with Material Flow Analyses. Furthermore the researchprojects try to identify a way to use the Environmental Utilisation Space in integrated assessments that focus not only on the environmental issues, but also on the social and economical aspects of sustainable development. One of the problems of this research is the valorisation of trade offs between and inside social, economic and natural capital.

There is also a more general effect of this project on the research of the centre. *The way in which participation of the stakeholders was operationalised has an impact on all research on Indicators for Sustainable Development.* The focus on epistemological problems and the practical answers found in fuzzy logic have an impact on the way indicators are used (selected, interpreted and used in decisionmaking).

4.3 Evaluation of project

Each calculation of the Environmental Utilisation Space is the result of subjective (political) choises. Some people might not agree with this, stating that the any calculation is largely based on empirical facts. The input of empirical facts is indeed important. However choises have to be made concerning the risks that are acceptable. Furthermore the allocation of scarse resources among people and economic sectors (needs) is also a matter of choises, in which the operationalisation of the equity-principle can lead to many different results.

It is somethimes understood that subjective calculations can not support policy, so one needs objective data. It is dangerous to reduce the debate to the question whether the Environmental Utilisation Space is either subjective or objective. We concluded that *a third kind of knowledge needs more attention. This is the intersubjective construction.* The Environmental Utilisation Space is a manmade construction, based on empirical input, risk assessments (and perceptions), ethical choises (equity) and preferences concerning the satisfaction of needs. 'Intersubjective' means, that the construction can be used collectively and that is is conform to the public opinion. Although subjective, the calculation should be accepted or supported by many stakeholders.

In a more formal sense the researchers found that the mathematical concept 'fuzzy set' could offer a tool for visualiszing this intersubjective construction. The fuzzy set quantifies the possibilities that material flows are less or more sustainable. The construction than is based on measurements of risk-perceptions, the consequences of ethical choises and the preferences of the stakeholders.

This approach is quite new and can have an *impact on the methods used in integrated assessment and resource management. It supports a participatory proces,* which is many times advised, but however difficult to implement when complex problems arise. While many stakeholders can indeed communicate their points of view and interests to policymakers, there role is until now generally marginal when it comes to the operationalisation of indicators and calculation of targets. In most cases different stakeholders set different targets. If a consensus is found it is generally a short term goal, putting long term considerations on the shelf.

With fuzzy logic it might be possible to find a *resolution for the conflicting views* concerning long term goals.

This approach gives a double role to the scientist: first he or she remains an important *contributer of empirical facts* which can or must be used as input for the calculation of the Environmental Utilisation Space. Second he or she can play the role of *facilitator*, guiding the debate in which stakeholders make their choises. This asks for the development of methods that make a representative collection of perceptions and preferences possible. Finally one needs tools to analyse these opinions in order to construct a fuzzy Environmental Utilisation Space.

So far this research project has developed the theoretical frame for this approach, identified a way to operationalise it (fuzzy sets), and made the first basic steps to work out a procedure to consult the stakeholders (supporting the debate with backcastingmodels) . The latter is largely based on a casestudy about climate change (greenhousegas-emissions, consumption of fossil fuels). It is quite possible that certain material flows need adapted procedures, although one might expect that backcasting offers a method that can be applied for many material flows.

4.4 Perspectives

The analyses of the preferences and choises of the stakeholders can be refined. In our opinion that reseach needs support of researchers with a background in mathematicians (experts operations research, fuzzy logic). However the refinement of the mathematical tools should be guided by consultations of the people that use those tools.

On three occasions intermediate results of the research were presented to a wider audience. Generally the audience was confronted only with the theoretical aspects, focussing on uncertainties, subjective choises, etc. This is however only a first step. Theory brings us to the right questions that should be answered. Solving those questions however is another thing. This research has selected specific mathematical tools tot tackle the problem. These techniques are however not simple to communicate to a wide audience, especially when it is assumed that a lecture should not take more dan 30 minutes.

The researchers than changed their strategy and focust on a smaller audiances: actors which could play an important role in the application of a concept like the Environmental Utilisation Space.

First there are the people active in education. One can always confront the broad public with the results of calculations of the Environmental Utilisation Space, hoping that these data will convince them to adapt their livestyle. However, while each calculation can in a sense be criticised, one could shift to the methods developed in this project in order to produce a more general assessment (screening) of the limits that earth imposes on consumption and production.

It might than be appropriate to present the concept in an educational frame that makes it possible for the public to experiment themselves with the different choises that can be made concerning the acceptability of risk, fair distribution of resources, etcetera. This changes their final position. No longer do they have to believe that one or another calculation is correct, or do they have to choose between the views of one or another stakeholder (environmental movement or industry). They can develop a more general and critical view on the possibilities that certain lifestyles are more or less sustainable. At the same time the broad public could learn more about the basic problems known in risk assessment, about uncertanties and the lack of knowledge in general, the precautionary principle, equity etc…

The researchers of this project concluded that professionals in education should be confronted with these opportunities. A seminar is organised (see 5.1.5.6 (5)) and a website is started focussing on the Environmental Utilisation Space, Indicators for Sustainable Development in general, partcipation, decision making and integrated assessment. Instead of producing the final education material concerning the Environmental Utilisation Space, the researchers prefered to launch a proces in the field of education that focusses on the broader knowledge and capacities *people need to develop a critical view on indicators* and there use in decisionmaking.

Secondly, another aspect needs attention. This concerns the *application of mathematical instruments* like fuzzy logic in the domain of sustainable development. The researchers found that in this case it was necesarry to organise a platform where mathematicians can meet professionals and semi-professionals in the domain of sustainable development.

When people from government administrations or stakeholders like industry and environmantal movement are confonted with these instruments, it is clear that this is quite new to them. Mathematics is a discipline from which the practical methods applied in decision making (operations research, simulation, expert ssytems,…) or only known by insiders. Although one must not expect that everyone should learn these techniques, at least those involved in decision making should know what mathematics can do and what it can not do.

Therefore a platform was created to tackle these problems, focussing on the application of fuzzy logic in sustainable development. The ambitions for the future are to organise an international network in this field.

4.5 Evaluation of PODO

PODO made *fundamental (theoretical) research* possible. The research on the Environmental Utilisation Space has shown that this was necessary. If one had asked only for concrete data - calculations of the Environmental Utilisation Space - the outcome would probably have been completely different. In that situation the result would probably have been an implementation of simple procedures, surrounded by proza stating that the results are hypothetical. Such results are already produced abroad and do not need endless repetition.

The fact that PODO made fundamental research possible provided the means to develop a whole new methodology in this field.

On could conclude that the operationalisation of the precautionary principle, equity and participation in decision making is a problem that needs more attention, especially *the translation of the theoretical considerations, into practical methods for decision making* is not yet fully developed. There exists pioneering casestudies in this field, but the Centre of Sustainable Development has the impression that until now only few people are aware of them and that the application and testing of these methods in policy needs more promotion.

On the other hand concrete data (calculations) are also needed and the researchers do hope to find the resources to apply their methods in order to produce those data.

It is clear that the production of complex indicators like the Environmental Utilisation Space and there calculation, using input from different stakeholders, askes for mathematical expertise.

The method developed so far can be refined, although this does not mean that one has to wait for these refinements, in order to make calculations. The method that is developed now can be used as a basis to compare whith more refined methods.

For the future it might be important to *promote cooperations between mathematicians and experts in the domain of sustainable development.* The researchers found that the mathematicians have a lot of interesting tools which can support decisionmaking, especially when it is the ambition to organise an participatory integrated assessment of sustainable development.

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INDICATORS FOR SUSTAINABLE DEVELOPMENT IN THE BELGIAN INDUSTRY

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1. GOALS

This paper summarizes our work concerning the measurement and reporting of environmental performance of the Belgian industry, the food-processing industry in particular.

Although focusing primarily on environmental performance measurement and reporting, this paper recognizes that some researchers are also addressing measurement and reporting of the broader dimensions of sustainable development, in a few cases even trying to integrate reporting on the environmental, social and economic aspects of industrial performance.

In the past relatively little attention was directed to examining the indicators that industrial firms use to measure environmental performance. Our initial goal was to identify a set of environmental performance indicators that would find broad utility across industries, improving their ability to assess environmental performance, and assist in the setting of both national and industrial environmental goals. However, in an attempt to provide more in-depth analysis rather than a general investigation, we decided to concentrate our efforts on just one (broad) industrial sector, the food-processing industry, and on one particular sector within that industry, namely breweries.

The specific goals of our study were:

- To examine existing experience in measuring progress in environmental performance;
- To identify factors that will improve industrial environmental performance;
- To assess the shortcomings of existing methods of measuring industrial environmental performance;
- To recommend a set of industrial environmental performance indicators.

Our study aimed to be an *industry-centered* analysis, focusing on a set of key areas of performance.

2. ACTIVITIES

The project consisted of 3 phases.

2.1 Phase 1: Analysis of the environmental pressures caused by the Belgian industry and the formulation of "Status indicators"

It was decided to concentrate on a thorough case study of one sector of the Belgian industry, namely 'breweries'. A detailed sector study was carried out, with a focus on:

- delimiting the sector and defining its relationships with other sectors;
- defining the products, its applications and its physical, chemical and environmental characteristics;
- describing the strategies and trends in demand and production, foreign trade, market structure, investements and employment;
- describing production processes (technologies), inputs (consumption of raw materials, water and energy) and unwanted outputs (waste, emisssions to air and water, noise, …).

Each step in the process was regarded as a 'black box'. In that way, the inputs and outputs could clearly be identified for each part of the process. This simplified the task of evaluating the environmental pressures caused by each step in the process, and thus of creating the so-called 'status indicators' at that level.

The necessary data were collected from existing databases, literature, federations and individual firms. An extensive survey was carried out.

2.2 Phase 2: Formulation of "Response indicators"

After having divided the production processes of the brewery sector into several important process steps, environmental pressures and possible meausures to eliminate or decrease these pressures were formulated. The most problematic process steps were identified and further investigated.

This led to the formulation of so-called 'response indicators'. Most attention was given to measures related to pollution prevention. The detailed study of the process steps revealed all the important variables and parameters determining the environmental pressures exerted by breweries. Re-adjusting these variables and

parameters could possibly lead to serious reductions of inputs (raw materials, water, energy), and unwanted outputs (solid waste, emissions to air and water, energy waste, ..). Measures concerning re-use, recycling and disposal (incineration, deposits), were also takken into account.

The response indicators were divided in measures representing a reference state of low effort (i.e. simple and short-term options) and a reference state of maximum effort (i.e. long-term options for process and product innovation).

An attempt was made to extend the results of the case study to the whole food-processing sector of the Belgian industry.

2.3 Phase 3: Evolution of progress towards sustainable development

The federal authorities could use the developed indicators as a tool to measure the environmental pressures caused by the breweries or other sectors in the food-processing industry, and the progress made by that particular sector towards sustainable development.

3. RESULTS

3.1 Profile of the Belgian breweries

At present there are some 112 breweries in Belgium (down from 3.223 in 1990). Their total production output in the year 2000 amounted to 14.733.779 hl per year. Production has remained steady since 1980. The decline in domestic consumption has been adequately offset by exports, which have more than doubled since 1960. Belgian beer exports currently account for more than 37 % of total production.

3.2 A description of the brewing process

The brewing proces consists of the following process steps or ‘unit operations’:

- Malting. Barley is steeped in water for two days, then transferred to large shallow boxes where it is allowed to germinate or sprout. As the barley begins to grow, biochemical changes occur within the grains and enzymes are formed and activated. Once sufficient enzyme levels are attained, the sprouted barley, now called malt, is kilned. By changing the temperature and humidity levels in the kiln, the flavor and color of the malt can be specified;

- The mill. Malted barley and other specialty malts are lightly crushed in a roller mill, keeping the husk mostly intact, but exposing the starchy endosperm;

- The grist case. The crushed malt, now called grist, is moved by conveyors to the grist case, where each batch is weighed out;

- The hot liquor tank. Hot water from the hot liquor tank is mixed with the grist in the steel's masher, a blending device located between the grist case and mash/lauter tun;

- The mash / lauter tun. The roughly mixed grist and hot water, now called mash, are thoroughly mixed in the mash/lauter tun, and allowed to rest for 90 minutes. During this time, naturally occurring enzymes from the grain become activated and convert the grain's starch into fermentable and non-fermentable sugars. This process is called conversion. After conversion is complete, lautering begins, or run-off to the kettle. More hot water is sprayed on top of the mash, to rinse the grain and extract all of the sweet liquid called wort;

- The brew kettle. Once the brew kettle is full of sweet wort, boiling begins. Hops are added at different times during the boil, to impart bitterness, character, and aroma;

- The whirlpool. After boiling for 90 minutes, the hopped wort is sent to the whirlpool, which clarifies the wort by settling out the hops and the trub (proteins which coagulate during the boil;

- The hop back. From the whirlpool, the wort is strained through more fresh hops, in the hop back. This gives the beers a fine fresh hop nose (aroma);

- The heat exchanger. The wort passes through a heat exchanger, to bring its temperature down from 200+°F to 70°F in a matter of seconds. After the wort is cooled, yeast is added to it, on its way to the fermenter;

- The fermenter. In the fermenter, the yeast metabolizes the fermentable sugars, producing ethanol (the alcohol) and carbon dioxide (the bubbles). The fermentation and maturation process takes about two weeks;

- The filter. After fermentation, the beer is filtered through several layers of diatomaceous earth, to remove any remaining trub, hops, and yeast, or filtration is accomplished with a D.E. filter, which clarifies the beer by passing it over microscopic siliceous particles;

- The bright beer tanks. In the bright beer tanks, the correct CO_2 level is reached and the beer is allowed to condition until packaging;

- Packaging. The beer is packaged in any one of a number of containers, including 12-ounce bottles, 64-ounce growlers, and kegs (in 5, 7.5, and 15.5 gallon sizes) to provide maximum flexibility for the customer.

Once the process steps had been identified and described, relevant information was gathered, more in particular on water usage, wastewater output and waste production and recovery. The volume and composition of discharges can vary considerably with the type of beer produced.

3.3 Key status indicators for the breweries and the food-processing industry in general

- Raw Materials. For the most part, breweries or food-processing facilities in general, are located close to their agricultural source. In the food-processing industries, one chief raw material usually makes up the largest percentage of the final food product's composition. The beverages industry, including breweries, are a notable exception to this rule;

- Water. Traditionally, breweries are large users of water. In the food-processing industries water is mostly used as an ingredient, but also as an initial and intermediate cleaning source, an efficient transportation conveyor of raw materials, and a principal agent used in sanitizing plant machinery and areas. Although water use will always be a part of breweries, it is a principal target for pollution prevention and source reduction practices. The main areas of potential reduction being considered by the entire food-processing industry are water used in conveying materials, plant cleanup, or other noningredient uses;

- Energy Use. Compared to other industries, such as the pulp and paper industry, the food processing industries are not considered particularly energy-intensive. Facilities usually require electrical power, supplied by local utilities, to run the machinery. Fossil fuel use is relatively low. In most cases natural gas is used to operate the boilers. Breweries however are an exception to this rule;

- Air Emissions. Air emissions are not a major concern for the food-processing industry, with the exception of breweries. Most operations typically utilize electric power and rarely emit harmful compounds to the environment during normal production operations. Air emissions from biological treatment processes have

become an area of concern, but a relatively minor one compared to wastewater issues;

- Wastewater. Primary issues of concern are biochemical oxygen demand (BOD), total suspended solids (TSS), and excessive nutrient loading, namely nitrogen and phosphorus compounds. The wastewater of breweries can be characterized as nontoxic, because it contains few hazardous and persistent compounds, with the possible exception of some toxic cleaning products. The wastewater of the fermentation processes is high in BOD. The overall wastewater volume of breweries is high compared to other food-processing sectors;

- Solid Waste. Primary issues of concern include both organic and packaging waste. Organic waste results from processing operations, i.e. spent grains and materials used in the fermentation process. Inorganic waste typically includes excessive packaging items, that is, plastic, glass, and metal. Organic wastes are finding ever-increasing markets for resale, and companies are slowly switching to more biodegradable and recyclable products for packaging. Excessive packaging has been reduced and recyclable products such as aluminum, glass, and high density polyethylene (HDPE) are being used where applicable.

The following list suggests a number of input-ouput environmental data of all Belgian breweries, to be used as status indicators for this particular industrial sector. The environmental issues of most importance to the breweries have been considered in two broad categories:

- Process inputs (resource consumption / conservation);

- Process outputs (principally solid waste, water pollution and air pollution)

Table 1: status indicators of inputs and (wanted) outputs for the breweries

Indicator	Total value: unit	Specific value: unit
Raw materials		
Barley	t/a	kg/hl
Malt	t/a	kg/hl
Raw fruit	t/a	kg/hl
Hop	t/a	kg/hl
Water		
Fresh water	mio m³/a	m³/hl
Process water	mio m³/a	m³/hl
Containers, packages		
	t/a	kg/hl
Energy		
Heat	GWh/a	kWh/hl
Electricity	GWh/a	kWh/hl
Finished product to be sold		
Malt	t/a	
Beer	hl/a	

Table 2: status indicators of unwanted outputs for the breweries

Indicator	Total value: unit	Specific value: unit
Recoverable materials		
Draff	t/a	kg/hl
Dry draff	t/a	kg/hl
Malt culms / powder	t/a	kg/hl
Spent grains	t/a	kg/hl
Bottom yeast	t/a	kg/hl
Recoverable wastes		
Cardboard	t/a	kg/hl
Waste paper	t/a	kg/hl
Waste labels	t/a	kg/hl
Pallets	t/a	kg/hl
Waste glass	t/a	kg/hl
Waste cases	t/a	kg/hl
Waste cans	t/a	kg/hl
Waste metals	t/a	kg/hl
Waste crown caps	t/a	kg/hl
Waste plastics	t/a	kg/hl
Kieselguhr	t/a	kg/hl
Others	t/a	kg/hl

Solid waste produced		
Hazardous wastes	t/a	kg/hl
Garbage	t/a	kg/hl
Other (filtration residue,…)	t/a	kg/hl
Waste water		
Volume	mio m^3/a	m^3/hl
COD	t/a	kg/hl
BOD	t/a	kg/hl
NH_4-N	t/a	kg/hl
tot-P	t/a	kg/hl
Atmospheric emissions		
CO_2-emissions	kton/a	kg/hl
SO_2-emissions	ton/a	kg/hl
NO_x-emissions	ton/a	kg/hl
Noise		

Noise originates from the filling plants, trucks en dust exhaust fans in the maling-house. Data are seldomly available.

It would be desirable to fully develop these indicators of industry performance regarding the key issues within each of these categories. Unfortunately, there is an insurmountable scarcity of information about the environmental performance of the breweries upon which these indicators must be based.

4. RESPONSE INDICATORS

4.1 Clean technology developments

Wastewater generation is the breweries' or most other food-processing firms' biggest area of concern. Therefore, most research on clean technologies focuses on the source reduction, recycling, reuse, and treatment of wastewater. Clean technologies are defined as "manufacturing processes or product technologies that reduce pollution or waste, energy use, or material use in comparison to the technologies that they replace."

Common source reduction methods employed at most breweries or other food processors include:

- improving good housekeeping practices A number of simple cost-effective means of achieving source reduction include installing automatic shut-off valves, using low-flow or air-injected faucets / spray cleaners, safety mechanisms to prevent overfilling, etc.;

- making process modifications. Process automation allows the user to improve efficiency, control the process of raw material inputs, and control the amount of wastes generated. Sensors can be used to control process temperature, humidity, pH, flow rates, and contamination levels. Automation reduces the chance of human error in manufacturing processes, it improves speed and accuracy in measuring process variables, and it reduces labor costs. Progressive automatization however can lead to rising consumption of electric energy;

- substituting more environmentally friendly raw materials. Examples include the use of biodegradable cleaning agents, or of peroxyacids instead of chlorine-containing cleaning agents and disinfectants, to avoid generation of hazardous chlorinated substances;

- segregating waste streams. Pretreatment opportunities look to minimize the loss of raw materials to the food-processing waste streams. This so-called "zero-discharge strategy" requires large capital expenditures and customized treatment solutions, which are difficult to find "off-the-shelf" because of the uniqueness of the various food-processing operations. The "zero emissions" strategy on the other hand relies on a network of companies utilizing each other's waste streams. This strategy is an economically more efficient system, because it does not require the waste products to be fully treated. Although effluent quantities are

decreased, material mass balances still dictate that process residuals such as sludges will require management and possibly off-site disposal.

4.2 Advanced wastewater treatment practices

Advanced wastewater treatment is defined as any treatment beyond biological (or secondary) treatment. These treatment practices are employed to target specific discharge constituents that are of concern. Typically, suspended or dissolved solids, nitrogen, and phosphorus are removed in advanced wastewater treatment.

Some technologies being used in advanced treatment of food-processing wastewater are:

- Membrane applications. Membrane applications focus on separating water from contaminants, using semipermeable membranes and applied pressure differentials. Microfiltration, ultrafiltration (UF), and reverse osmosis (RO) are the current membrane systems used commercially. The filtering capabilities of each, i.e. the ability to filter based on contaminant particle size, decreases respectively. Membrane applications can be less energy intensive than evaporation and distillation operations, and thay take up less space. Membrane technology does not produce a sludge disposal problem (unlike chemical precipitation), but it does produce a concentrated brine solution;

- Ozonation and UV disinfection. Chlorination to disinfect wastewater is being heavily criticized due to chlorination byproducts and toxicity concerns that residual chlorine pose to aquatic life. Ozone disinfection and UV disinfection are the two principal means of disinfecting wastewater without using chlorination. Ozonation leaves no residual in the treated wastewater, and it does not produce the same amount of disinfection byproducts that chlorination produces. UV disinfection is even more environmentally friendly, but requires more space and cleaner wastewater to be effective. Both technologies require high capital and operating costs;

- Charge seperation. Charge separation involves separating uncharged water molecules and charged contaminants, such as nitrogen compounds, and phosphates (i.e. NH_4^+, NO_2^-, NO_3^-, and PO_4^{-3}). Ion exchange is widely used to filter wastewater through cationic and anionic resins to remove the wastewater's charged ions of concern. Ion exchange replaces the waste particles with a donor ion from the resin. Ion exchange does not produce a chemical sludge, it protects the water quality of the receiving waters, and it decreases the nutrient-loading problems that cause eutrophication in receiving waters;

- Other technologies. Other separation practices include using centrifugal and gravity mechanisms to separate and remove contaminants from a wastewater. Problems with these methods include capital costs to modify current treatment processes, and increased operational energy costs;

4.3 Improved packaging

Food-processing manufacturers have to re-evaluate their use of packaging, because excessive packaging has contributed to an overabundance of solid waste, and a fast-growing dilemma of what to do with it.

Packaging changes at breweries or other food manufacturers include:

- the use of plastic liners in corrugated boxes;
- the use of high density polyethylene (HDPE) plastic totes;
- the substitution of foam food-packaging containers for ones made from materials free of chlorofluorocarbons;
- the use of recyclable products such as aluminum, glass, and HDPE where applicable.

Benefits of changing packaging are:

- decreasing costs in some cases (but in most cases the cost is the same or even slightly higher);
- improving the public relations image and gaining an advantage over the competition, throught advertising packaging as more environmentally friendly;
- decreasing the ultimate solid waste disposal and associated costs (‘disposal charges’).

4.4 Reduction of energy consumption

The recycling of heat through heat exchangers should be achieved. Further possibilities to regain energy (e.g. generation of biogas by anaerobic treatment of highly polluted waste waters or sludges) should be evaluated.

4.5 Reduction of emissions into the atmosphere

To reduce the emissions of substances into the air the following measures can to be taken into account:

- capsulation of devices and installations;
- appropriate storage of substances;
- desucking of waste gas;
- purification of waste gas.

5. RECOMMENDATIONS

To enhance the development and use of industrial environmental indicators, the federal authorities should take the following actions:

- establish *quantitative* goals, both at the national and at the firm level, and strenghten the role of the federal authorities in setting and reporting progress toward attaining these national environmental goals;
- develop improved methods of ranking, categorizing and prioritizing the relative impact of industrial environmental loads. This requires moving from the measurement of environmental *loads* (resource use, water emissions, air emissions, …) to the measurement of environmental *impacts* (human health impacts, ecosystem impacts, …);
- establish consistent, standardized industrial environmental performance indicators, allowing for benchmarking across industries, and promoting these standardized indicators in international forums;
- promote the development and use of industrial environmental performance indicators, and transfer knowledge on best practices in industrial environmental performance measurement across industries and sectors, particularly to small and medium-sized enterprises;
- conduct research on methods of integrating socioeconomic criteria into sustainability measures, and on furthering the understanding of the implications of long-term industrial activity on the environment, including issues such as materials flow and energy use.

Industrial indicators for sustainable development can provide a tool for influencing the decision making, both at the government and at the manufacturer level.

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LEGAL ASPECTS OF THE CHOICE OF ENVIRONMENTAL POLICY INSTRUMENTS FROM THE POINT OF VIEW OF BELGIAN, EUROPEAN AND INTERNATIONAL LAW

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1. INTRODUCTION

Current executive summary is the result of the research project “Legal aspects of the choice of environmental policy instruments from the point of view of Belgian, European, and international law”. The project is part of the federal ‘Plan voor Wetenschappelijke ondersteuning van een Beleid Gericht op Duurzame ontwikkeling,’ in particular the programme ‘Hefbomen voor een Beleid Gericht op Duurzame Ontwikkeling.’ It aims to provide for an analysis of the legal framework within which the Belgian federal and regional governments have to pursue their environmental policy.

2. AIMS AND METHODOLOGY

The Belgian federal and regional authorities in principle have a wide variety of environmental policy instruments at their disposal to tackle environmental issues. Their choice for a particular instrument is however subject to constraints imposed upon them by virtue of legal straightjackets, over and above any limitations they may have by reason of considerations of economic policy. This straightjacket may find its origin in Belgian, European, and/or international law. Constraints arise both in a positive and in a negative sense. In a negative sense, in that the use of a given instrument may be prohibited by any of the aforementioned legal orders. In a positive sense, *i.e.* these legal orders prescribing the use of a particular instrument. Current project aims to describe the room for manoeuvre left to authorities within the context of the legal preconditions.

By virtue of the doctrine of direct effect, by which European law in particular may penetrate directly into the Belgian legal order, as well as in view of the fact that international law may require the European and/or the Belgian legislator to implement international obligations without further ado, the distinction between these three layers of legal obligations may be somewhat artificial. Nevertheless, the distinction between these three legal orders has been maintained throughout this research, for didactical reasons mostly. Indeed in line with the authors’ assignment, the study employs the methodological tool of distinguishing between policy instruments. Theirs was a logical choice, in that authorities themselves take policy instruments as a starting point, reviewing any legal constraints only at a later stage.

3. TAXONOMY OF ENVIRONMENTAL POLICY INSTRUMENTS

3.1 Generally

Environmental policy instruments are divided into (1) social regulation; (2) planning; (3) financial support; (4) direct regulation; and (5) market-based instruments.

3.2 Instruments of social regulation

Instruments of social regulation aim to internalise environmental awareness and responsibility into the personal decision-making process of individuals and undertakings. This may take place either by (1) information exchange (campaigns, education, labels, impact assessment, reporting); (2) self-regulation (voluntary agreements, self-assessment); and (3) environmental management systems (including an environmental audit).

3.3 Instruments of planning

These aim to offer an overview of current environmental issues; the means to remedy any degradation; and the budgetary constraints involved. They can be distinguished along the following parameters: micro- [at the undertaking's level, e.g. via eco-management systems] and macro planning [at the various regulatory levels, from local to international]; non-binding [this is the standard form] and binding [these are the exceptions]; and sectoral [targeting a specific environmental agent] and non-sectoral [encompassing a wider range of issues].

3.4 Instruments of financial support

This encompasses subsidies, soft loans, and fiscal incentives. The former two speak for themselves, whilst the latter is somewhat more complex, including e.g. incentives to encourage investments in environmentally friendly technology (e.g. via accelerated depreciation, and greater possibilities to set investments off against tax), measures to reduce the cost of environmentally friendly products or activities, and income tax reductions for those investing in environmentally advantageous stocks.

3.5 Instruments of direct regulation

Classic 'command and control' aims to influence the behaviour of polluters in a direct fashion, by regulating and/or prohibiting polluting activities. One can distinguish in

this group between permits (prescribing the use of certain technology, containing emission limits, etc.), prohibitions and limitations, and quality control (including imission limits, requirements for the design of technology, production processes and-methods, etc).

3.6 Market-based instruments

These aim to influence the cost/benefit analysis of the economically active individuals and undertakings, with a view to encouraging them to opt for environmentally friendly choices. In other words, environmentally less interesting alternatives, are not prohibited, but carry a price. Amongst marked-based instruments, one can distinguish between implementation incentives (such as administrative fines, and financial securities), the regulation of liability (either criminal and/or civil liability), deposit-return schemes (entailing a surcharge on environmentally unfriendly goods), tradable permits (creating a market in emissions deemed unfriendly), and environmental levies (imposing a fiscal charge on the environmental pressure caused by the individual or the organisation).

4. LEGAL ASPECTS OF THE CHOICE OF ENVIRONMENTAL POLICY INSTRUMENTS FROM THE POINT OF VIEW OF BELGIAN, EUROPEAN, AND INTERNATIONAL LAW

4.1 Generally

The summary below is not exhaustive. It regroups the most important findings of the study with respect to each instrument.

4.2 Instruments of social regulation

4.2.1 'Green' claims in advertising

In view of the impact of advertising on consumption patterns, all three legal orders reviewed now include varying degrees of regulation for green claims in advertising. Two scenarios may be distinguished. In a first category of cases, advertising is employed to emphasise the alleged environmentally friendly qualities of the product. Misleading advertising would have both an economic (cheating the consumer in his legitimate expectations) and an environmental impact (potentially leading to increased consumption of environmentally unfriendly products). In a second category, environmentally unfriendly products are advertised. The economic impact

of this type of advertising is less direct. The most important issue in this category is precisely the environmental impact. Externalities in both cases may be addressed by the authorities, by prohibitions of certain types of advertising, as well as by restrictions. Such measures obviously may have an impact on trade. At the international level, this brings the rules of the World Trade Organisation, in particular of the General Agreement on Tariffs and Trade (1994) into play. The European Community has generally harmonised in this area by way of Directives 84/450 and 97/55 (on misleading advertising). Product-specific regulation (in particular for hazardous substances and preparations) includes specific provisions (Directives 67/548, 88/379, 98/8 and 1999/45). Secondary Community law does not regulate straightforward advertising prohibitions. The introduction of such prohibitions by a Member State consequently has to be assessed vis-à-vis the Treaty Articles on the free movement of goods and services. At the Belgian level, one first has to review the division of powers with respect to advertising. Regulating advertising primarily rests with the federal level (Article 6 §1, VI, *in fine*, 4° of the Special Act of 8 August 1980, hereinafter 'Special Act'), a power exercised in the Act of 14 July 1991 on commercial practices and the protection of the consumer (Articles 23, 28 and 29) as well as in product-specific legislation (biocides, pesticides, and hazardous substances in particular).

4.2.2 Labelling

Any label aims to inform the consumer of all data necessary to use the product sensibly. In this sense, the 'label' full stop differs from eco-labels (see below), which aim to provide the consumer with data so as to influence his decision at the point of sale. Labels in general aim to protect the health of consumers, as well as the environment. In particular the existence of diverging labelling requirements, has an impact on free trade, thus leading to constraints on their use. At the international level, this brings the rules of the World Trade Organisation, in particular of the General Agreement on Tariffs and Trade (1994) into play. The EC has harmonised extensively in this area, in particular with respect to hazardous substances and preparations, as well as for biocides, and pesticides, considerably reigning in Member States' room for manoeuvre. Member States are principally not in a position to disallow the marketing of a product which meets the minimum standards of these directives (notwithstanding temporary safeguards) At the Belgian level, powers lay overwhelmingly with the federal authorities (through the areas of ecological standardisation and consumer protection in particular). Consequently the Regions have no room at all to regulate the environment through product labelling.

4.2.3 Eco-labels

Eco-labels have the specific intention to inform consumers of the environmental qualities of a product. The specific risk in this instance is for consumers to become misinformed through a wide variety of labels. Moreover, from an economic law point of view, labels may act as a *de facto* barrier to trade, if and to the extent that the criteria for a product to be awarded the label, are tailor-made for domestic produce. At the international level, this brings the rules of the World Trade Organisation, in particular of the General Agreement on Tariffs and Trade (1994) into play. At the European level, Regulation 1980/2000 (replacing a previous regulation, specifies the development of the EC-wide eco-label, whilst leaving national eco-labels unchallenged. Purely within the Belgian context, the eco-label is a federal issue, with a limited contentious issue as to the need to involve the regions in the development of the label. However, whilst the legal base exists for Belgium to introduce such label, this has no happened in practice.

4.2.4 Environmental impact assessment

An environmental impact assessment report is a means for the authorities to review the environmental impact of a planned project. At the international level, the 1991 Espoo Convention on Environmental Impact Assessment in a Transboundary Context, extends partially into the EC Directive 85/337. The Directive deals with both purely internal (in the Member States) assessment, as well as with Tran boundary issues. Moreover, Directive 2001/42 now provide for an impact assessment of plans and programmes which form the framework for future projects. Within Belgium, the competence for environmental impact assessment runs parallel with the overall environmental competences, thus leaving the bulk of this with the Regions. This is however less clear for the impact assessment of plans and programmes.

4.2.5 Safety reports

The dioxin disaster in Seveso served as a catalyst for international action on preventive action with respect to dangerous activities. The 1992 Helsinki Convention on the Transboundary effects of industrial accidents was entered into y the EC but not by Belgium. It only applies to industrial accidents with a Transboundary dimension. The relevant EC legislation has a wider field of application. Directive 96/82 focuses overwhelmingly on incidents which do no have a Transboundary character. The Directive includes reporting and notification duties, as well as emergency planning. It also looks into the relationship between town planning and the containment of accidents. The implementation of this Directive in Belgium is hugely complicated, given the country's complicated constitutional structure, and

touching simultaneously upon environmental issues (a regional competence), labour protection and general protection of the population. This has triggered the need for a co-operation agreement (1999).

4.2.6 Voluntary agreements

A voluntary agreement is generally an agreement between the authorities and one or more (organisations of) undertakings where the latter commit themselves to realise a given aim with the means which they themselves select. The authorities commit themselves not to introduce stricter legislation during the validity of the agreement. At the international level, this brings the rules of the World Trade Organisation, in particular of the General Agreement on Tariffs and Trade (1994) into play. At the EC level, the Commission has adopted a Communication in 1996, which generally reveals not much enthusiasm for the instrument at the EC level. As for the compatibility of these agreements at the national level with Community law, there are a number of pitfalls, including in particular Articles 81-82 EC, as well as the Treaty Articles on the free movement of goods. It is also noteworthy that Member States cannot employ voluntary agreements for the implementation of Community Directives, to the extent that these grant rights and obligations to individuals. In the Flemish Region, the 1994 Decree on environmental agreements lays down an extensive set of rules with respect to these agreements, as does a federal Act of 1998 (relevant for those sectoral agreements which include product standards).

4.2.7 Environmental management systems

Environmental management systems aim to organise the undertaking in such a way as to minimise the impact of its activities on the environment. At the international level, this brings the rules of the World Trade Organisation, in particular of the General Agreement on Tariffs and Trade (1994) into play. The EC has introduced specific rules, most recently through Regulation 761/2001 (Eco-Management and – Audit Scheme, EMAS II), and implementing legislation. The regime is voluntary (albeit that Member States may opt to make the system mandatory, which they have so far failed to do). As for the development of a *national* standard, it is noteworthy that the Member States have lost their powers to develop their own national system, given that they have recognised both the international equivalent (the ISO 14000 series), and the European regime (EMAS). Any national eco-management regimes have to be retracted. Nevertheless, the Regulation does include some provisions which need implementation. These concern in particular some details of the implementation measures. For some of these implementing measures, the Belgian

Regions have competence. For others, it is the federal State which needs to co-operate with the Regional authorities.

4.3 Instruments of planning

Environmental planning is essentially a structural policy instrument which leads to relatively little legal controversy. At the international level, this brings the rules of the World Trade Organisation, in particular of the General Agreement on Tariffs and Trade (1994) into play. The European Community puts structure into its environmental policy planning essentially via its Environmental Action Programmes (EAPs): these summarise the environmental challenges of the Union and outline the aims and priorities for the future. MAP 6 relates to the period 2001-2010 and focuses on four priority areas: (1) climate change; (2) nature and biodiversity, (3) environment and health, and (4) sustainable use of natural resources and waste. Other than these areas, much emphasis is also laid on obliging Member States to issue plans for a variety of sectors (waste, water, air…). Within the Belgian context, environmental planning does not seem to create substantial issues of division of powers. Indeed in principle, each authority is entitled to plan any measures which it can take within its respective sphere of competence. Each of the three Belgian Regions has its legislative framework for planning measures. At the federal level, mention should be made of the Act of 5 May 1997 concerning the co-ordination of the federal policies on sustainable development.

4.4 Instruments of financial support

Granting financial support to environmentally friendly investments is subject to a number of conditions which aim to prevent competition from being disturbed. At the international level, both the SCM Agreement (the WTO Agreement on Subsidies and Countervailing Measures) and the Agreement on liberalising trade in agricultural products, provide for a relatively wide flexibility for Members to grant environmental subsidies to their industries. Obviously, for the Belgian context, the conditions imposed by EC law are of paramount interest. The European Commission has set out its policy in this respect in so-called ‘guidelines’ for the assessment of national environmental subsidies under the relevant Articles of the Treaty. These guidelines allow for both direct (direct transfer of sums from the authorities to the undertaking concerned) and indirect subsidies (tax exemptions and the like). Even if practical applications sometimes pose difficulties of interpretation, the Guidelines nevertheless provide for a very useful means for Member States to predict the compatibility of their proposed scheme with the EC Treaty. In the purely Belgian context, means of support are regarded as being part of the general economic policy, for which the

Regions are in principle the competent authorities. The Regions' general competence for environmental issues, may if needed also serve as a legal ground for intervention.

4.5 Instruments of direct regulation

4.5.1 Permits

The permit has always been a regulatory instrument of high importance, including in the environmental area. There are a number of international treaties, for instance, which either encourage or indeed even oblige States to include permit requirements in their legislation. There is however no general international framework which would deal with the issue of permits in a general fashion. EC environmental policy employs permits as a preferred instrument to control emissions and their consequential polluting effects. Directive 96/61 confirmed the principal role of permits. It provides for Integrated Pollution Prevention (IPPC), thus addressing the disadvantage of having separate permits for various environmental agents. The IPPC Directive leaves no room for manoeuvre to the Member States with respect to the core element of introducing IPPC; obviously, the Directive prescribes the use of a permits for this aim, and details its required content. Importantly, sectoral Directives (such as for water and waste) likewise impose a permit requirement for the specific issue that they regulate. In Belgium, the principal responsibility for permit issues in the environmental arena, lies with the Regions (exception made for ionising radiation, including radioactive waste).

4.5.2 Prohibitions and limitations

The introduction of a prohibition or of limitations to trade, obviously has a serious impact on trade. At the international level, this brings the rules of the World Trade Organisation, in particular of the General Agreement on Tariffs and Trade (1994) into play. At the European level, prohibitions and limitations may either be imposed by European regulation itself, or by unilateral Member States action. In both events, these measures may be subject precisely to WTO scrutiny. Moreover, unilateral action by an individual Member State, is subject to the limitations imposed by the Treaty. To the extent that an issue is 'exhaustively' regulated by the EC, Member States must not resort to any unilateral action – except if this is specifically provided for by the legislation at issue. In those cases where the harmonising legislation is either based on Article 95 EC (the Internal Market Article of the Treaty), or on Article 176 EC (the environmental title), unilateral measures are always possible – even after harmonisation – provided, however, that such measures abide by the limits and

conditions imposed by the Treaty Articles on the free movement of goods. Within the purely Belgian context, measures which have a disproportionate impact on the Belgian Economic and Monetary Union, are disallowed. The concept is similar to the European concept of the same name, and implies a serious limitation to the exercise by the Regions of their environmental powers. Moreover, the Regions' environmental rules must not disproportionately impact on the freedom to exercise a trade.

4.5.3 Quality requirements

A wide variety of means falls under this heading. These include quality standards, process standards, and emission standards and are usually explicitly sanctioned by either international or European legislation. Quality standards as well as process standards are a competence of the Region. As for emission standards, the Regions are competent for production units, and the federal State for products.

4.6 Market-based instruments

4.6.1 Enforcement incentives

With respect to public international law, the issue of criminal enforcement of environmental law has only recently been put on the agenda. Reference can be made in particular to the activities of the Association Internationale de Droit Pénal (A.I.D.P.), more specifically the recommendations of its Rio de Janeiro conference. The Council of Europe likewise has looked into this issue. Reference can be made to the Resolution on the contribution of criminal law to the protection of the environment, which calls upon Members to provide for criminal enforcement of the laws for the protection of water, soil, and air. The 1988 "Convention sur la protection de l'environnement par le droit pénal" essentially obliges Parties to provide for criminal sanctioning of serious environmental infringements. A wide variety of articles moreover deals with issues of a criminal procedure – with respect to some core issues of Parties' criminal law. The Convention also has a pillar which deals with international co-operation in investigating environmental crimes – this is however less developed than the other part of the Convention. As for the other parts of enforcement – administrative enforcement and financial securities – these have as yet not been addressed at the international level. European environmental law has so far not yet focused on either criminal law or financial securities as a means of enforcement of environmental law (albeit that a proposal in that direction is currently making its way though the Institutions). The Treaty does offer the possibility for the Commission to request a monetary charge from those Member States that refrain

from enforcing a judgment of the Court of Justice – including in the environmental area. Indeed the first ever fine granted in this respect was against Greece, for not imposing a judgment on the issue of waste law. In secondary Community law, the choice of instruments for implementing Community environmental law, is usually entirely left to the Member States. As for Belgium, the division of competences with respect to criminal environmental law, has now been refined (following a number of cases in the Court of Arbitration, which dealt with Flemish attempts to develop a true Flemish environmental criminal law. Currently, the competence to require a financial security, is shared by the national and regional authorities.

4.6.2 Liability

The 1993 Council of Europe Convention on civil liability for damage resulting from activities dangerous to the environment (Convention of Lugano) aims to develop a tort rule with respect to damage inflicted on the environment, by dangerous activities. The Convention does however also pay some attention to the prevention and the remediation of damage. It centres upon faultless liability, based upon the polluter pays principle, and additionally provides for a right to access on environmental data. Observers generally take the view that this Convention in fact is unlikely ever to enter into force. The reason for this are not only the far-reaching implications of the Convention, but also the fact that it interferes strongly with regional initiatives to regulate the issues concerned. Reference is made in this respect to the efforts at the European level, to introduce a Community-wide environmental liability regime. Within Belgium, the federal legislator is in principle competent to regulate the issue, albeit with an additional, implied power for the Regions.

4.6.3 Deposit and return schemes

At the international level, the rules of the World Trade Organisation, in particular of the General Agreement on Tariffs and Trade (1994) come into play. There is no secondary legislation in the European Community providing for a harmonised system – thus leaving the area as yet to the Treaty Articles on the free movement of goods in particular. The Belgian division of powers in this area is extremely complex.

4.6.4 Environmental levies

At the international level, the rules of the World Trade Organisation, in particular of the General Agreement on Tariffs and Trade (1994) come into play. At the European level, Member States' room for manoeuvre is limited by Article 90 EC. The room for national environmental taxation in the EC is embedded in a number of articles which are not totally identical to GATT, but nevertheless remarkably similar. Tax

discrimination and -differentiation are a powerful tool to direct trade streams, notably in favour of domestic production. The EC Treaty therefore has introduced Articles 90 *et seq.* EC in order to prevent the re-partitioning of the market, which would be contrary to the principle of the free movement of goods set out in Articles 28 *et seq.* (previously Articles 30 *et seq.*) EC. Disparities between national tax laws may penalise cross-border operations and lead to trade distortions. The EC Treaty aims to remedy this through the harmonisation of the tax laws of the Member States and through eliminating discriminatory indirect taxation of imported goods. Importantly, in its present stage, the view of the Court is, that Community law does not restrict the freedom of each Member State to lay down tax arrangements which differentiate between certain products on the basis of objective criteria, such as the nature of the raw materials used or the production processes employed. Such differentiation is compatible with Community law if it is based on objective criteria, such as the nature of the raw materials used or the production processes employed; and if it pursues economic or social policy objectives which are themselves compatible with the requirements of the Treaty and secondary law, and if the detailed rules are such as to avoid any form of discrimination, direct or indirect, in regard to imports from other Member States or any form of protection of domestic products. A recent application by the Court in the environmental field (the *Outokumpu Oy* case) however would seem to signal less flexibility. Within the purely Belgian context, the division of powers is complicated, with the powers of the Region limited both by procedural concerns, and by the concern to maintain the Belgian economic and monetary union.

5. CONCLUSION

From the executive summary above, it will be clear that a wide array of means indeed is at the disposal of environmental authorities. It should also be noted that the extensive legal environment of these instruments, makes for sometimes rapid legal developments. Extensive analysis of each of the instruments referred to above, is included in the report.

HL/02/003

THE USE OF VOLUNTARY INSTRUMENTS FOR THE REALISATION OF A SUSTAINABLE DEVELOPMENT

SECTION 1: "ENVIRONMENTAL MANAGEMENT SYSTEMS"

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SECTION 2: "ENVIRONMENTAL NEGOTIATED AGREEMENTS"

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SECTION 1: “Environmental management systems”

1. SETTING OF THE RESEARCH PROJECT

The research project of which this synthesis is a research deliverable, is called “The Use of Voluntary Instruments for the Realisation of a Sustainable Development”. The first section of this report is related to the first section of the research project on “Environmental Management Systems”.

The project was commissioned by the *Belgian Federal Services for Scientific, Technological and Cultural Affairs*, which are affiliated to the Ministry of the Belgian Prime Minister. It was executed by the *Center for Environmental Economics and Environmental Management*, which is part of the Faculty of Economics and Business Administration of Ghent University, Belgium, under the supervision of Prof. dr. M. De Clercq and Prof. dr. J.J. Bouma.

2. OBJECTIVES

The research pertains to the following two kinds of voluntary environmental (policy) instruments: *Environmental Management Systems* (Section 1) and *Voluntary Environmental Agreements* (Section 2).
Its general objective is to study the role these approaches can fulfill in the realisation of a *Sustainable Development*.

The main research objective of the first section is to adapt environmental management systems, in such a way that questions and transforms the whole company on aspects of *“Strong” Ecological Sustainability* (see box on the following page), for both SMEs and major companies.

During the course of the project, this objective was further specified into “the identification of generic characteristics of *“corporate processes of environmental management”* (see box on the following page), which are critical to guarantee their effective and substantial contribution to the ecological componentof Sustainable Development: *“Strong” Ecological Sustainability*.

Processes for Environmental Management in companies deal with the strategic design and development, as well as the operational implementation and improvement of systematic corporate initiatives and activities, which aim at reducing environmental impacts and at improving corporate environmental performance.
Strong Ecological Sustainability is the interpretation of the concept of Ecological Sustainability, which rejects (high degrees of) substitutability between ecological capital and other forms of human(-made) capital. In this context, it is contended that both the capacities of internal functionality and resilience of eco-systems, as well as those of reproductivity of natural resources and of assimilation of environmental pollution have instrumental value for human kind, and intrinsic value in themselves.Proponents of Strong Ecological Sustainability adhere to the principle of "constant natural capital": all these eco-system functions should at least remain intact.
This interpretation of Ecological Sustainability is stricter, and has - in comparison with more widely accepted and most often adopted interpretations of Ecological Sustainability - much more pervasive implications for companies and other societal actors, that place a burden on the natural environment.
In section 4 ("Concepten van Duurzame Ontwikkeling en Duurzaamheid") in *Deel 1* (*"Literatuurverslag - Evaluatie van de Strategische Uitgangspunten van Milieubeheer, en Argumentatie van het "Leerinstrument over Sterke Ecologische Duurzaamheid" voor bedrijven"*) of the full research report, a detailed description of the various interpretations of Ecological Sustainability is reported on.

This main objective automatically leads to the following sub-objectives:

- The operationalisation of the concept of Strong Ecological Sustainability for a company or industrial sector.

- Determine how a company can set strategic objectives for Strong Ecological Sustainability, which are meaningful, attainable, sufficiently ambitious and credible.

- Determine the factors within a business organisation and its corporate culture, which limit or enhance its path of development to Strong Ecological Sustainability.

- Design and develop a "measuring tool" to measure and interpret these improvements, so that corporate policies and practices for the purpose of Strong Ecological Sustainability can be made more adequate.

3. ENVIRONMENTAL MANAGEMENT SYSTEMS: SETTING, AND THEIR RELATION TO STRONG ECOLOGICAL SUSTAINABILITY

In section 3 ("Lokale tot Globale Milieuproblematiek") and section 4 ("Concepten van Duurzame Ontwikkeling en Duurzaamheid") from *Deel I* (*"Literatuurverslag - Evaluatie van de Strategische Uitgangspunten van Milieubeheer, en Argumentatie van het "Leerinstrument over Sterke Ecologische Duurzaamheid" voor bedrijven"*) of the full research report, it is shown that a Sustainable Development to great extent requires forms of "Strong Ecologically Sustainable Enterprising". [Roome (2001), p. 4]

During the 80s, it appeared that the business community is one of the main societal actors, which contribute to the systematic qualitative and quantitative degradation of the natural environment and of eco-systems. [cf. United Nations Conference on Environment and Development: "Agenda 21"; World Commission on Environment and Development]

During the first half of the 90s, it increasingly appeared that environmental issues do not only influence companies through more stringent environmental legislation and new environmental technologies. Most corporate functions, -decisions and -activities have considerable bearing on the environmental performance of a company.

As a reaction to these insights, a number of initiatives were developed and implemented to enable companies to systematicly manage the environmental aspects of their business by means of the operational instrument of environmental management systems. In this context, the ISO 14001 Standard and the Environmental Management and Auditing Scheme (EMAS) of the European Commission are not the only, but arguably the most important initiatives, as these are currently most widely implemented in business practice.

Concurrently, environmental management systems - as conceived in these initiatives - are implicitly believed or explicitly claimed to support and enhance the contribution of companies to Strong Ecological Sustainability [cf. International Institute for Sustainable Development; International Standards Organisation (ISO); Fifth Action Programme of the European Union].

Environmental management systems - as intended and implemented in the above initiatives - have a certain potential and represent a first step to enable companies - albeit in a limited way - to contribute to Strong Ecological Sustainability. [Spencer-Cooke (1998), p. 100]
Nevertheless, fundamental differences exist between these forms of environmental management on the one hand, and "Management for Ecological Sustainability"

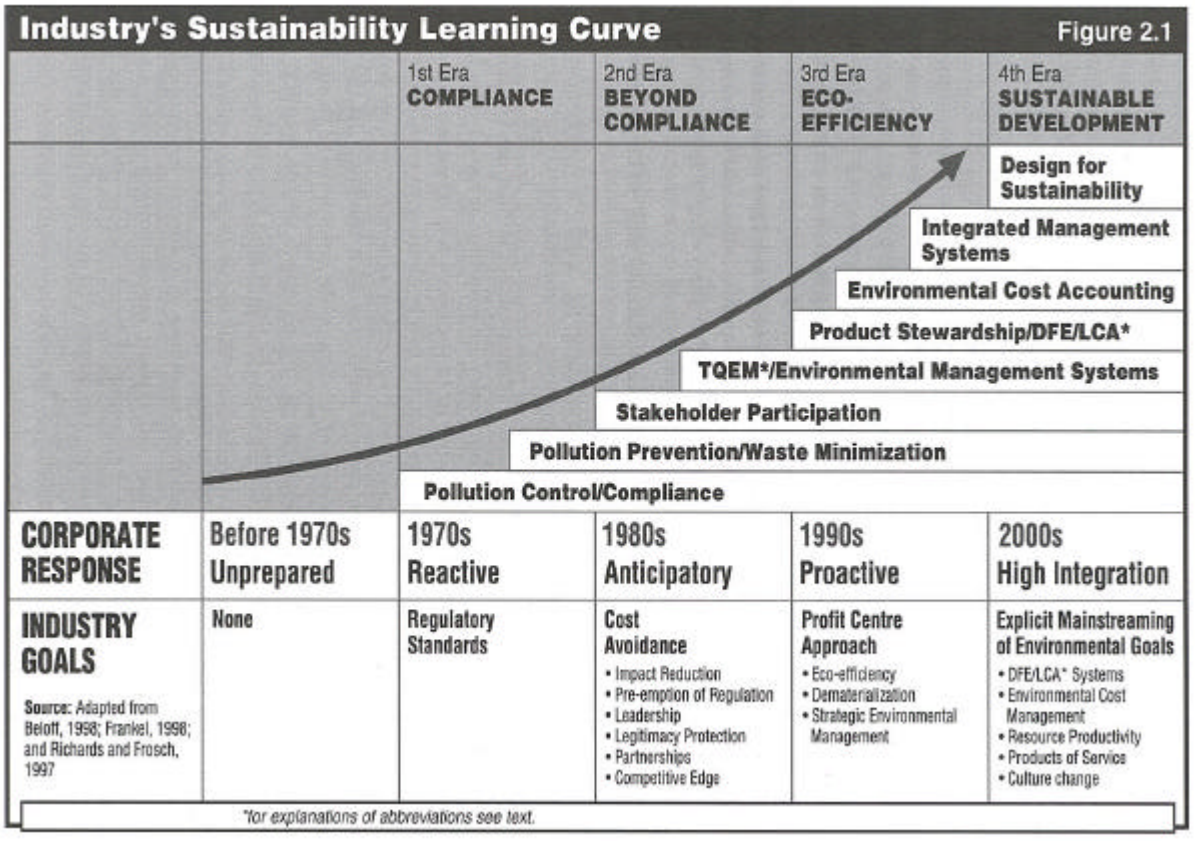
[Fischer and Schot (1998), p. IX] or what the author of this report calls “Management for Strong Ecological Sustainability”. [Sheldon (1997), p. 15-16]

To this end is referred to figure 1. In fact, current environmental management systems originated in the *“Beyond Compliance*-era”, whereas operational management systems for Strong Ecological Sustainability would surface in the *“Sustainable Development*-era” (cf. *“Integrated Management Systems”*).

As a contribution to the societal transformation process to a Sustainable Development, the business community as a whole, as well as individual companies follow a learning curve already for some time, on which successive phases (can be) are gone through.

Figure 1 depicts a limited number of important characteristics, concepts and instruments of these learning phases. [Nattrass and Altomare (1999), p. 16]

Figure 1: The Business World’s and Industry’s Learning Curve to Strong Ecologically Sustainable Enterprising:



Source: Nattrass and Altomare (1999), p. 16

The characteristics of these successive phases or “eras” pertain to concepts, approaches and motivations to increasingly and strategicly integrate environmental concerns and - issues in the (core) functions and -activities of the company. This learning curve does not imply that all corporate initiatives for environmental management already comply with the characteristics of each respective phase.

For example, not all concepts and approaches of environmental management in the *“Eco-Efficiency*-era” are presently applied and implemented by all companies. In that sense (was) is the related time axis only “applicable” to pioneering companies of the respective phases. [Nattrass and Altomare (1999), p. 14-17]

Only two general, but fundamental explanations are put forward here for the difference between present forms of environmental management, and “Management for Strong Ecological Sustainability”.

When the business paradigms [Hoffman and Ehrenfeld (1998), p. 60-62] and points of departure, which are presently almost universally adopted in the development and implementation of environmental management processes, are analysed, a number of fundamental and sometimes interconnected inadequacies in current approaches of environmental management can be identified in light of their contribution and support of Strong Ecological Sustainability.

One of the root causes for this is that essential strategic and conceptual implications of Strong Ecological Sustainability at the corporate level are not reflected in these paradigms. [Hoffman and Ehrenfeld (1998), p. 60-62; Roome (1998), p. 260; Nattrass and Altomare (1999), p. 170]

Except for the omission of several corporate implications, another root cause for the mentioned inadequacies exists: these operational instruments are intended “to manage something we have not even properly defined”. [Spencer-Cooke (1998), p. 99]

For a long time to come one of the most important scientific and corporate practice-related challenges will remain to gain better understanding of how direct and indirect environmental impacts, jointly caused by companies and other societal actors, contribute to local to global states of the natural environment and its eco-systems, which are not “strong” ecologically sustainable.

Therefore, it is contended that current environmental management systems - as operational instruments, which support corporate processes of environmental management - do not fulfill their potential to effectively and substantially contribute to Strong Ecological Sustainability.

This is why it is crucial for companies to go through the strategic self-assessment process, which is depicted in figure 2. This process can be initiated by means of the "Learning Tool", which is contained in deliverable 3 of the full research report (*Deel III: "Leerinstrument over Sterke Ecologische Duurzaamheid" voor bedrijven*).

Figure 2: scheme of the self-assessment process

(1°) strategic evaluation of existing approaches for environmental management

?

(2°) redesign of corporate environmental strategy

?

(3°) redevelopment of environmental processes and of the operational tool of environmental management systems

?

(4°) periodic feedback loop to (1), and again going through the evaluation process

On the other hand, the "territory" between environmental management and Strong Ecological Sustainability does represent one of the key areas for scientific research and for corporate practice, where the basics of an ecologically sustainable business world can become developed. [Spencer-Cooke (1998), p. 100]

SECTION 2: “Environmental Negociated Agreements”

Striving for sustainable development implies the active participation from the actors who all together determine the social climate. However the government experiences a lot of problems to stimulate the different actors to take up their responsibilities with respect to sustainable development. This creates the need for new instruments based on shared responsibility and co-operation with industry. Environmental negotiated agreements are such a new instrument. Environmental negotiated agreements are defined as agreements between government and industry by which both parties commit oneself to realise the agreed environmental goals. One hopes, by using this instrument, to enlarge the involvement of industry in environmental policy in a more active way, which should sharpen the environmental consciousness of industry in order build together on sustainable development.

The last decade in Belgium as well as in Europe (especially in the Netherlands and in Germany) environmental negotiated agreements are used more and more as an instrument in environmental policy. The achieved successes with environmental negotiated agreements in those neighbouring countries point to the possibilities of this instrument for the environmental policy in Belgium. Up till now twenty-six environmental negotiated agreements are concluded in Belgium and Flanders. These environmental negotiated agreements had varying successes. Some of them achieved good results and contributed to the fact that the environmental impact of certain industrial processes diminished and/or the use of certain strongly polluting substances was cut down. Others were only partially or hardly not fulfilled or were fulfilled but didn’t cause any significant environmental gains.

On the basis of this relatively short experience with environmental negotiated agreements in Belgium it is yet to early to draw a conclusion on the appropriateness of this instrument for environmental policy. Up till now little investigation is carried out about making an inventory and analysing the performance of these environmental negotiated agreements. Neither has one made a lot of effort trying to identify the critical factors leading to success or failure of environmental negotiated agreements. With this report we want to make a contribution on this subject.

The final goal of this study is to get a deeper understanding of the factors that could determine the performance of environmental negotiated agreements on the basis of a comparative case study of all negotiated agreements in Belgium. Hereby we take in to account elements related to the specification of the environmental negotiated agreement as well as elements related to the socio-economic context in which the negotiated agreement was concluded and executed. Before we can investigate the influence of these critical factors leading to success or failure we must have a

standard to define success or failure, namely the performance of an environmental negotiated agreement. We then expect a positive relationship between the identified critical factors and the performance of an environmental negotiated agreement. The analysis of these factors leading to success or failure in actual cases can form a first, orienting step for decisions about the appropriateness of an environmental negotiated agreement on the one hand and can identify elements to keep in mind when negotiating and formulating a negotiated agreement.

This study is based on a theoretical analysis as well as on an empirical investigation of the environmental negotiated agreements in Belgium. The comparative case study covers twenty-one negotiated agreements who are brought together to thirteen agreements by taking comparable agreements together. Five environmental negotiated agreements are not taken into account because they are only recently closed or because at last they were never signed.

The group of environmental negotiated agreements that were taken into consideration for the comparative case study contains five agreements related to products, three agreements related to production processes and five agreements related to waste management.

5 environmental negotiated agreements related to products:

- **Agreement on the reduction of the amount of mercury in primary batteries (2)**
- **Agreement on the reduction of the amount of phosphates in washing-preparations**
- **Agreement on the reduction of the amount of CKF in spray-cans (2)**
- **Agreement on the reduction of the amount of CFK in cooling installations**
- **Agreement on the reduction of the amount of CFK in the synthetic material sector (2)**

3 environmental negotiated agreements related to production processes:

- **Agreement with BASF about the draining of phosphate-gypsum**
- **Agreement on the storage of fuel by particular families (2)**
- **Agreement on the emissions of SO_2 and NO_x by the electricity supply sector**

5 environmental negotiated agreements related to waste management:

- **Agreement on the selective collection and recycling of aluminium waste**
- **Agreement on the selective collection and assimilation of batteries**
- **Agreement on prevention and recycling of packaging waste (2)**
- **Agreement on the selective collection of old pharmaceuticals (3)**
- **Agreement on the selective collection and assimilation of old paper (2)**

Although the sample was limited the study nevertheless points to a number of important policy considerations. Looked upon from a positive research methodological point of view their validity of course relates strictly to the cases studied. However we believe that because of their nature they can be considered as important factors to take into consideration for decisions about the appropriateness of this instrument and about the actual design of an environmental negotiated agreement.

In our view, the performance of a negotiated environmental agreement is a mixture of the degree of good application of the agreement, the degree of impact the agreement has on the environment and on the economic efficiency, and the degree of resource development that occurs while negotiating and implementing the agreement. Taking into account only the application of the agreement results in a very narrow definition of performance. Taking into account only the impact of the agreement is a better solution, though the individual impact of an agreement on the environment and on the economic efficiency is difficult to measure. We therefore take into account both the application and the impact, while not minimising the resource development.

The theoretical analysis as well as the empirical research point to a number of internal as well as external (socio-economic) factors of good performance or success. Four external preconditions for success were identified :

the general policy style: a tradition of consensus seeking and joint problem solving is generally considered to be an enabling factor for the realisation of a successful negotiated agreement;

the readiness to use severe alternative instruments in case of non-compliance with the agreement concluded: the stick behind the door;

the potential of the sector to negotiate and act as one collective actor due to for example the dominance of one major player, the small number of actors concerned, the power of the industry association, the low potential for free riding, the homogeneity of the actors concerned…

the potential for market success triggered off by the implementation of the negotiated agreement (the market 'carrot'). In other words the potential that firms participating in the agreement have to distinguish themselves towards other firms in the sector(s) covered by the agreement by environmentally beneficial behaviour. Putting it differently participating in the (future) agreement can be rewarding in market terms because:

potential customers are able to distinguish clearly which companies are performing environmentally better by participating in the agreement;

buyers are sensitive to the positive environmental behaviour of firms: their willingness to pay for their products is higher or to the minimum buyers are willing to favour them over substituting products at the same price due to their higher environmental performance.

It should be noted that taken individually each of the factors is not as such a conditio sine qua non for the success of a negotiated agreement. Rather it is the combination of the success factors that is ultimately decisive for the success or non-success of the agreement. This is important because some of the success factor – the sector structure and to a large extent the competitive structure - are independent factors that cannot be manipulated by the government. The other two - the general policy climate and certainly the alternative instrument - however are under the control of the policy maker and can thus be used to create a combination of external factors that constitute a favourable environment for a negotiated agreement.

The questions used in the study to enable the research teams to assess the environment wherein the different negotiated agreements were functioning could be used as a quick checklist to assess whether or not the environment is potentially favourable for the conclusion of a successful negotiated agreement.

Even when the external factors are favourable to the conclusion and the execution of a negotiated agreement success is by no way automatically guaranteed. Success indeed depends also upon the creation of a number of internal preconditions. They are to a certain extent influenced by the external factors identified above, but the degree of policy freedom in this respect is much larger. In the study those internal factors of success were captured under the heading of specification. They relate to environmental performance, economic efficiency and learning. Well-specified negotiated agreements are important because they lead to a higher rate of application, more demanding objectives and as such a better impact on the target variables. Our analysis essentially points to the following important elements:

1. Well-defined Environmental Performance Indicators

Successful negotiated agreements are characterised by clearly specified targets that represent a meaningful improvement over the business-as-usual evolution. The targets are quantified and intermediate milestones are identified. The identification of the business-as-usual scenario is often not an easy task but is clearly necessary if one aims at significant progress in environmental performance. Nevertheless it should be pointed out that even if in the end nothing more than business-as-usual is realised the agreement can still be successful in terms of efficiency, because it enables industry to realise the targets in a flexible way, thus decreasing the associated costs.

2. A Credible and Well-specified Monitoring Mechanism

Success clearly depends on monitoring. Thus the creation of a mutually accepted and performing monitoring system is crucial. A number of elements seem important here. First of all, monitoring mechanisms are working better if they are clearly specified and agreed upon by the parties concerned at the start of the agreement. If the monitoring rules still have to be discussed at the moment of evaluation itself the monitoring agreement clearly lacks credibility. Secondly, monitoring is not only important because it can - potentially at least- be linked to a sanctioning mechanism (cf. de ‘stick behind the door’ hypothesis), but perhaps even more importantly because it creates for the parties concerned the social momentum according to which they are positively motivated to prove that their performance is at least sufficient if not exemplary with respect to other parties concerned. Thirdly, a good monitoring mechanism provides credibility also to the outside word. Often it is noted that third parties are critical with respect to the effectiveness of voluntary agreements and do question there usefulness. A reliable monitoring scheme could help convincing them of the opposite. Involving them in the monitoring process could help overcoming those concerns. Fourthly, in order to guarantee its objectiveness as well

as its social acceptability the autonomy and the independence of the monitoring body should be guaranteed. Fifthly, it should be realised that credible monitoring mechanisms demand a significant investment in terms of time, personnel and financial resources. Negotiated agreements are therefore not costless; their administrative feasibility should be judged against the implementation costs of other instruments.

3. A Credible mechanism for achieving the environmental performance objective

Agreements clearly perform better if they do not only state goals but indicate clearly how the participating parties will effectively realise them. The kind of mechanism is of course dependent upon the nature of the goals to be realised. For example with respect to agreements relating to product responsibility often collective action is required. The credibility of such a scheme is undermined if no realistic funding scheme is created. Other potential approaches include the setting of individual performance targets, the provision of encouragement, technical support and advice by either sector associations, public authorities or independent bodies. The capability of the implementation mechanism must be judged in relation to the stringency and the nature of the environmental performance objective.

4. A Credible Mechanism for Preventing Free riding

A number of agreements studied clearly were performing sub-optimally because their implementation demanded some form of collective action and free riding occurred. As a result the effectiveness of the agreement is diminished and the erosion of the agreement is stimulated because participants in most cases do not longer see the advantage of participating in it. The potential for free riding of course is dependent partially upon the characteristics of the sector concerned, but it can be positively or negatively influenced by the design of the agreement itself. Prevention of free riding can be done by the private sector itself (for example through its buying policies) or can rely upon government action (for example fines of taxes in case of non-participation or non-compliance). The strictness of the sanctioning mechanism must be judged against the severity of the consequences of participating in the agreement. It should be realised that 'overkill' measures are seldom politically realistic.

5. The Stimulation of Learning Processes

The theoretical analysis as well as the case study analysis pointed to the importance of the so-called resource development: the improvement in the policy resource base resulting from negotiating and implementing the agreement. The theoretical analysis pointed to the fact that voluntary initiatives are especially interesting in situations of shared uncertainty because due to their interesting properties (co-operation,

flexibility, revisability) they stimulate learning processes. Learning could relate to the reduction of information asymmetries (for example the dissemination of current best practices, the identification of new technical and managerial solutions, or the generation of new environmental insights). Even if no explicit learning targets are included, the practical implementation of the agreement should favour the development of such collective learning processes. An explicit implementation mechanism stipulating how the learning is expected to occur (for example through co-operative research programmes, or through site visits) is to be provided for. Here also, the effectiveness of the learning process could benefit from a well devised monitoring system that tracks down the learning initiatives taken and the dissemination of the results of these activities. The detailed requirements of a monitoring system will depend upon the nature of the learning objective and the implementation mechanism that is adopted. As learning is a long term phenomenon and often requires insight into a variety of complex processes a sufficiently long time horizon for the agreement is to be welcomed as well as stability with respect to the other elements of the regulatory environment.

6. A Burden Sharing Mechanism Consistent with a Cost-efficient outcome

The burden sharing mechanism defines who is responsible for achieving the environmental performance objective. In order to limit the total cost of achieving the environmental goals an explicit ex ante burden sharing mechanism that differentiates between actors in order to reduce the aggregate costs of achievement of the objective is necessary. For an 'individual action' agreement the responsibilities for action and payment coincide: the actors that take the actions effectively have to bear the costs. In this case, burden sharing refers to the apportionment of the general policy goal to the different actors concerned. Those actors that have the lowest marginal costs should do the most efforts to reach the collective target. In other words targets should be differentiated in such a way that marginal costs of action are equalised. In case this allocation conflicts with other political goals additional instruments should be used to compensate for the undesired effects rather than changing the allocation pattern of the efforts themselves. In case collective action is required to reach the goals of the agreement, the cost allocation should reflect the difference in contribution of the actors concerned to the environmental problem that lays at the origin of the negotiated agreement. Particular care should be taken to avoid that in the negotiating or even in the executing phase powerful actors can shift the burden of adaptation to less powerful ones when such a shift is not in line with efficiency considerations.

7. The Importance of Back-up Policies

An important factor explaining the success or failure of negotiated agreements is the fact whether or not the different actors considered it in their own interest to join the agreement and faithfully execute it. The objectives pursued through the agreement should be complementary to the business strategies of the participants. Within this perspective private industry will only voluntarily execute certain requirements if the investments that are required are characterised by a positive return on investment. This private business logic limits the applicability of this instruments and leads some scholars and policy makers to conclude that negotiated agreements as all voluntary initiatives are only effective to pick up low hanging fruits and thus are not suitable instruments in the substantial industrial restructuring processes that are required to achieve sustainable development. One should not forget however that whether or not a particular environmental investment is characterised by a positive return depends on the economic parameters (the relative prices) that directly or indirectly influence the calculation of the relevant benefits and costs. This points to the importance of incorporating negotiating agreements in a total policy package that aims amongst others to correct relative prices in an environmentally friendly way. Some successful cases clearly pointed to the fact that in the negotiating game preceding the conclusion of the agreement the fact that the government made a unilateral and drastic first move explained to a large extent why demanding targets could be set and where realised. This argument pleads in favour of a greater government involvement in the setting of the targets to be reached, while leaving it to the private parties concerned to select the appropriate ways to realise those targets. The greater degree of flexibility obtained in the negotiated agreements in comparison to the regulatory approach enables significant costs savings and as such provides still enough incentives for private industry to participate. More research is needed to investigate the role that negotiated agreements could play as a part of total policy packages and to identify the economic and institutional conditions under which such policy packages (for example the combination of voluntary agreements and environmental taxes, the combination of voluntary agreements and negotiable pollution rights) could be effective.

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OPPORTUNITIES AND LIMITATIONS FOR BELGIAN ENVIRONMENTAL TAXATION

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1. INTRODUCTION

The aim of the research project "Opportunities and limitations for Belgian environmental taxation" was to analyse Belgium's ability to establish own national environmental taxation programs. In this research project we depart from the idea that the consequences of a severe environmental policy may turn into conflict with the international economic order which is focused on the realisation of free trade. The focus on environmental taxes can be explained by the then prevailing attention to this instrument on diverse policy levels. Though, during the research project, the attention on the international environmental forums shifted gradually from environmental taxes to flexible and voluntary instruments. We account for this evolution in our research project.

On the whole, the research activities of this project can be classified into three main research themes. Firstly, we examine in detail the relationship between the environmental policy and the competitiveness of an economy. We also examine and evaluate the international economic order in detail. Secondly, we indicate how the existing international economic order can be adapted. In this part of the project we give an overview of the instruments that may be interesting in this context. In the last part of the research project we present an analysis of the burden sharing agreement of the European Union.

To conclude this introduction we remark that our research project is closely linked to the program "Leverages for a policy aimed at sustainable development" because Belgium should account for the international economic order if it wants to reach a sustainable development.

2. METHODOLOGY AND RESULTS OF OUR RESEARCH

2.1 Analysis of the international economic order

We first dealt with the interactions between environmental policy and competitiveness. Through a study of literature we distinguished a couple of hypotheses about the possible impact of a severe environmental policy on an economy's competitiveness. The first Hypothesis states that a stringent environmental policy induces the delocalisation of industries to developing countries, characterised by the lack environmental regulation. The second hypothesis reads as follows; less developed countries use less stringent environmental policy consciously to attract multinational enterprises. Our overview of the empirical literature about

these two hypotheses learns that the negative effects of a stringent environmental policy on the competitiveness of the country remain confined. Our own research consisted of an analysis of investment flows from a couple of industry groups. The distinction between the different groups was made on the ground of each industries environmental impacts.

The third hypothesis concerning the link between environmental policy and competitiveness is the Porter hypothesis. According to this hypothesis, a stringent environmental policy can bring along positive consequences for the competitiveness of a country through innovation and competition. In our research project we present the results of our own empirical investigation on this hypothesis. In the conduct of our research we accounted for a frequently returning limitations in other empirical investigations. More specifically, our analysis is carried out at the product level, not at the sector level which is generally the case. We judge it likely that the impact of a change in the environmental regulation, in this case a stricter regulation, on the competitiveness differs for every product individually. In our research project we evaluate the impact of the Montreal Protocol on the American export of a couple of products that make use of CFK's, the coolant that should gradually be replaced according to the protocol. There are some countries and enterprises that made early efforts in the search for CFK replacing products. We evaluate whether these efforts did lead to a positive impact on the export of these countries. The final conclusion of the research was that countries who undertook early efforts experienced a positive impact on their exports of household refrigerators and freezers and industrial refrigeration installations. The impact of a pro-active environmental policy on the export of air-conditioning equipment is not statistically significant. We conclude that we found empirical support for the Porter hypothesis, though only for some specific products. The Porter hypothesis is thus not generalisable for all products.

In our research we also considered the potential role of export-diversification in the field of environmental policy. The results of our empirical research show that a diversified pattern of exports may be considered as an insurance against changes in environmental regulations. This can be explained as follows, a possible reversion of the export of a specific product caused by a tighter environmental regulation may be compensated by an increase in the export of an other product.

In our research activities we related the moderate drawback of environmental policy on the competitiveness of a country with the costs linked with environmental regulation. We noticed that the costs related to the environmental regulation remain generally modest. In our research project we calculated the marginal emission reduction costs for some American industries. It turned out that these emission reduction costs show a declining trend through the years 1988 – 1993. Sometimes

they even turned out to be negative. This may be an explanation for the missing negative impact from tight environmental regulations on the competitiveness of an economy.

Concerning our conclusion so far, a tight environmental policy doesn't have to turn out negative or may even turn out positive for competitiveness, we investigate the valid conditions to establish a national environmental policy. We consider Belgium as a member state of the European Union and ask ourselves the question whether this membership may be a limitation for the conduct of an own environmental policy.

The main aim of the European Union upon its creation was the establishment of a common market. This remains the principal goal of the Union but through the years there was growing attention for other themes, such as the environment. For example, article 2 of the Amsterdam Treaty now encompasses the promotion of a high level of protection and the improvement of the quality of the environment. Also the aim for sustainable development is taken up in this article. Moreover, article 6 of the same Treaty states that environmental considerations should be accounted for in all measures and that special attention should be paid to sustainable development. We found that it is far from evident to come to an environmental policy on the European level for diverse reasons. This shows the need for ongoing national environmental policies. Again, this poses the difficulty that national environmental policies may be in conflict with the goals of the European Union, in the first place the aim of a common market. To ensure this, the European Union opted to formulate a number of guidelines for the establishment of national environmental prescriptions. The first general guideline states that every environmental measure should deal with three principles, namely prevention, the polluter pays and precaution. The second guideline relates to import taxes, quantitative restrictions and taxes and measures with equal effects. This guideline contains that every environmental tax that brings along a trade restriction is forbidden. The third guideline of the European Union, concerning internal taxation, states that a country may not impose additional taxes on foreign producers next to the taxes imposed on equal domestic products. The guideline about the harmonisation of indirect taxes is fourth in line. This guideline offers perspectives for the introduction of product and emission related taxes because these are not indirect taxes subject to this guideline. The fifth guideline relates to fair and undisturbed competition and environmental policy. The implementation of some environmental prescriptions may require the co-operation between firms what in turn may impact the competition between these firms. Principally, co-operation agreements and the like who have implications on the competition are forbidden. Though, an exception can be made in case of an environmental goal. The sixth and last guideline relates to state aid. Subsidies are

principally forbidden but there exist some exceptions, such as in the case of investments in environmentally friendly technologies. Next to these guidelines there exist a number of principles and conditions valid for national environmental measures. Firstly, a national environmental policy may only deal with an environmental problem if there's no regulation on the European level. The second condition contains that the measure should have a clear environmental goal. That condition states that the environmental measure may not contain any discrimination or disguised protectionism. So we can conclude that the European Union brings along some restrictions for member states in their creation of an environmental policy. Nonetheless, there remain sufficient possibilities to take all necessary measures.

Next to the limitations brought along by the European Union, Belgium has to account for the World Trade Organisations prescriptions aimed at the creation of free trade. The articles of the WTO are valid in regard to the international trade in general but Belgium's environmental policy may not be in conflict with these articles. The environment as such isn't, except from article XX, mentioned at all in the articles form the WTO. Article XX comprehends some general exceptions to the WTO articles. An exception can be made when this is necessary for the protection of human, animal or plant life and health. An other exception can be made for the conservation of exhaustible natural resources.

The Agreement on Technical Barriers to Trade does take into account that it can be necessary from the point of the environment to create some barriers to trade. This is explicitly mentioned in article of this agreement.

To conclude the research activities in the framework of the first part of the research project we present a more detailed analysis of the concept of sustainable development. We departed from the definition in the Brundtland report stating that a sustainable development is a development that meets the needs of the current generation without compromising the needs of future generations. It's important to realise that this brings along some challenges. For example, we should take into account that the world population is growing exponentially for the moment, that there are limits to the diverse natural resources, that there are boundaries to the carrying capacity of the ecosystem and that large parts of the world face a socio-economic leeway. These are each challenges of direct importance to the creation of a sustainable economy in industrial economies. The International Institute for Sustainable Development (IISD) sums up some principles for trade, development and environmental policies with a view on sustainable development. The definition of the concept sustainable development through principles allows us to check whether the implementation of these principles is possible within the existing framework of

free trade. The goal of these principles is to take care that trade and the developing- and environmental policy support the creation of sustainable development. In defining the concept sustainable development the IISD makes a threesome assumptions / boundary conditions. In the first place, the IISD points to the importance of driving back poverty. A world in which poverty exists can hardly be called sustainable. Moreover, people from poor countries will hardly care about the environment. Secondly, both the national and the international environmental policy are of vital importance for all aspects of sustainable development. Finally, the importance of the realisation of free trade is stressed. From this it is clear that sustainable development knows three dimensions. There's not only the need for a better environment, there's also a social and economic dimension.

A first important principle in goal of sustainable development is the strive for efficiency and internalisation of costs. This encompasses that the prices paid by producers and consumers reflect the real costs, including external costs. A second principle, is striving for equality in and between different generations. For reaching more equality, the IISD thinks in the first place of an ongoing liberalisation of trade and increased investments in the developing countries. The third principle encompasses the recognition of the environmental integrity. This implies amongst other that we recognise the impact of human activity on the environment as well as nature's limited regeneration capacity. While striving for environmental integrity we have to pay attention that the plant and animal populations incur no irrecoverable harm. It's about to expect that this aim can not be realised by internalising external costs, further measures will be required. A fourth principle is about subsidiarity, measures should be taken on a local level as long as this is the most efficient. Nonetheless, we have to point to the importance of the harmonisation of environmental standards if we want to safeguard free trade. The next principle comprehends the enhancement of the international co-operation in the field of the environmental, trade and developing policy. The IISD's sixth principle is related to science and precaution. One can opt to require scientific certainty about the damage before one proceeds to implement environmental measures. Otherwise, one can opt for the precautionary principle and proceed with environmental measures before one is sure about the potential harm. The seventh IISD principle relates to openness and transparency. One can defend the option that a firm should reveal information about its charges on the environment. The experience with the Toxics Release Inventory from the United States teaches us that an obligation to reveal such information can move firms to undertake actions to reduce their emissions.

If one wants to come to a sustainable development through these principles, one has to take into account the international economic order. In our opinion, it's possible that

the first principle may conflict with free trade if a specific imported product is taxed on the ground of pollution during production. Besides, the international economic order may also harm the realisation of the protection of the environmental integrity. Concerning the other articles, we don't expect a conflict between the aim for sustainable development and the existing international economic order.

So, the main conclusion of this part is that a country shouldn't fear a negative influence on it's competitiveness by implementing environmental measures. The international economic order, which is, through the European Union and the WTO, mainly focused on the realisation of free trade, is the major difficulty in establishing an environmental policy. A detailed analysis of the issue of sustainable development learned us that there are some potential conflicts with the aim of free trade as well.

2.2 Research on the possible adjustment of the international economic order to turns it into a positive incentive for a co-ordinated environmental fiscal policy

The aim of this part of the research project was to work out how the existing international economic order can be adjusted to reach a more efficient environmental policy. We not only stood still by environmental taxes as such but also by other environmental instruments available to policy makers. We extended our scope of view to other instruments because of the increasing attention for these instruments, as already mentioned in the introduction. First of all, we present a definition of all instruments. In the continuation of the second part of the research project, we examine to what extent they can stimulate the diffusion of environmentally friendly technologies.

A consumer subsidy is the first instrument of which we evaluate the potential impact on the diffusion of environmentally friendly technologies. We researched the possible emission reductions when giving consumers a subsidy for the replacement of their heating equipment. A subsidy of 500 € for the replacement of their burner could bring along a reduction of the residential energy use of 25%. The estimated cost of the subsidy for the Belgian government is about 400 - 500 million €. A second subsidy of which we estimated the effect on the emissions is a subsidy of 1000€ consumers can receive when buying a new car that's among the 10% most efficient available. To finance this subsidy we considered an increase in the annual car tax of 8€. The increase of the car tax can be proportional to the age of the car. One can also opt to give a subsidy to consumers who buy a car just missing the category of the 10% most efficient cars. We suppose therefore a subsidy of 500€. In this case, the increase in the car tax should rise to 12€. The final impact on the transport emissions

is hard to analyse because a lot of other factors, like the number of cars in circulation and the number of kilometres driven by each car, interact. We accounted for these factors in our analysis but it complicated the estimates of possible emission reductions. In our simulation we come to a decrease in the energy needs of the car fleet ranging from 25 till 31%. Our simulation further learned us that a comparable emission reduction from trucks and buses is possible. We also analysed the potential impact of a consumer subsidy for buying energy efficient equipment. The simulation indicated a reduction in the emissions of 12 million tons through a period of 10 years, this equals 2% of all emissions in the European Union. To conclude this analysis we asked ourselves the question whether the European Union could have an objection against such a subsidy. We suppose a consumer subsidy may not turn into conflict with the creation of a common market on the condition that every producer has equal opportunity to launch products that qualify for the subsidy.

The second environmental instrument we analysed in detail is the tradable emission permit. Departing from the arrangement that a tradable emission permit can't move firms to produce environmentally friendly products we propose the enlargement of the system of tradable permits with a tradable certificate. These certificates should be distributed among the firms producing goods that bring along lower emissions during consumption. We evaluated the possible emission reductions in the transport sector. A comparison of the emissions during the production and the emissions during the consumption of a car and truck learned us that the potential of a tradable certificate could be large. The CO_2-emissions produced by a car or a truck during consumption are a multiple of the CO_2-emission generated during production. So, it's an interesting line of thought to stimulate producers to produce environmental friendly cars. In the market for passenger cars we calculate a possible CO_2-emission reduction ranging from 25 till 38%, depending on the price of the tradable certificate, in a period of 15 years. In the market of trucks, the potential emission reduction remains limited to maximum 12%. This less spectacular possible emission reduction may partly be explained by the fact that a truck's fuel efficiency is already a very important aspect for transport firms in their investment decisions. This means that truck constructors are for long a long time obliged to take into account the energy efficiency of their products, the trucks.

Subsequently, we analysed the potential benefits related to the pairing of voluntary agreements and emission trading. In our research we argue that it's possible to ask an entrance price to the market of tradable emission permits because the aggregated marginal emission reduction cost in case of emission trading will be lower than the aggregated marginal emission reduction cost in case of a voluntary agreement. Firms are thus willing to pay a price to participate in emissions trading. Once a firm can sell

emission permits, it will be stimulated to cut back its emissions further than required by the voluntary agreement. Namely, the firm can sell the emission permits to other firms participating in the voluntary agreement. In our simulation of a voluntary agreement with an option to emissions trading we come to stronger emission reductions than required by the voluntary agreement. This is of course a better result than can be obtained through a voluntary agreement as such. In our simulation we also compared emission trading combined with a voluntary agreement with emission trading without voluntary agreement. The main conclusion of this comparison is that the combination of both instruments induces firms with the highest emission reduction costs to cut their emissions to. It's important to notice that the flexibility of emissions trading remains untouched by the introduction of a voluntary agreement.

The final instrument we analysed in detail is an environmental tax. We evaluated the potential impact of an environmental tax on a firm's decision on the early replacement of its capital goods. The goal of this environmental tax is of course to reduce emissions. First of all we want to stress that the emission reduction will show a lag compared to the increase in the energy-efficiency if we account for the enlargement investments to. We supposed that the government fixes taxes in function of social welfare and hereby takes into account firms reactions. These reactions can vary strongly. The firm may for example opt to invest in end-of-pipe technology but also to invest in research and development on environmental friendly technologies. We also introduced a variable to measure technological optimism among entrepreneurs. One of our conclusions was that the needed environmental tax to induce firms to invest in R&D is lower as more entrepreneurs are optimistic about technological progress. When we measure social welfare of an environmental tax on the basis of tax revenues we have to conclude that a high level of technological optimism is negative for welfare. Namely, a strong technological progress has an erosion of the tax basis, the emissions, for consequence.

2.3 Possible contribution of our country in the establishment of an international set of fiscal instruments

In their paper Eyckmans en Cornillie (2000) analysed the cost-efficiency of the burden sharing agreement of the European Union. In the first place, they carried out a graphical analysis. It was clear that a uniform emission reduction of 8% brings along great inequality in the marginal emission reduction costs. So, this is far from a cost-efficient distribution of efforts. The burden sharing agreement has as a consequence that the differences in emission reductions costs are less pronounced. Therefore, this agreement is positive from the cost-efficiency point of view. Though, there's no equalisation of the marginal emission reduction costs so an ongoing

differentiation of efforts remains necessary. The second method of analysis of Eyckmans and Cornillie (2000) was the calculation of implicit welfare weights bounded to the output of the different countries. From this, it's once more clear that the division of efforts is far from equal and cost-efficient. The emission reduction objectives assigned to Germany, the United Kingdom and Germany, are, according to the analysis of Eyckmans and Cornillie, not ambitious enough. In contrast, other countries should combat their emissions by more than optimal from the cost-efficient point of view. In their analysis, the authors also accounted for equality considerations. The authors made the assumption that rich EU countries can be asked additional efforts compared to the member states with a lower GNP. When we take into account these equality considerations, the burden sharing agreement is far from cost-efficient because it is particularly the rich countries that are treated favourably. Rich countries should be asked additional efforts form the point of equality. The authors also the analysed the situation in which there's emission trading among the European Union member states. When there's no inequality aversion, the implicit welfare weights linked to different countries are equal. In other words, it's irrelevant where the emission reductions are executed. If we do take into account inequality considerations, the implicit welfare weights of the different countries do differ. These results can be explained as follows. The consequence of emissions trading is the equalisation of marginal emission reduction costs. If we strive for enhanced efforts from rich member states, this is not a desirable result. Eyckmans en Cornillie also analysed the impact of a limit on emission trading. Their research shows that this entails an increase in the emission reduction costs for the European Union as a whole.

Furthermore, we paid attention to the costs and benefits linked to emission trading. A study of literature learned us that emission trading is more advantageous as more countries participate. For example, emission trading among the Annex B countries of the Kyoto protocol makes a cost reduction of 50% possible in comparison with the situation without emission trading. The smaller cost savings in case of emission trading on a smaller scale shouldn't be an obstruction for the implementation of emission trading in a limited number of countries. The cost savings that thus will be realised can be a stimulus for other countries to join the emission trading program. Another option is to limit the emission trading to a couple of sectors, for example the energy producing sectors. Cost savings of up to 21% are possible in this case. An extension of the system to the energy-intensive sectors raises the cost savings up to 24%. We should make the remark that the savings in the emission reduction costs are in relation to a situation in which emissions are pushed back domestically in an efficient manner. A uniform division of the emission reduction obligations among the different sectors brings along an increase in the emission reduction costs. The cost

savings from the introduction of emission trading will in this case be much more spectacular. In our research project we analysed the EU's proposal to introduce a limit on emission trading. Zhang (2000) illustrated that such a limit can be advantageous for the European Union. A limit on emissions trading makes it interesting for the European Union to cut back more emissions. Namely, the proposed limit by the European Union doesn't encompass a limitation for the EU itself, so it's lucrative to make excess efforts in order to sell permits on the international permit market. Therefore, we should conclude that as many countries as possible should participate in emission trading and that there shouldn't be any limit on the emission reductions that can be realised through emissions trading.

3. CONCLUSIONS AND RECOMMENDATIONS

The main conclusion of the first part of our research project is that a government shouldn't fear very negative consequences of environmental policy for its competitiveness. Our empirical research of the consequences of the Montreal Protocol is a perfect illustration of the fact that a stringent and efficient environmental policy can even have positive effects on a country's competitiveness for a couple of industries. We do suggest to take into account the prescriptions of the European Union and the World Trade Organisation. This brought us to the next research question : to what extent can the existing international economic order form a threat to the introduction of an environmental policy ? We determined that the European Union in the first place strives for the creation of a common market. This was the original mission of the European Union, meanwhile extended and refined, among others some aims in the field of environmental policy. For the moment, the EU only handles a number of basic principles the member states have to take into account while conducting an environmental policy. Next to the prescriptions of the EU, there are also the WTO articles. Belgium should take into account while formulating its environmental policy. In fact, this means that the environmental policy may not imply any restriction to free trade. Though, there are some exceptions, among others for measures in relation to the environment. In practice, there are severe conditions to fulfil before one can make an appeal on these articles.

The second research question of the project related to the possible adjustment of the international economic order. We came to the conclusion that a lot of instruments can contribute to the diffusion of environmentally friendly technologies. From research it seemed that consumer subsidies, the linking of voluntary agreements and emissions trading, a tradable certificate and an environmental tax all can contribute to the diffusion of cleaner technologies. Concerning the potential of these instruments, one

can recommend the Belgian government to take initiatives in this field. Some of these initiatives can be translated into national measures. In the case of other measures, European initiatives will be required. In the last case, Belgium will have to bring up these issues on an European level.

The third and last part of the research project presented an economic analysis of the burden sharing agreement of the European Union. We determined that the division of efforts could create a decrease in the total emission reduction costs. At the same time, we determined that the less thriving member states are still required to take to much action. Furthermore, it seemed from our research that considerable cost savings can be realised through emissions trading. The installation of a limit on this emissions trading encompasses that a part of these cost savings can not be realised. The European Union defends such a limit on emissions trading. In the view of the higher costs accompanied with this limit, this may seem a strange attitude. Though, a study of Zhang shows that the limit proposed by the EU, encompasses advantages for the union itself compared to unlimited emissions trading. We also determined that the former Sovjet Union can profit from free emissions trading. This free trade allows the former Sovjet Union to cash their 'hot air'.

The results of the third part of our research project plead for the fact Belgium should start a discussion on the European level concerning the burden sharing agreement. Belgium should stress that the burden sharing agreement doesn't go far enough in the division of efforts. At the same time, a reallocation of efforts should be overweight. Furthermore, Belgium could start a discussion on the European level about the global negative consequences of a limit on international emissions trading.

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THE IMPACT OF ENVIRONMENTAL POLICY ON THE COMPETITIVENESS OF BELGIAN INDUSTRY

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1. INTRODUCTION

Recent decades have seen the introduction of a host of new environmental regulations and international agreements aimed at making polluters pay for the damage they do to the environment. The application of the "polluter pays" and "precautionary" principles together with greater producer liability have combined to generate substantial additional costs for companies. Indeed, the cost of cutting pollution can often exceed 5% of total production costs. The concern now is that certain firms and industries may struggle to compete because many of their foreign competitors are not faced with equally stringent environmental regulations and standards. The goal of this research is to assess the impact of different environmental strategies at the corporate level, which are (at least partly) induced by environmental regulation, on the competitive position of firms. The focus of our research is on firms, rather than industries.

2. GOALS AND OBJECTIVES

The main research question to be answered through this research project can be synthesized as follows:

> ‘Do public environmental policy measures reduce or improve the international competitiveness of industry?’

The original research proposal contained in the following five research objectives:

1. To implement a thorough review of the academic literature on the nature of the relationship between environmental regulation and the competitiveness of firms;
2. To analyse the impact of environmental regulation on the environmental management practices of firms, as well as the importance of regulatory pressures relative to other stakeholder pressures for the formulation of corporate environmental strategies;
3. To analyse the effectiveness and economic implications of different environmental management strategies;
4. To implement a case study in order to gain a better understanding of the cumulative impact of environmental regulation on the competitiveness of firms in a specific industry;

5. To formulate some policy recommendations with regard to a further strengthening of corporate environmental practices and the scope for regulatory initiatives at the European level.

The main goal of this research proposal is the design of a general evaluation procedure that will allow public policy makers to assess the impact on the competitiveness of firms. As a result, public policy makers will be informed regarding the sustainability of the public environmental policy measures they introduce.

3. DATA SOURCES AND RESEARCH METHOD

The methodology used in this study to assess the linkages between environmental policy and industrial competitiveness is very appropriate for this type of research. On the one hand, the research structure is based on the international literature and similar studies that have been conducted at the international level. When designing the conceptual tool to evaluate the effectiveness of public environmental policy measures, recent concepts from the core-competence or the resource-based theory of the firm were included. It is argued in this study that firms may develop core competencies in the area of 'environmental strategy', which in the long run may lead to an improvement of their competitiveness.

3.1 Data sources

Empirical research in economics usually measures the costs of environmental regulation to firms by the costs of pollution control (See Jaffe et al, 1995 for an excellent review of this literature). The total costs of pollution control are defined as the sum of the annual depreciation on environmental investments (end-of-pipe or process-integrated), the operational costs of environmental investments (energy, raw materials, staff,..), the administrative costs associated with achieving environmental compliance, expenditures on R&D related to new environmental technologies, environmental taxes, fees and fines. The financial benefits and savings resulting from environmental investments need to be subtracted from this total in order to arrive at the net costs or true costs of environmental regulation.

This approach has several drawbacks. First of all, pollution control increasingly takes the form of process-integrated investments, in which case it is far more difficult to estimate the costs associated with the environmental component of the new production process. Second, the operational costs are also difficult to measure (usually, a fixed percentage is added to costs of environmental investments to

account for them). Third, the savings due to better pollution control are usually not well known. Fourth, some benefits such as the gains resulting from a better public image cannot be quantified.

Probably as important a consideration is that these data are not readily available for Belgian firms. There is as yet no regulatory requirement to keep a separate account of environmental costs and benefits. As a result, most firms have no clear view on the net costs of pollution control.

In management research, other measures have recently been adopted to capture corporate commitments to pollution control. These include changes in the Toxic Release Inventory Index (Hart and Ahuja, 1996), environmental ratings (Russo and Fouts, 1997), self-reported environmental management practices (Sharma and Vredenburg, 1998; Judge and Douglas, 1998), and the uniform application of an environmental standard worldwide.

There is at present no Toxic Release Inventory Index in Belgium (the best that exists is an index for water pollution). Nor is there an independent environmental rating agency in Belgium. This left us with no other choice but to use self-reported data on environmental management practices. The advantage of this approach is that the researcher gains an understanding of the extent to which environmental regulation has translated into lasting organizational changes that reflect a strong commitment to reducing and preventing environmental problems.

Based on an extensive review of the environmental management literature, 9 criteria were selected to classify respondents according to their posture towards environmental issues. These included: (1) the development of green capabilities, (2) senior management commitment to environmental performance, (3) integration of environmental issues in strategic management, (4) participation of environmental managers in strategic planning, (5) employee training and participation, (6) the degree of functional coverage, (7) internal environmental reporting, (8) external environmental reporting, and (9) application of some form of life cycle analysis.

The data were gathered through a survey conducted in 1998 - 99 of the most polluting firms in Belgium. The firms included accounted for 80% of water pollution and solid waste production in 1998. The relevant governmental agencies in Belgium were contacted to obtain the coordinates of companies contributing significantly to water pollution or waste production. This resulted in a sample of 450 companies, heavily concentrated in the manufacturing sector. These companies were then contacted in order to identify which manager was responsible for environmental issues and to solicit their cooperation in the survey which was subsequently sent to

them. The research team provided the opportunity to all participating managers to obtain extensive guidance when filling in the questionnaire. A total of 198 usable responses were received by the authors.

3.2 Research method

The aim was to summarize the information on environmental management practices in such a way that it can be used in quantitative evaluation procedures. For this purpose, the 9 criteria mentioned above were subjected to a cluster analysis. This suggested a classification consisting of three environmental management strategies: (1) *reactive,* (2) *anticipatory,* and (3) *pro-active.* This solution yielded a clear separation along all 9 criteria. Cluster analysis does not result in an absolute score or measure of the extent to which an environmental strategy can be considered pro-active. Instead, it indicates that the environmental practices of some firms can be considered as more pro-active (or more reactive) relative to those of other firms.

The second research objective was addressed by relating this classification of firms to the perceived pressures exerted by regulators and other stakeholders. To measure the perceived importance of different stakeholders, managers were asked to rate on a Likert scale of 1 to 5 the influence of various stakeholder pressures on decisions related to environmental management, with 1 denoting no influence at all and 5 a very strong influence. The list of stakeholder pressures included: domestic and international customers, domestic and international suppliers, shareholders, employees, financial institutions, domestic and international rivals, the national and sub-national governments, local public agencies, international treaties and agreements, the media and environmental NGOs. It was verified empirically (using Multivariate Analysis of Variance or MANOVA) whether the perceived pressures exerted by the various stakeholders are affected by a firm's classification as a firm characterized by a reactive, anticipatory or pro-active environmental strategy. Simultaneously, this analysis indicated what the important stakeholder influences are in each stage of corporate greening.

With respect to the third research objective, an insight into the relative effectiveness was gained by linking the survey data to financial performance data. The latter were obtained from the annual statements and balance sheets of all participating firms, as collected by the National Bank of Belgium. Return on assets was selected as an indicator of financial performance, because it is the most commonly used measure of financial performance used in similar studies. The classification of firms according to their environmental management strategy was used to introduce 2 dummy variables (one for a pro-active strategy, one for a reactive strategy) into regression analysis.

Other control variables included firms size, sales growth, industry growth, industry concentration ratio, capital intensity and advertising intensity and the ratio of own assets to total assets.

4. RESULTS AND CONCLUSIONS - LIST OF SELECTED PAPERS WITH MAIN RESULT

4.1 International co-ordination of environmental policy from an EU perspective

The main conclusion of this paper is that the co-ordination of environmental policy at the European and international levels offers a unique opportunity to simultaneously achieve economic growth driven by free trade and foreign direct investments, and substantial environmental protection. The harmonisation of environmental regulation in the European Union has caused the poorer member states to rise to the level of environmental protection prevailing in the richer ones. It has also partially prevented unilateral environmental regulations by member states from having a strong influence on individual firms, industries and the environmental quality of neighbouring States.

However, many member states have recently introduced additional instruments – mainly economic incentives – to regulate environmental pollution, and a harmonised use of such instruments at the level of the European Union is still in its early stages. A case study on the regulation of water pollution in Belgium was used to highlight some of the possible costs associated with an unco-ordinated use of economic incentives, in particular environmental taxes. In Belgium, water pollution through rivers is mainly a problem of asymmetric spillovers from the upstream region (Wallonia) to the downstream region (Flanders). However, the effluent taxes on water pollution, issued unilaterally by each region in 1990, do not internalise such externalities. A more strongly co-ordinated policy seems desirable but may need to be combined with side payments in order to be acceptable. Such a proposal would currently not gain much political support in Belgium where the more general issue of inter-regional transfer payments (e.g. as regards social security) has been the subject of a major debate between the Walloon and Flemish regions. The transboundary nature of water pollution is however not unique to Belgium, but common to all European countries. This problem of transboundary water pollution has already been addressed at the level of the European Union mainly by issuing common environmental quality standards. Yet, a broadening of the regulatory instruments used by the European Union is necessary, as has recently been recognised by the Union itself.

This paper has also suggested that innovative 'green' thinking can contribute to sustainable economic growth through the development of a sector for environment friendly technologies and products. The European Union has endorsed this idea in its fifth Environmental Action Programme, and has adjusted the process of European environmental policymaking accordingly. The recent directive to encourage the re-use of packaging materials, which has developed in co-operation with industry, can be considered a step in the right direction. Yet, we found little evidence of green thinking in the Belgian case, suggesting that environmental policy in Belgium has not contributed much to green thinking or to the adoption of a long term perspective by business leaders on the economic opportunities generated by a green approach. A better co-ordination of environmental policy at the national level can provide an incentive for behavioural change. The European Union can also contribute to a change in attitude of managers vis-à-vis the environment both directly through its regulatory efforts and indirectly through competitive pressures from the single market.

Finally, this paper suggests that the European Union is increasing its co-operation with industry to develop new environmental regulations. As a result of this trend, recent environmental initiatives have taken the form of voluntary agreements. Many industrial sectors are dominated by a limited number of multinational enterprises. These firms can be expected to play an increasingly important role in shaping future European environmental policy. It was argued that most multinational enterprises would benefit from a European approach to environmental policy. However, the impact of European versus unilateral environmental regulation on MNE operations requires further in-depth research.

4.2 Environmental policy and corporate strategy in a small open economy

This paper identified the key determinants of proactive environmental management in a small open economy. These determinants include regulatory pressures, the pursuit of economic opportunities (i.e. the simultaneous pursuit of environmental and industrial performance), the valuation of good relationships with local communities in host countries and internal and external stakeholder pressures. The paper focussed on the environmental strategies of MNEs in small open economies because of their strong involvement in highly polluting activities and their key role in the dissemination of new technologies and managerial practices across borders. One interesting finding is that the environmental practices of foreign MNEs appear to be superior to those of domestic firms in host countries, at least in the case of Belgium.

It appears that regulatory pressures exerted by the government of a small open economy have more impact on the strategic decisions of domestic companies than on the decisions of subsidiaries of foreign MNEs. Indeed, the research provides evidence that high perceived regulatory pressures induce domestic firms to adopt more proactive environmental management strategies. However, this conclusion does not extend to the case of subsidiaries of foreign MNEs. Therefore, this hypothesis could not be accepted in general. The hypothesis, which stated that subsidiaries of foreign MNEs implement environmental strategies in host countries based on regulations prevailing in their home country is also rejected, as environmental management strategies of MNE subsidiaries do not appear responsive to environmental pressures in the MNE's home country.

The perception that proactive environmental management leads to economic benefits (reputation effects, access to new markets, efficiency gains) was shown to contribute positively towards the greening of corporate strategies.

As regards the hypothesis, that internal and external stakeholder pressures constitute a moderately important element affecting the choice of a specific environmental management strategy, the strongest pressure comes from shareholders, for whom poor environmental performance implies increased investment risks. Moreover, it also appears that rivalry pressures may push MNEs towards the implementation of more proactive environmental management strategies in their affiliates. In addition, the paper's findings suggest that stakeholder pressures do not operate in isolation from each other: it is their joint effect that may raise a company's awareness of environmental issues, and motivates them to develop green FSAs. However, the joint impact of external stakeholder pressures does not appear to be as significant. Finally, the hypothesis is confirmed that the valuation of good relationships with host country actors stimulates subsidiaries of foreign MNEs to adopt stringent environmental standards worldwide was confirmed.

In sum, shareholder pressures and perceived economic opportunities are the key determinants of a proactive environmental strategy. In addition, Belgian firms respond to national and sub-national regulatory pressures when choosing between a reactive and a proactive environmental management strategy. However, government environmental regulations have less influence on the choice of an environmental strategy in the case of an MNE. This conclusion holds for both regulatory pressures prevailing in home and host countries. The chapter's findings suggest no role for strategic policy-making, whereby stringent environmental regulations would lead to first mover advantages internationally, and strengthen the competitiveness of specific domestic industries (cfr. Nehrt, 1996). Moreover, these results also show that the

impact of national regulations, whether from home or host countries, on the behavior of MNEs is rather limited.

4.3 The impact of stakeholders on proactive environmental management

This paper has evaluated the impact of various stakeholders on corporate environmental management, with an empirical application to large polluting firms active in Belgium. The firms were classified according to their environmental management practices. Cluster analysis suggested a classification consisting of three environmental management strategies: (1) *reactive,* (2) *anticipatory,* and (3) *proactive*. Whereas many firms have already shifted from a reactive to an anticipatory environmental strategy, only a minority has adopted a proactive strategy.

Overall, regulators (central government and local public agencies) and international agreements were identified as the most important source of pressure inducing greater corporate environmental responsibility. It is doubtful that firms with a reactive environmental strategy would have considered environmental investments in the absence of any regulation. Moreover, the shift to an anticipatory environmental strategy appears to be motivated by a belief that prevention 'at the source' leads to lower pollution abatement and compliance costs.

Firms with a proactive environmental strategy do perceive regulatory pressures less strongly than firms with an anticipatory environmental strategy. This finding suggests that a shift tot truly green strategies may be achieved more effectively through cooperative efforts between industry and regulatory agencies than through conventional environmental policy (e.g. command and control measures, economic incentives). In fact, there is already a tendency for regulatory agencies to consult with industry before enacting or implementing new environmental rules, and a greater emphasis on voluntary regulation in most industrialized countries (Rugman, Kirton and Soloway, 2000). This tendency is also reflected in the post 1992 EU environmental policy. However, this voluntary approach needs to be combined with more a stringent enforcement of conventional regulation in order to also induce continuous improvements in corporate environmental performance within firms that do not view environmental issues as a priority.

This research supports the view that proactive environmental practices reflect a response to the changing norms and expectations of various stakeholders, other than regulators. However, not all stakeholders have been equally instrumental to proactive strategy. More specifically, the perceived contribution of business system stakeholders to the greening of strategic management, although clearly present,

appears to be rather limited, when size and industry effects are accounted for. These findings are in contrast with Henriques and Sadorsky's (1996, 1999). The latter results suggested that shareholders and customers in particular contributed very substantially towards a more proactive environmental management approach. This discrepancy may be explained by two institutional elements. First, stock markets have traditionally not been a key source of funding in Belgium, as compared to Anglo-Saxon countries. Second, Belgian firms tend to specialize in the production of intermediate goods. Their lack of direct contact with final consumers may help explain their apparent insensitivity to green consumerism. However, the situation prevailing for Belgian firms could change in the future, if a number of trends observed in Canada also took place there. First, environmental NGOs could indirectly become more influential by targeting some of their lobbying efforts towards consumers and investors. Second, regulators could use market instruments more extensively in order to change consumption patterns in favour of green products. Third, regulators could also rely more on liability charges for environmental damage, and bring environmental risks associated with particular environmental practices more to the attention of investors. Fourth, regulators could introduce more stringent environmental reporting requirements, making it easier for stock markets to reward leaders and punish non-compliers.

Finally, environmental NGOs and the media are not perceived as more important by firms with a proactive environmental strategy as compared to firms with an anticipatory or reactive environmental strategy. Thus, environmental NGOs and the media are not viewed, at present, as instrumental to the development of green strategies. This may be explained by these stakeholders' key focus on criticizing firms during environmental crises. Hence, these stakeholders should start adopting a more constructive approach if their aim really is to improve corporate environmental practices.

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DEVELOPMENT OF EVALUATION CRITERIA FOR THE ENVIRONMENTAL FISCAL POLICY OF PESTICIDES

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PART 1

Note:

This study consists of two parts: an environmental one and a socio-economic one. The environmental part of this study -presented in Part 1 of the report- was established by the Laboratory for Environmental Toxicology and Aquatic Ecology of the University of Ghent. The socio-economic part -rendered in Part 2 of the report- was realized by the environmental engineering office ECOLAS. Although both parts came about simultaneously, the report first deals with the environment, it tackles the socio-economic aspects in a second stage and concludes by linking the two in the decision tree. This summary only refers to the results of the environmental part. The socio-economic aspects and the decision tree can be found in the second part of the report.

Annually, 10 million kg of pesticides (in active substances) are used for agricultural purposes in Belgium. Furthermore, also the quantities used by industry (e.g. wood protection), public authorities (e.g. maintenance of green areas) and private persons (e.g. aerosols) (non-agricultural use) are not to be neglected. Only a limited part of the total quantities of pesticides used effectively reach their target. Given the possible harmful impact of these substances on ecosystems and on humans, it is necessary to reduce their use.

One of the economic instruments that can be used to this end are ecotaxes. As a scientifically based methodology for the levying of such taxes is not yet available, this study suggests the identification and application of environmental criteria/indicators for a number of pesticides: atrazine, simazine, diuron, isoproturon, dichlorvos, endosulfan and the wood protection substances arsenic pentoxide, chrome trioxide, potassium bichromate and copper oxide (Report: Part 1). Given the uncertainty with respect to the socio-economic viability of such taxes in a European context, the scope of the socio-economic consequences of levying taxes on pesticides in an international context is also identified and evaluated (Report: Part 2).

To allow for a risk assessment of the selected pesticides by means of USES and the defined risk indicators, an extensive study of literature was first carried out with respect to the environmental characteristics (exposure and toxicity data) of these pesticides. The results of this study are presented in chapter I of the report.

In the second phase of the study, the environmental effects studied during the first phase were combined to form indices/indicators. In order to have a frame of reference to test the applicability of these indices/indicators in predicting the risks that

pesticides entail for man and environment, detailed risk assessments were carried out for each active substance with the help of the USES 2.0 model.

The USES 2.0 (Uniform System for the Evaluation of Substances) computer model is a decision-support instrument for the assessment of the risks substances may entail for man and environment. The system can be used for risk assessment and prioritization of new and existing substances, plant treatment products and non-agricultural pesticides.

USES proceeds to a quantitative comparison of the impact assessment and exposure estimate results. For this comparison, it uses so-called risk quotients (RCR). A risk quotient is the ratio between the potential exposure to a substance and the level at which no harmful or well-described effects are to be expected. It allows for the determination of the probability with which negative effects may occur.

USES results for pesticides indicate that the compartments for which the limits were most often exceeded were surface water and soil. All assessed pesticides seem to carry a risk for aquatic organisms. Especially the use of diuron (agr and non-agr) bears a high risk (RCR: factor 10^4 to 10^5 above standard). This substance is followed (in decreasing order of risk) by: endosulfan, isoproturon, atrazine, simazine, dichlorvos and CCA.

Generally, the soil risk is smaller than the risk for the aquatic compartment. It appears from the assessment that endosulfan carries the highest risk for the soil ecosystem (RCR: 124), followed by atrazine, CCA, dichlorvos (agr), diuron (agr), isoproturon, simazine (agr) en dichlorvos (non-agr). Furthermore, for some pesticides, the exposure of birds and mammals to sprinkling water is risky. For atrazine (agr) and dichlorvos (non-agr), the safety value for man (MOS: 100) is not reached.

A global ranking of pesticides (man and environment) runs as follows:
diuron (agr) > atrazine (agr) > dichlorvos (agr) >
dichlorvos (non-agr) = simazine (agr) >
diuron (non-agr) = isoproturon (agr) = endosulfan (agr) >
simazine (non-agr)

To obtain an impact classification, environmental indicators can be used next to the risk assessment model. Environmental indicators are systems that (1) *quantify information* so that its meaning becomes clear immediately, and (2) *simplify information* with respect to complex phenomena. In the context of this study, it is indeed important to develop simple systems that can still adequately estimate the impact of pesticides on man and environment.

In the third phase of the project, a number of existing environmental risk indicators were critically assessed. Following on from this, a number of relevant indicators were withheld for further research: the Environmental Impact Quotient (EIQ), the Environmental Yardstick for Pesticides (EYP), Ipest, p-EMA and SYNOPS. These indicators were developed for the selected pesticides and tested by comparison with the results of the detailed risk assessment. This comparison led to the following conclusions:

Compared to USES, each indicator seems to reckon with only a limited number of parameters and environmental compartments. Furthermore, the different systems also use different methods (hazard based, risk ratio approach).

When globally ranking the pesticides with the help of these indicators, some clear differences come about compared to USES. As was already mentioned before, these variations are due to the difference in parameters, aggregation method and various models used.

Further research showed that the results obtained by means of the risk-based indicators (Environmental Yardstick and SYNOPS) are very similar to the USES results. A further division by compartment (e.g. aquatic environment) also showed a good correspondence between the rankings of USES, the Environmental Yardstick and SYNOPS.

The results showed that none of the existing indicators adequately quantified the environmental impact. Only SYNOPS and the Environmental Yardstick -based on the risk assessment principle: PEC/effect- seem to be suitable as a basis for building a new, more complete indicator.

Taking into account the findings above as well as the fact that the risk-based indicators gave the most comparable results, a new indicator was developed: HEPRIS (Human and Environmental Pesticide Risk Indicator). This indicator quantifies the environmental burden by supposing that it is the result of a combination of exposure and toxicity. Concretely, a Predicted Environmental Concentration (PEC) is defined for all compartments. Based on the impact data, a Predicted No Effect Concentration (PNEC) is laid down. For each compartment, the PEC and PNEC values are compared and added up to form a risk quotient. The following modules can be distinguished: aquatic ecosystem, soil ecosystem, birds, mammals, bioaccumulation, bees and groundwater. These modules are then combined in a total environmental score. Based on this value, a risk evaluation for the whole ecosystem can be given.

Apart from the risk for the environment, the risk for man is also calculated. To do so, a methodology from Norway is being used, which assesses the risk for man with the help of a qualitative method.

Based on both the risk for man and the risk for the environment, a summary score can be determined to obtain a final ranking of the pesticide.

A comparison of the HEPRIS indicator results for pesticides with the USES results shows that the results for the environmental module are more than satisfactory. As for man, these results are hard to interpret because of a lack of consistent validation systems. In each case, prudence is called for when interpreting these results.

To check its practicability, the HEPRIS indicator was submitted to a SWOT-analysis.

The environmental risk is estimated in a quantitative manner. Furthermore, the indicator's structure is such that the different modules can be assessed individually, and thus combined in various ways (flexible system). This approach also allows the user to adapt the indicator to local conditions.

The PEC calculation makes use of simple comparisons. It is clear that this method is but a very rough approximation of reality, compared to complex exposure models that can assess the environmental concentrations in a more precise manner.

The major weakness of this indicator undoubtedly is the method used to assess the risk for man. Contrary to the assessment of the environmental risk, a qualitative method is used. As was said, this method will be used until a sound quantitative approach is available. This means that models need to be developed that assess the exposure for man in a more correct and field-tested manner. Moreover, it is very difficult to integrate carcinogenic, endocrine, mutagenic, teratogenic and other effects in such a quantitative model.

The weighting of the ecotoxicological and human score is also prone to discussions. The method used here (average of both) perhaps is too progressive. More conservative approaches take the highest value to measure the risk in its totality.

To conclude, further research is necessary to lay down an optimal indicator that adequately assesses both the risk for man and the risk for the environment. In addition, the indicator developed here needs to be further validated for different pesticides. This would allow a refinement of the methodology that was put into place.

PART 2

Denmark, Sweden and to a lesser degree the Netherlands were the first OECD-countries taking initiatives in the field of ecotaxes on pesticides and relating them to broader policy changes in the framework of a more sustainable agriculture. The ecotaxes introduced by Denmark and Sweden are part of a pesticide reduction programme combining direct regulation, economic instruments, information dissemination and other flanking policy measures. These foreign experiences reveal that ecotaxation, combined with socio-economic correction measures, can generate beneficial results in the framework of pesticide reduction programmes.

In this study, the socio-economic consequences of a fictive ecotax in Belgium are examined for 10 chemical substances: atrazine, simazine, diuron, isoproturon, dichloorvos, endosulfan, arsenic acid, chromic trioxide, potassium dichromate and copperIIoxide. The additional costs are computed as well as the expected reduction in use of a number of ecotax scenarios for the most important user groups of the selected pesticides: families, agriculturers and the wood preserving industry.

In order to estimate the influence of an ecotax on the private use of pesticides, a survey was organised in a number of garden centres. The four herbicides atrazine, simazine, isoproturon and diuron were considered as a starting point for this survey. Endosulfan is used in a very limited amount by families, while dichloorvos is an insecticide and submitted to a different purchasing pattern. The results of the survey give rise to parameters concerning the use of and the purchasing behaviour of pesticides and concerning the price elasticity of demand for these products from families. Based among others on the foreign experiences, ecotax scenarios were chosen of 0,05 Euro[1] and 0,1 Euro per gramme active substance. From the results of the survey price sensitivity diagrams were derived for the different package volumes, containing the spread of acceptable prices as well as the optimal price. These diagrams allow to estimate the expected reduction in use in function of the price increase.

In the case of an ecotax of 0,05 Euro per gramme active substance, 15% of the families do not buy the pesticides anymore in a package of 0,1 kg (or liter); maximum 45% of the families do not buy them anymore in a package of 1 kg (or liter). In the case of an ecotax of 0,1 Euro per gramme active substance, these percentages respectively amount to 25% until 67%. The used quantities are expected to diminish

[1] Euro values based on BF-levels

with percentages between 9% and 37% in the case of an ecotax of 0,05 Euro and with percentages between 28% and 81% in the case of an ecotax of 0,1 Euro.

In order to reveal the socio-economic feasibility of an ecotax, the Household Budget 1996-1997 of the National Institute for Statistics was used as a reference point. The two ecotax scenarios only cause a limited influence on the income, which means that it is economically feasible to introduce the ecotaxes. In the case of the lowest income category, on which the tax has the largest influence, the mean expenses for cleaning and maintenance products (e.g. pesticides) increase with 23%. This corresponds to a very limited rise of the share of these cleaning and maintenance products in the income.

As the private use of herbicides in function of the human and ecotoxicological potential risk is classified in ecotax class IV, an ecotax of 0,1 Euro can be opted for. The use reduction percentages are in that case relatively larger than in the case of the ecotax scenario of 0,05 Euro per gramme active substance. On the other hand, the extra influence on the income is very small, i.e. an increase of the income share of the mean expenses with 0,19% for the lowest income category.

The socio-economic study of the consequences of an environmental tax on products containing dichloorvos allowed for non-agricultural use, indicates that especially the sale of insecticide release plates for household use would strongly decrease in the case of a tax of 0,05 Euro per gramme active substance. It is considered realistic that this sale would be cut off in the case of a tax of 0,25 Euro per gramme active substance, as is stated by the Follow-up Commission concerning environmental taxes. Against these expected socio-economic effects for producers and distributors, the remark has to be made that most of the aimed allowance holders offer alternative and less harmful products within the same use category.

During the information collection concerning the cost price of the pesticides for agricultural use, a large shortage has been revealed concerning the transparancy of the pricing process of these products formed by very confidential data as well as the fact that prices of pesticides depend on the quantity bought by the farmer at the end of an application year.

The three ecotax scenarios of the Follow-up Commission (0,05; 0,1 and 0,25 Euro per gramme active substance) were computed for the crops in which the active substances are used frequently and for which the pesticide cost per acre is available.

For these crops it was verified to which degree the Gross Standard Balance[2] decreases as a consequence of the different ecotaxes[3]. It is assumed that a decrease of over 10% of the Balance is socio-economically not acceptable. This means that a stronger fall of the Balance largely affects the competitiveness of these crops. If the ecotax scenarios lead to a socio-economically acceptable decrease of the Balance, it is computed what reduction in use can be expected, starting from a price elasticity of demand of –0,4.

For the cultivation of potatoes, an ecotax of 0,05 Euro per gramme endosulfan does not seem to be socio-economically viable. In the case of an ecotax of 0,1 Euro and 0,25 Euro per gramme active substance, the Gross Standard Balance even becomes negative. This means that employment within this cultivation comes under high pressure as a result of a possible ecotax. For the cultivation of maize as well as winter wheat and winter barley, ecotaxes of 0,1 Euro and 0,25 Euro per gramme atrazine (maize) and isoproturon (winter wheat and barley) also give rise to socio-economically unacceptable consequences.

For certain cultivations the socio-economic consequences of an ecotax are limited, whereas substantial reductions in use are possible. This is the case for the use of simazine and diuron in arboriculture, the use of simazine in the cultivation of peas and finally the use of simazine and diuron in half-standard orchards.

For some cultivations the socio-economic consequences can be rather limited, but the expected reduction in the use of the active substances resulting from an ecotax is too limited to attain the goal of the levy. Active substances and the corresponding cultivations to be ranged within this category, are simazine-strawberries and diuron-azaleas, begonias and cut flowers.

The calculations also demonstrate that an ecotax of even 0,25 Euro per gramme dichloorvos does not affect the Gross Standard Balance of the cultivation of tomatoes under glass and vegetables under glass in general. On the other hand, according to the Ministry of Agriculture dichloorvos is indispensable for the integrated protection of

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2 The Gross Standard Balance is the value of the gross balance corresponding to the mean Belgian situation for every agricultural production. The gross balance of a crop corresponds to the yields of the gross production or the value of the main and by-products, of which certain operational costs (e.g. pesticides) are subtracted.

3 The Gross Standard Balance “after ecotax” consists of the original GSB, of which the additional cost per acre is substracted, resulting from an ecotax on pesticides. This additional cost equals the ecotax value and consists of the used quantity of active substances per acre multiplied by the ecotax in BF (Euro) per gramme active substance.

vegetables under glass and a ban on dichloorvos would mean the end of this culture. Because of the large price inelasticity within these cultivations, it seems to be appropriate that dichloorvos is exempted of an environmental tax for the mentioned applications.

The wood protecting products within the use category “Wood protection products for which the use is not reserved” contain 0,1% and 0,2% of endosulfan, which means that a levy needs to be very high in order to produce a change in behaviour. Thus, an ecotax as instrument to stimulate a lesser use of products against woodworm with a base of endosulfan is not appropriate. Moreover, these products are not often used in practice and sufficient environmental friendly alternatives are available.

Within the use category “Wood protection products for industrial use”, an ecotax of 0,05; 0,1 and 0,25 Euro per gramme active substance would imply an additional cost of 198 to 1.611 Euro per m³ treated wood. This means that the cost of a m³ of treated wood can almost be doubled or even increased with a factor 6. Starting from a yearly production of 400.000 to 450.000 m³ treated wood, an ecotax can entail an additional cost for the wood preserving industry of 80 until approximately 726 million Euro. Comparing the current added value of companies with wood preservation as a main or side activity with the additional costs of a possible ecotax, the added value is smaller that the additional cost in the case of the lowest ecotax scenario. Moreover, these economic data are related to the main economic activity, possibly not wood preserving. This means that a part of the added value results from not-preserving activities, which can give rise to even more considerable socio-economic consequences. These substantial economic implications are confirmed by the results of a survey organised in cooperation with the wood sector federation.

The decision tree for the introduction of an ecotax in Belgium is based on the preconditions developed during the execution of the study at hand. Conclusively, it can be stated that the following aspects specifically need to be borne in mind:

- substitutes with a lower environmental and/or human risk need to be available;
- the ecotax cannot involve significant socio-economic effects for the target groups;
- in the case of predicted significant socio-economic effects, compensating measures need to be build in, so that the yield of the ecotax finds its way back to the aimed sectors/users.

The decision tree starts from the methodology developed in the framework of this project by the Laboratory for Biological Research on Water pollution (UG). The HEPRIS risk analysis classifies the active substances in 5 classes of environmental

and human risk. These 5 classes also form the basis for a potential ecotax level. The two lowest risk classes are not submitted to an ecotax. For the third risk class an ecotax of 0,05 Euro is taken, for the fourth class an ecotax of 0,1 Euro and for the fifth class an ecotax of 0,25 Euro per gramme active substance. Further, the introduction of an ecotax is dependant on the use of the concerning pesticide:

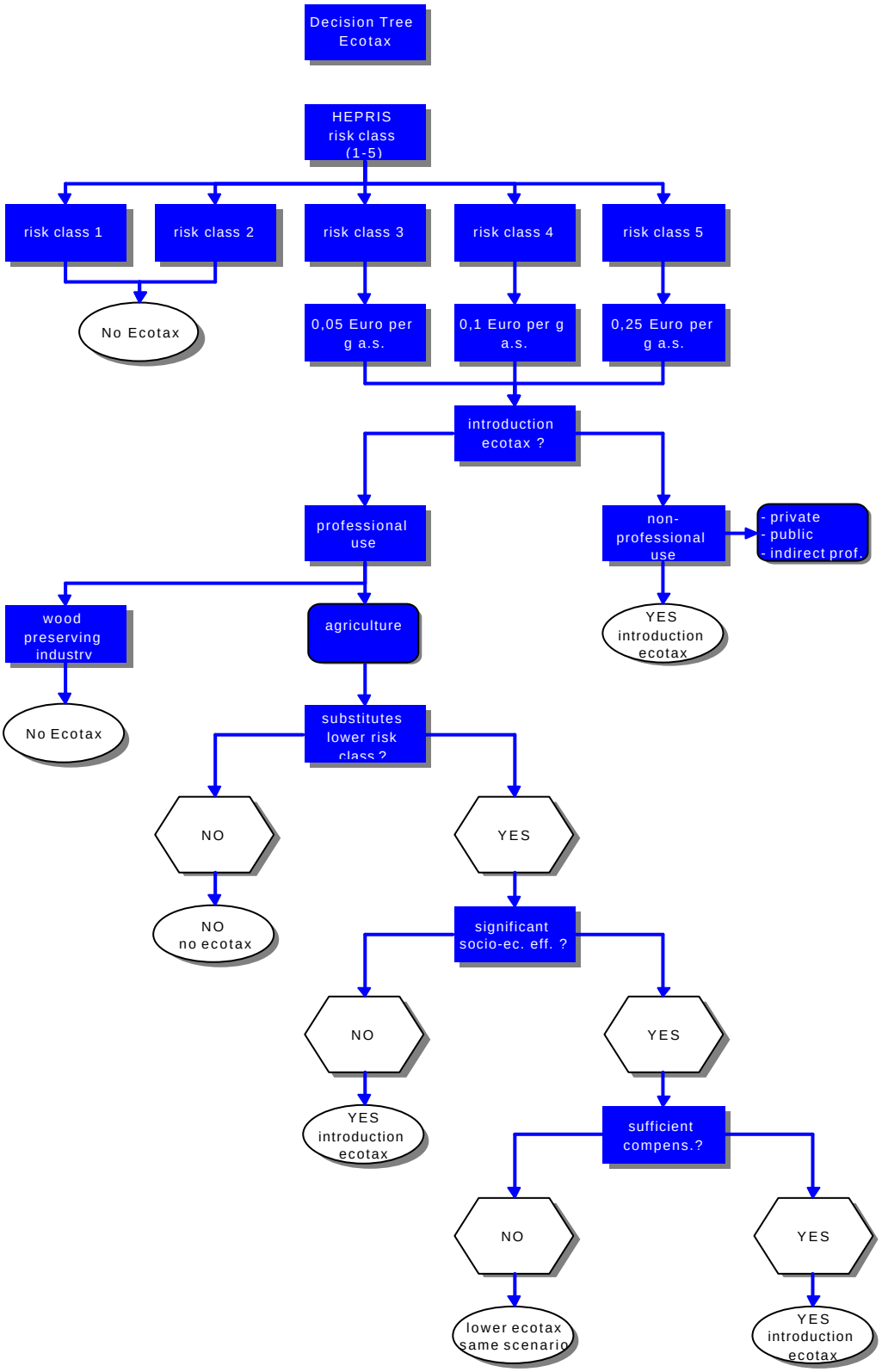
1. For non-professional users (private use, public services, industry except for professional users) the ecotaxes can be introduced. The study has indeed indicated that less harmful substitutes are available for the examined substances and that no significant socio-economic effects are expected.

2. For the professional wood preserving industry the ecotax cannot be introduced, as a result of the substantial socio-economic consequences prevailing from the study.

3. For the professional agricultural users, the decision tree is established in function of the availability of substitutes as well as the occurrence of significant socio-economic effects. If substitutes with a lower risk potential are available and the ecotax causes significant socio-economic effects (decrease of the Gross Standard Balance is larger than 10%), the introduction of compensating measures needs to be examined. If compensating measures are not possible to the extent that they rise the Gross Standard Balance up to a level of at least 90% of the Gross Standard Balance before introduction of the ecotax, the levy cannot be installed on the proposed level and the same decision methodology needs to be followed for a lower ecotax level (0,25 $\rightarrow$ 0,1 $\rightarrow$ 0,05 $\rightarrow$ 0 Euro/gramme active substance).

The decision tree has a logical as well as a theoretically correct structure that meets the preconditions within which an ecotax needs to be introduced. The target groups considered to be submitted to an ecotax are limited, which simplifies the application of the decision tree. In the view of a correct application of this tree, an important responsibility is preserved for the Follow-up Commission, considering its responsibilities in the framework of the Belgian ecotax agreement. In cooperation with the sectors submitted to an ecotax, the Follow-up Commission can apply the decision tree and judge which ecotax is the most appropriate in order to obtain its goal, i.e. a reduction in the use of pesticides with a high environmental and human risk.

Proposition of a decision tree for an ecotax on pesticides



HL/02/013

AN INTEGRATED APPROACH TO CHAIN ANALYSIS FOR THE PURPOSE OF CHAIN MANAGEMENT BY COMPANIES

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1. INTRODUCTION

The Centre for Sustainable development of the University of Ghent has finished A study concerning 'An integrated approach to chain analysis for the purpose of chain management by companies' ordered by the Belgian State, Prime Minister's Office, Federal Department for Scientific, Technical and Cultural Affairs (DWTC)

The project was carried out within the framework of the "Plan for Scientific Support of a Policy geared towards

Sustainable Development", within the section "Levers for a Policy geared towards Sustainable Development".

The project aims at an integrated approach, which implies here that it will focus on both environmental and social impacts. There is more to sustainable development than just environmental protection purely and simply: the social component (including the north-south question) is equally important.

When the attention of the company is not restricted to what happens within the company, but also includes the assessment and continual improvement in the other stages in the product's life (i.e. from the "cradle" to the "grave" - or from the raw material stage to the waste stage), it can develop a chain management. The analysis of sticking points which precedes this is known as chain analysis: by means of the chain analysis, a "snap-shot" is, as it were, taken of the development and use of a product from cradle to grave. "Flashing lights" are located at points along the chain were problems arise.

Underpinning the project are the following problem definitions:

The lack of a simple, easy-to-use framework for businesses in the implementation of chain analysis as a basis for a systematic approach in the quest for chain management;

The one-sided, environmentally related approach in cradle-to-the-grave evaluations from a product-based perspective (e.g. in the implementation of chain management) and the lack of consideration for the related social aspects.

2. GOALS

The precise objective of the project is to establish an initial framework for businesses in implementing a chain analysis as an instrument for generating options that enable chain management. This chain analysis entails an environmentally and socially based analysis of a manufactured product from a cradle-to-the-grave perspective.

Scientific objective:

The development of a theory for taking into account social aspects in a cradle-to-the-grave approach from a product perspective;

Build-up of experience and a critical evaluation of the methodology for the environmentally-based life-cycle analysis in the light of chain management, and using this in combination with the aforementioned theory for taking into account the social aspects. This combined approach shall be evaluated in practice using a case study;

Build-up of know-how and experience with respect to the systematic approach of chain management as an instrument for business.

Support of environmental and social policies :

The model developed during this project utilizing the methodology suggested above to explore both ecological and social impacts effected over the life cycle of a product, will provide a medium for product management. It might provide inspiration for instruments such as standardisation, eco-social labels , and product standards

Social objective:

This study establishes a framework for businesses, making them able to implement a concise chain analysis. This analysis will enable them to trace both environmental as well as social problems in the product chain.

The valorisation takes place through the creation of a brochure, articles and workshops.

3. METHODOLOGY

The first phase of the project involved the elaboration of a **theoretical model** to be developed for the evaluation of social and ecological aspects related to the life cycle of a product and its associated businesses. The aim was to arrive at an integrated approach. This theoretical phase focused mainly on a study of available literature. The initial step was to create an as broad as possible framework for a cradle-to-the-grave approach with respect to the social and ecological aspects.

The second phase aimed to put together a list of parameters, which could be used for establishing a checklist for a chain analysis. The checklist is required to identify the social and environmental aspects of the product's chain. The list is based on the theoretical exercise in the first phase.

Once the first two phases were completed, the checklist was sounded out in the real world (third phase). To this end, the theory was applied for two concrete case studies. On the basis of the findings of the case studies, both the model and the checklist were adjusted where necessary.

During the fourth phase attention was primarily focused on the valorisation of the study (brochure, workshop, publications,…).

4. STUDY

4.1 Theoretical part

4.1.1 Model

A study of available literature formed the first part of the study. At the moment many initiatives are being undertaken with respect to the social aspects of business practice. The landscape of social business practice is in a constant state of flux. The theoretical study was continued and various initiatives and their developments were described and/or analysed. In addition to the literature study various interviews were also held in order to be able to follow the fast-moving developments in this field. For the environmental part, a survey was made of various initiatives.

A theoretical model was made for chain analysis as an instrument for analysing the decision-making process for chain management in businesses. In developing this theoretical model, the LCA method was used for the environmental part. This method

was developed for environmental 'craddle to grave' analysis of products based on the flow of materials. During the study it was concluded that this LCA method was not applicable for analysing the social aspects. Social aspects depend on the management of companies and not on the flow of materials. They need a place specific approach.

The final model goes beyond a simple focus on the life span of the product by incorporating product based approach. It implies equally an organization-based approach. This twofold model outlines a step-by-step plan, the essence of which is to make a clear differentiation between criteria closely related to the product on the one hand, and organization-specific criteria on the other. For the analysis of the product related aspects a process tree is designed. The organization related aspects are studied within the framework of the production chain.

The product and proces related analysis concerns only the environmental aspects. The organization related analysis concerns both environmental and social aspects.

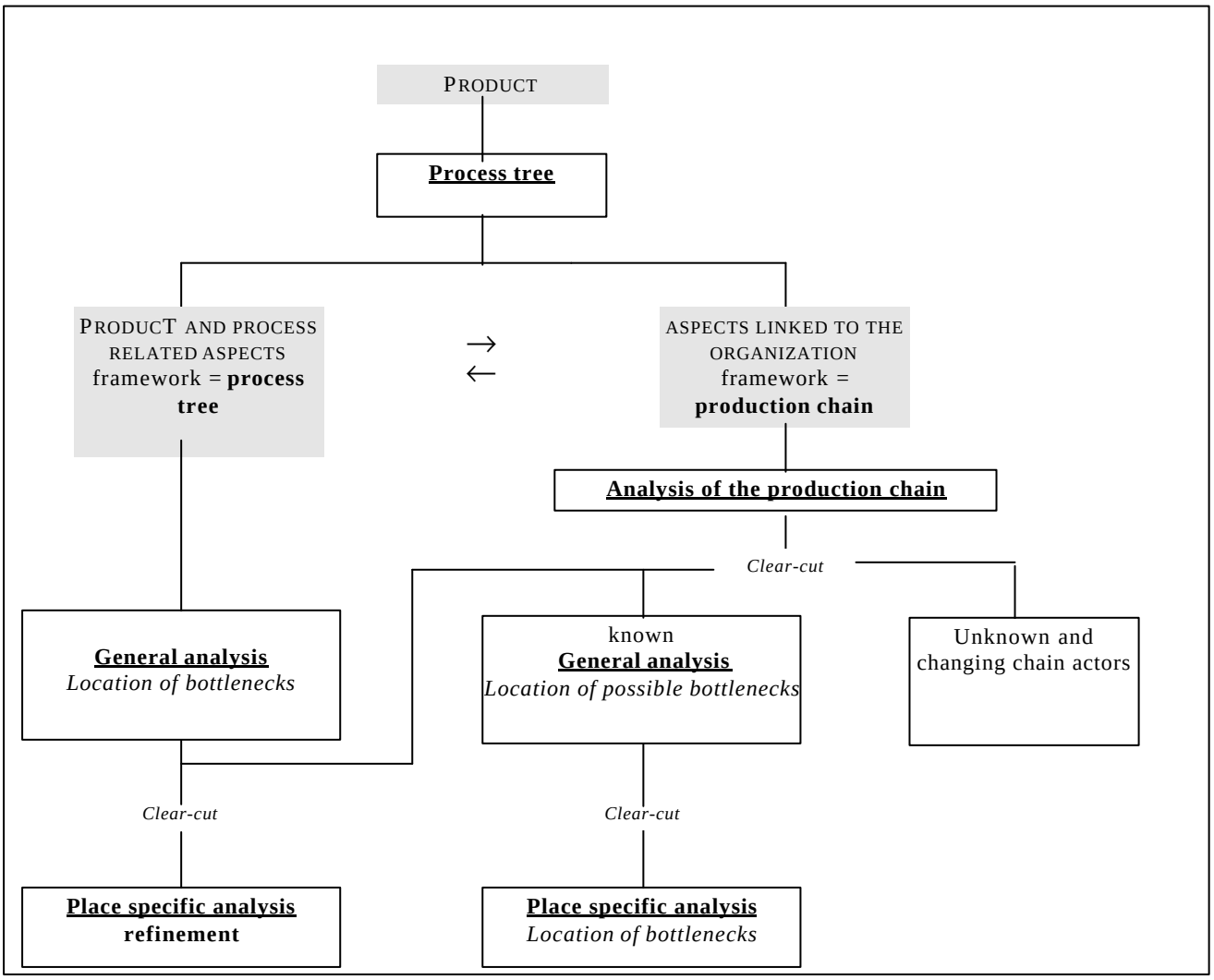

Figure: theoretical modal for an integrated approach of chain management

4.1.2 Impact categories

The study had to define the different impact categories to consider for the realisation of the chain analysis following the model.

For the environmental part the choice was based on the study of the different LCA's and the ISO 14040.

Environmental impact categories

Product related:

climat change;
stratospherical ozon depletion;
smog;
acidification;
nitrification;
renewable resources;
non renewable resources;
human toxicity;
ecotoxicity;
waste production;
odour nuisances.

Organization related:

noise nuisances;
affection of ecosystems and landscape.

For the list of the international recognised social impact categories, the study referred to the UN convention on the Rights of the Child, the Universal Declaration on Human Rights, the ILO Conventions and representative initiatives.

During the study of available literature, various initiatives relating to social management of companies, as well as different initiatives examining social policies were looked at more closely. One of the conclusions of this study was that there was a confused tangle of different initiatives undertaken from various perspectives, but that a gradual evolution could be identified. It can be said, for example, that the contents and/or the objectives of the various social business projects are all pointing towards an international consensus.

Social impact categories:

freedom of association and protection of the right to organise;

forced labour;
discrimination;
equal remuneration;
child labour;
wages;
working hours;
health and safety;
social security and contracts.

The study proposes a concrete definition of the criteria that are to be satisfied in all those categories, if a company wants to go for a sustainable management system. For the social categories an overview was made of the criteria that are to be satisfied. The environmental criteria were more difficult to express concretely. Few international environmental standards give clear environmental criteria for companies. The evaluation of the environmental impact has to be done by normalisation, comparison and benchmarking.

4.2 Checklist

A checklist was established within the framework created during the theoretical part of the project. This checklist was made for the use of organisations who want to make an integrated chain analysis of their products. This checklist contains a product related and a part related to the organisation. For each part a generic and a place specific approach are provided. The place specific approach is divided in function of the way the data are collected, and the persons that are asked to give the information.

4.3 Case Studies

The checklist was evaluated in the real world. It was read through and discussed by various experts, and was evaluated and adapted by using two case studies in which several companies were visited.

The underlying principles in making a choice for the case studies had to be:

- The business must be motivated to such a degree that it is prepared to incorporate the concept of sustainable development within the business strategy;
- The business' own product is required to have "footprints" in the South or East;
- The preference is for a simple product;

- The business where the product is manufactured is required to be representative of the business community.

A case study that satisfied specific criteria was planned for the third phase (see theoretical framework). Given the reluctance of businesses to co-operate it was not possible to work with a partner who met all the criteria. For this reason it was decided to carry out two case studies. The first involved a washing-up liquid concentrate produced by a company that promoted sustainability as a sales argument. The second concerned a T-shirt with a fairly fixed chain structure in India and imported by an organization selling fair-trade products from third world countries in Belgium.

The first study was exceptionally time-consuming and provided an example of the complexity of a chain for a commercial product. Many players in the chain were contacted by letter or by phone, and a picture of the chain began to form. The majority of companies insisted on confidentiality of information and refused to co-operate to any great extent. Because of the time limit, only some companies were visited.

In the second case study, the greater part of those involved in the chain were visited. Most of these were situated in two regions of India. This case study highlighted the problems of monitoring in a third world country.

The checklist was also implemented in test cases by the Fair Trade Charter in the Netherlands (garment industry) and by the University of Gayaquil in Ecuador (banana plantations).

4.4 Monitoring

An additional far-ranging investigation was carried out into the way in which monitoring can be conducted. The way in which the case study was carried out, particularly with respect to the social part, was decisive for the quality of the results. To this end a study of literature was carried out. In view of the fact that few studies exist on the monitoring of the social aspects of a company, a diverse range of contacts were made with the various organizations who are tackling this problem. Interviews were taken, a workshop and a training course for auditors were assisted. Currently a number of organizations world-wide have implemented trial projects in order to gain a better understanding of these problems. A number of networks have been established to co-operate in this field. A general picture was drawn of these problems and a proposal for a global structure for general monitoring was established.

4.5 Valorisation

A partnership with the Dutch Fair Trade Charter (Eerlijke Handelshandvest) was set up, and they used our checklist for carrying out the first case studies. A test will be carried out into how the monitoring of this Fair Trade Charter can be established in practice. They will ensure the necessary feedback.

Two workshops entitled *'Towards more sustainable development for businesses. Chain management and chain analysis'* were held that aimed at the main target group, the business community. Not only did businesses participate, but a great deal of interest was also shown from a variety of other disciplines, both from a social and an environmental perspective.

A project was worked out in collaboration with the University of Guayaquil at Ecuador. Some Ecuadorian banana plantations where monitored with the checklist. A report was written and the information was used to adapt the checklist.

The final report was distributed to different interested persons and institutes. It is available on the web site of the Centre.

A brochure was worked out in Dutch titled 'Chain analysis, a manual for companies'. It is available at the Centre.

Different articles where written and the project was presented at different lectures (annex 1).

Two conferences were organised titled 'The Companies aim to Sustainable development? Chain management and chain analysis.'

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The theoretical model developped during the study makes it possible to carry out a social and environmental chain analysis. The study concluded that product evaluation based on social and environmental criteria needs a twofolded analysis based on the proces tree for the productlinked aspects (LCA method) and on the production chain for the aspects linked to the organizations. The workability of the model was confirmed by the case studies.

For the product related aspects software tools were used to determine (by approximation) of the most problematic links of the chain. This allows on short notice get a view of the generic analysis. The results of this analysis depend on the sector of production and the kind of product. One of the conclusions is that the generic situation can differ from the real situation. It is recommended that the results be refined through a place specific analysis.

The collection of the data came up to be one of the most important bottlenecks of the analysis. The existing databanks for LCA are not sufficient. Also for the general organisation linked aspects there is a lack of accessible databanks.

Social criteria are culturally linked. It is not possible only to refer to international standards. National law and local customs have to be taken into account. Some items need also sector specific criteria. The determination of those national and sector specific criteria takes time. The data cannot be consulted at a centralised place.

The checklist has been developed as broad as possible. It can be refined for more specific uses.

In formulating the social criteria for the checklist a number of organisations were contacted who set up criteria for socially acceptable management in different forms. It included codes of conduct, management systems, fair trade practices, etc. A trend was identified towards uniformity in the criteria.

For each social item specific criteria based on international standards could be found. These concrete demands are internationally recognised as essential for responsible entrepreneurship. This is not possible for the environmental aspects. The evaluation has to be done by comparison.

Detailed chain analysis can only be done if the chain is controlled.

It is important to keep in mind that the analysis is just a "snap shot" taken at a specific time. One has to take into account the evolution in time.

The study demonstrated that the way in which organisations are monitored is of crucial importance to the results of the analysis. A survey of the most important aspects of monitoring and a structure in which the monitoring can be carried out were worked out.

5.2 Recommendations

… for companies

In the business world few initiatives combine social and environmental chain analysis. The model elaborated by this study is unique and makes this kind of analysis possible. This was demonstrated by the case studies. The instrument is still new and can be refined. It is possible to differentiate the check list per sector and per country. The workability of the tool can be worked out in collaboration with enterprises, unions or federations.

…for companies and the government

There is a need for organised and accesible data banks for the social and for the environmental aspects.

Data should be available by product, sector and country.

When a chain actor has very changeable suppliers it is more interesting to check the criteria that determinate the choice of the suppliers.

The way the monitoring of companies is done is of crucial importance to the results of the analysis. The study offers a structure and specific recommandations.

…for the government

The checklist can be refined per product group, sector and country. This will make it easier to do the generic part of the analysis. For the environmental part the existing LCA studies can be used. Research must be made possible to set up data banks and to update them.

Soft ware is mostly interesting for comparisons. A continuous qualitative survey of the existing software tools and data banks, and the publication of the results of those surveys is necessary.

For pragmatic reasons the chain analysis needs concrete standards for the environmental aspects that are based on international or European agreements, similar to the social part. They could refer to the international agreements of the UNEP (PIC list), OSPAR (lists of the North sea conference), etc… A permanently updated list is recommended. Scientific research concerning dangerous substances can be stimulated. The criteria of - for example - the eco-label could be used.

There is a need for an internationally recognised social standard, that gives minimum criteria for organisations that strive to a sustainable management.

In the same way that stimulation programs are issued for companies concerning innovation, ecodesign, and so on, there should also be programs that stimulate companies financially to accomplish chain analysis and chain management. There is an interest in 'sustainable entrepreneurship'. Companies have to take their responsability and be partners in 'sustainable' initiatives.

The checklist is exhaustive and can be used as a basis for instruments of integrated product management. The future policies of the government concerning integrated product management have to consider social and environmental aspects, and can use the theoretical developments of the study.

One of the possible applications of product policies is related to the building up of a system for an eco-social label. The study worked out a model for this label, that can be resumed as followed. The general criteria on an international level have to be set up following a democratic system that includes all stakeholders. Those criteria can be refined on different levels:

internationally per sector;
nationally in general;
nationally per sector.

The stakeholders will be involved at each level following a democratic system (with attention for minorities).

There will be a feedback (concerning the criteria and the composition and procedures of the study groups) with the higher level.

APPENDIX -VALORISATION

PRESENTATIONS

- 8 March '00: theoretical phase (Prof. B. Mazijn), presentation on the project in the “sustainable development” course at the University of Ghent (tutor: Prof. B. Mazijn)

- 15 March '00: practical phase (E. Borgo and S. Spillemaeckers), presentation on the project in the “sustainable development” course at the University of Ghent (tutor: Prof. B. Mazijn)

- 23 March '00: contribution to the "responsible business practice", organised by ABVV (E. Borgo)

- 10 May '00: 'Towards de-materialisation?' contribution to the training course of the environment co-ordinator, KMO educational institute - Management, Club Environmental co-ordinator 1999-2000 in Bruges (Prof. B. Mazijn).

- 11 May '00: contribution to the "sustainable development ", organised by HIVA (E. Borgo)

- 17 May '00: 'Towards de-materialisation?' contribution to the training course of the environment co-ordinator, KMO educational institute - Management, Club Environmental co-ordinator 1999-2000 in Bruges (Prof. B. Mazijn).

- 25 May '00: Contribution to the “Sustainable Development” workshop, organised by LUC in the framework of the "Special training for environmental co-ordinators" programme (E. Borgo).

- 14 december '00 ': Contibution to the seminar "Bedrijven op weg naar duurzame ontwikkeling ? Ketenbeheer en ketenanalyse." CDO, Gent, Centrum voor Duurzame Ontwikkeling (B.Mazijn, S. Spillemaeckers).

- 11 january '01: contribution to the seminar "Mapping out strategies for sustainable development: the multi stakeholder dialogue and vision building in the textile industry and consumption cluster" (S. Spillemaeckers).

LIST OF PUBLICATIONS

BORGO (E.) & SPILLEMAECKERS (S.), *'Eén stap in de richting van duurzame ontwikkeling"*, in : *De Morgen*, 25/08/1999.
(Newspaper article: "A step in the direction of sustainable development")

BORGO (E.), *"De LCA-methodiek : instrument voor het beoordelen van ecologische... én sociale criteria ?"* In : *Bedrijven op weg naar duurzame ontwikkeling ?* Informatiemap bij studiedag van 16 december 1998, Gent, Centrum voor Duurzame Ontwikkeling, 1998.
("The LCA Method: an instrument for evaluating ecological and social criteria", published in "Businesses on the way towards Sustainable Development", a workshop information folder)

BORGO (E.), *"Integraal ketenbeheer is meer dan milieu alleen"*, in: MAZIJN, B., "*Duurzame Ontwikkeling : socio-ecologische aspecten in mondiaal perspectief*", cursus, Gent, Universiteit Gent, academiejaar 1998 - 1999.
("Integrated chain management involves more than just the environment" in course book "Sustainable Development: socio-ecological aspects in a global perspective")

BORGO (E.), *"Naar duurzamere productie- en consumptiepatronen ? Over ecologische en sociale labels"*, in *Samenleving en politiek*, 6/1999, N° 7, pp. 36-42.
("Towards sustainable patterns of production and consumption? A look at ecological and social labels")

BORGO (E.), "*Theoretisch kader voor het ontwerpen van een checklist voor de uitvoering van een ketenanalyse"*, paper, Brussel, DWTC, 1998.
("Theoretical framework for the design of a checklist for the implementation of a chain analysis")

CDO, *'Internationale Handel'* in *Mens*, 1e kwartaal 2000.
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LAW & ECONOMICS OF THE CHOICE OF ENVIRONMENTAL POLICY INSTRUMENTS

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1. INTRODUCTION

The project Law & Economics of the Choice of Environmental Policy Instruments is part of two sections of the research program Levers of a Policy for Sustainable Development: the section Policy Instruments for sustainable development and the section Socio-economic consequences of a policy for sustainable development.

The interdisciplinary approach Law & Economics has been crucial in determining the concept and realisation of the project. Two teams provided the legal contribution: a team from the Fondation Universitaire Luxembourgeoise (Arlon) and a team from the Institute of Administrative Law of the K.U.Leuven. The economic contribution was the responsibility of the research group Energy, Transport and Environment, which is part of the Centre for Economic Studies of the K.U.Leuven.

The collaboration between legal scholars and economists lead to a - more realistic - economic conceptual model, which served to evaluate social costs of different environmental policy instruments. The interdisciplinary approach was an added value in the design stage of the economic model (selection of instruments; identification and ordering of cost parameters) and in the implementation of the model (valuation of parameters).

Moreover the interdisciplinary approach has led to the inclusion of monitoring and enforcement while modelling the environmental policy instruments. Traditionally environmental economists mostly tended to ignore monitoring and enforcement aspects. Most models assumed that firms would perfectly implement environmental regulation. In recent years, however, a considerable strand of literature has been developed dedicated to the study of economic aspects associated with monitoring and enforcement (for an overview see Cohen (2000)). However, for legal scholars it is self-evident that policy instruments, such as emission standards or environmental taxes, are only politically relevant if their compliance can be enforced. The core of enforcement consists of sanctioning instruments, such as fines, cessation orders or the withdrawal of licenses.

In order to model the monitoring and enforcement stage it was decided to use the concept of the regulatory chain. The notion 'regulatory chain' has a legal-technical basis. For an extended definition we refer to the doctoral research of C.M.Billiet[35]. It defines the successive stages in the lifecycle of policy instruments and consists of a

[35] Billiet, C.M., The administrative enforcement of environmental protection law. Legal aspects (diss.), U.Gent – Centre for Environmental Law, in progress.

rule-making stage, an implementation stage and an enforcement stage. Within this framework a functional analysis of the complementary relation between rule-making instruments (such as an obligation to use a particular abatement technology or to pay an emission tax) and enforcement instruments (such as fines or imprisonment) could be performed. In bringing together rule-making and enforcement instruments their matching potential was taken into account. A particular sanction can indeed be unsuitable to enforce one or more rule-making instruments.

2. OBJECTIVES

The project aims at the development of a methodology for the evaluation of social costs associated with different environmental policy instruments. Five aspects are particularly emphasised:

- The project aims at an interdisciplinary approach Law & Economics.
- The project takes the complete lifecycle of the policy instruments into account, including monitoring and enforcement.
- The project analyses a broad range of policy instruments.
- The project analyses policy instruments within an institutional framework.
- The project accounts for the whole of social costs (polluters, government and citizens).

We already elaborated on the first two points in the introduction. Here we focus on the other three aspects.

The selection of the rule-making instruments was limited to instruments that fulfil three conditions:

- Legally formalised instruments.

  Some instruments, such as environmental education, can be implemented without using specific legislation. Most of the environmental policy instruments, however, are formalised in legislation. These instruments were an obvious choice, due to the collaboration between law and economics. Their study valorises the legal know-how.

- Instruments that are implemented in Belgian environmental legislation.

Therefore, the project only involves instruments that have been published in legislation in the 'Belgisch Staatsblad' (Belgian Law Gazette). This choice excludes some instruments; the most noticeable example being tradable emission permits, which legally do not exist in Belgian legislation. The selected instruments do, however, include decennia of legislative practice and therefore form a wide spectrum. The idea was to develop the legal knowledge base about the different environmental policy instruments. Further, in order to obtain insight into the cost structure of instruments, it was more realistic to work with instruments that were already generally applied and used.

- Instruments that are binding.

  Through this condition, instruments – or at least certain variations of instruments – that have a mere indicative value are excluded from the analysis. This constraint followed from the decision to model the monitoring and enforcement stage. The sanctioning instruments under study, are typically associated with rule-making instruments that oblige to something, that impose to do or not do some particular action.

Alongside the choice to work within the Belgian legislative practice, we also decided to pay specific attention to the institutional reality within which environmental legislators work. The incorporation of these institutional constraints makes the economic conceptual model more realistic. A legislator always operates within the framework of a constitution. He is also bound to respect supranational obligations, such as human right treaties and treaties for the protection of the liberty to trade. This framework excludes certain specifications of instruments. For example, it is useless to model a fine without developing a – admittedly expensive – procedure of appeal. The constitutional framework can also have a similar cost increasing impact. For example, the Belgian constitution obliges the legislator to legally formalise taxes through laws or decrees, and this increases the costs of environmental taxation in more than one respect.

Our research takes the whole of the social costs into account. Therefore, we model not only the costs for firms but also for government and citizens. All costs, including control and enforcement costs, associated with the regulation are accurately defined and valued for the three actors. Up until now, these costs were often neglected or very crudely estimated. Traditionally environmental economics focussed on abatement and production costs associated with environmental regulation. However, in recent years the informational, legal and administrative costs are becoming more pertinent.

3. RESEARCH RESULTS

Results are divided into three categories: the instruments used by the Belgian environmental legislators, a theoretical general equilibrium model and a case study, including the estimation of social costs, using a partial equilibrium model.

3.1 Instruments used by the Belgian environmental legislator

The instruments used by the Belgian (unitary and federal), Flemish, Walloon and Brussels' environmental legislators were identified and analysed by studying the environmental legislation since 1946 in the authentic texts. The result can be consulted in table 1.

Legal classification	**Economic classification**
I. Rule-making instruments 1. Primary rules 1.1. Management rules 1.2. Commercialisation rules 1.3. Ecolabelling systems and ecolabelling duties 1.4. Emission taxes 1.5. Emission rules 1.6. Factor taxes 1.7. Usage rules 1.8. Usage rights 1.9. Immission rules 1.10. Location rules 1.11. Installation rules 1.12. Import and export limitations 1.13. Authorising notification duties 1.14. Environmental quality rules 1.15. Environmental subsidies 1.16. Rules concerning the composition or construction and other technical product characteristics 1.17. Rules concerning the composition or construction and other technical packaging characteristics 1.18. Objective liability 1.19. Design and construction rules 1.20. Product taxes 1.21. Product approval systems and product approval duties 1.22. Production quota and production bans 1.23. Project approval systems and project approval duties 1.24. Restitution duties 1.25. Safety distances 1.26. Safety and emergency duties 1.27. License systems and license duties 1.28. Sale and delivery rules 1.29. Transportation rules 1.30. Pollution bans 1.31. Removal and clean-up duties 1.32. Duties to take care 2. Secundary rules 2.1. Documentation duties 2.2. Record taxes 2.3. Recognition systems and duties 2.4. Notification duties	1. Standards 1. Emissions (J.I.1.5) 2. Immissions (J.I.1.9) 3. Products (output) (J.I.1.16, 1.21 en 1.22) 4. Input (J.I.1.16) 5. Technology and infrastructure (J.I.1.11 en 1.19) **Taxes and subsidies** 1. Emissions (J.I.1.4) 2. Immissions 3. Products (output) (J.I.1.20) 4. Input (J.I.1.6) 5. Technology and infrastructure (J.I.1.8) **Tradable emission permits** **Liability** (J.I.1.18) **Voluntary instruments /** 1. Publicity 2. Voluntary agreements **Provision of information** (J.I.2.1, 2.4 en 2.7) ***Penalties*** 1. Fine (J.II.2 and 8) 2. Imprisonment (J.II.12) 3. Plant closure (J.II.1)

2.5. Inspection and maintenance duties 2.6. Some design and construction rules 2.7. Supervision duties 2.8. Duty to guarantee **II. <u>Sanctions</u>** 1. Plant closure 2. Administrative fine 3. Administrative coercion 4. Restoration to the original condition 5. Withdrawal ex tunc 6. Emergency sanctions 7. Withdrawal ex nunc 8. Criminal fine 9. Regularisation order 10. Suspension 11. Confiscation 12. Imprisonment 13. Change of authorising conditions	

Table 1

Obviously this overview is open to further elaboration of knowledge and insights. The research material was very substantial and the analysis was often quite complex. However, this overview is without a doubt relatively complete and definite. It offers a reliable picture of the instruments used by the Belgian legislators since ARAB[36] 1946. This overview is, moreover, rather representative for the legislative practice in Western Europe. Other Western-European environmental regulators use similar rule-making instruments and associated sanctioning instruments.

3.2 General equilibrium model

General equilibrium models allow us to model and study the interactions between the polluting sector and the rest of the economy. The existing research in a general equilibrium setting shows that, when enforcement costs are omitted and therefore perfect compliance is assumed, emission taxes and auctioned tradable permits are the most efficient instruments if their revenues were used to reduce existing labour taxes. Other environmental policy instruments did not have this important advantage.

In a general equilibrium model including enforcement costs we show that this ranking of instruments not necessarily holds true. Reasons behind this are the differences in enforcement costs between instruments and the fact that revenues from fines (associated with all instruments) can also be used to reduce existing labour taxes.

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[36] Global regulation concerning the protection of labour conditions.

3.3 Case study in a partial equilibrium setting

In a partial equilibrium setting only the market of the polluting good is studied in the model. The rest of the economy is assumed to function normally[37] and not to interact with the market under investigation. Adding to this, that the production level of all firms on this market is fixed, we can concentrate fully on the study of environmental regulatory chains and their costs. The role of interactions with the rest of the economy we have already briefly discussed when describing the general equilibrium model.

A case study illustrates the partial equilibrium model. The case study involves the estimation of abatement costs by the textile industry situated by the Leie (a Flemish river). These costs depend, among others, on the environmental policy instruments in use and on the heterogeneity of the firms. Firms differ, after all, in location, history and production processes; this can lead to substantial differences in abatement costs. In the illustration we limit ourselves to the study of water pollution caused by BOD[38]-emissions of textile improvement firms and carpet producers.

Assumptions

Considering the inspection frequency we assume that every company is audited with a probability of ten percent by the environmental inspection agency. This value is based on a press release of the Ministry of the Flemish government on 11 June 2001. It states *'… that every class-I-firm is inspected thoroughly not even once every ten year'*. Moreover it is assumed that a firm in violation with the environmental regulation will have a higher probability of being inspected. This probability depends on the size of the violation. This variable part of the inspection frequency represents inspections conducted after complaints by neighbours, interest groups or civil servants other than environmental inspectors. The environmental inspection agency always reacts on such complaints (Milieuhandhavingsrapport, 2000).

In the model we take the different actors we distinguish in this project into account: firm, government and citizen. All possible costs associated with the environmental

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37 A partial equilibrium model is a sufficiently correct representation of the economy when there are no important distortions present in the rest of the economy.

38 Biological oxygen demand or BOD represents the amount of oxygen (mg/l waste water) certain bacteria use, in the course of five days at 20°C, in order to degrade the biological degradable material, more specifically for the oxidation of organic carbon to carbon dioxide.

policy can be included in the total costs. These costs are discussed in detail and estimated in our research.

Firms have to take two decisions: firstly they decide to which degree they will comply with the environmental regulation and secondly they determine which technology will be used to comply. These decisions are taken in order to minimise the expected costs.

Instruments: profile and selection of regulatory chains

We work with a limited regulatory model. The instruments we combine within this model are:

- Rule-making instruments: emission taxes, emission standards, technology standards, authorising notification duties and license duties;

- Implementation instruments: documentation duties, notification duties and inspection and maintenance duties;

- Sanctioning instruments: criminal fine, administrative fine, transaction offer, suspension, cessation order, regularisation order and withdrawal ex nunc.

For each of these instruments we have developed a profile, based on an analysis of the legislative framework (human right treaties and the constitution) and of the legislative practice since 1946. This instrument profile was adapted to the regulatory and political background of the case study. The building blocks of the instrument were subject of a cost analysis. Next an example of such a profile for the emission standard is given.

Emission standards determine the allowable emissions or introduction of pollutants by humans in water, atmosphere or soil. They can prohibit or limit emissions. Emission limitations can be limiting in location, timing or quantity.

In light of the comparison we make between emission standards, emission taxes and technology standards only the emission limitations are relevant. We therefore do not discuss the emission prohibition.

The regulator, who designs an emission limitation, has to determine several elements. If he opts for a quantitative emission limitation, he has to select a *parameter* and the *unit* in which it is expressed. He has to *value* each parameter in the selected unit. In principle, he also has to decide on the *measuring method* (method of sampling, analysis and interpretation of results). In order to implement and enforce the rule it is necessary that the point of emission is accessible and

measurable. An obligation to install *measuring devices* and an *obligation to perform and register measurements* can be added. The legal formalisation of the whole should happen through a law or decree (mainly for its legal basis) and through executory decisions (technical aspects) (decision corpus and appendices). As will be clear later, it can, moreover, be necessary to systematically arrange certain aspects on the level of individual administrative decision.

Emission limitation aimed at reducing water pollution use physical, chemical and microbiological *parameters*. In general physical parameters are expressed in specific *units*. Temperature and acidity of water, for example, are respectively expressed in degrees Celsius and pH. Chemical and microbiological parameters are mostly expressed as concentrations (quantity per unit of volume). When emission limitations concern emissions in water, simple concentrations, such as microgram per litre, are since the eighties no longer in use; concentrations linked with a reference volume or exceptionally with the output quantity or production capacity are now in use. The objective of this approach is to make the policy more than a dilution policy. The combination with the reference volume or with production data immediately implies an effort level for the polluter to reduce emissions. This combination expects the determination of the allowable values on a regulatory scale (sectoral reference volume or sectoral coupling with production data) and the determination of the license itself. The determination of the license is a rescaling of the regulatory determination in light of the relevant firm data. We decide to model the chemical and microbiological parameters as concentrations combined with a sectoral reference volume, with rescaling based on the individual license.

The *values* chosen mostly are a combination of an immediate value and a calculated value based on the average value over a short time period, namely one day (24 hours). Obviously the immediate value is less stringent than the average value. We opt to model the combination of an immediate value with a value averaged over 24 hours. Moreover, the legislative practice only deals with emission limit values. The determination of measurement methods has recently become common practice; this greatly improves the knowability of the rule. We, therefore, only use emission limit values and presume that the measurement methods have been defined.

The *accessibility and measurability* of the effluent point is most efficiently organised by means of a general statement that dictates that this point and its access roads should always be easily and safely accessible and should safely allow measurements and sampling. This is, therefore, the way we assume this aspect to be handled in the remainder of our analysis.

The obligation to install *measurement equipment* and to *perform and register measurements* is often imposed. We choose to model the emission limitation both with and without obligation to install measurement equipment and to perform and register measurements.

The instruments were combined into regulatory chains for further research and are mentioned in table 2.

Chain	Rule making	Implementation	Enforcement
1.	Emission tax	Documentation duty Notification duty 2	a) Criminal fine b) Administrative fine c) Transaction offer
2.	Emission standard (1)	Inspection and maintenance duty	a) Criminal fine b) Administrative fine c) Transaction offer
3.	Emission standard (1) Authorising notification duty	Inspection and maintenance duty	a) Criminal fine b) Administrative fine c) Transaction offer
4.	Emission standard (1) License duty	Inspection and maintenance duty kennisgevingsplicht 2 Inspection and maintenance duty	a) Criminal fine b) Administrative fine c) Transaction offer
5.	Emission standard (2)	Documentation duty Notification duty 1	a) Criminal fine b) Administrative fine c) Transaction offer
6.	Emission standard (2) Authorising notification duty	Documentation duty Notification duty 1	a) Criminal fine b) Administrative fine c) Transaction offer
7.	Emission standard (2) License duty	Documentation duty Notification duty 1 Notification duty 2 Inspection and maintenance duty	a) Criminal fine b) Administrative fine c) Transaction offer
8.	Technology standard	Notification duty 1 Inspection and maintenance duty	a) Criminal fine b) Administrative fine c) Transaction offer
9.	Technology standard Authorising notification duty	Notification duty 1 Inspection and maintenance duty	a) Criminal fine b) Administrative fine c) Transaction offer
10.	Technology standard License duty	Notification duty 1 Notification duty 2 Inspection and maintenance duty Inspection and maintenance duty	a) Criminal fine b) Administrative fine c) Transaction offer

Table 2

3.4 Cost factors and cost analysis

We identify cost factors that result from the legal context and from the instrument itself. The cost factors resulting from the legal context are:

- guarantees required for civil rights;
- guarantees required for criminal pursuits;
- the possibility that an instrument is unavailable;
- uncertainty about the competency status of an instrument or a variation thereof;
- dysfunctional structure of the instrument due to limitations in the division of competencies;
- structural susceptibility of the instruments for violations of the equality principle or the discrimination injunction

The cost factors resulting from the instrument itself are:

- sustainability
- technical content (environmental and legal)
- knowability
- rules which require a procedure to be implemented
- legal formalisation
- time profile in the implementation stage
- rules which require an administration as implementation partner
- flexibility
- clustering (necessary versus advisable)

For each of these cost factors we have performed a relative valuation per instrument and taken into account the different stages of the regulatory chain as well as the information question.

For firms these costs consist, among others, of abatement costs, of expected fines when violating the environmental regulation and of costs associated with the extra administrative obligations. Managers, for example, have to stay on top of the different regulatory obligations and their consequences for the company. If necessary they have to request a license. They have to collect information about the different technological possibilities in order to comply with the regulation. Possibly employees will need extra training. The firm also incurs costs of the yearly tax assessment. Data have to be collected and filled in. Calculations have to be made. Moreover firms need to perform measurements in order to determine its actual emissions. Firms will also have to accompany the inspectors, when it is being inspected, and will have to perform a contra-analysis if necessary.

For the government costs are incurred, among others, during the legislative process (e.g. meetings with interest groups, with administrations and with experts; asking the advice of the Council of State; the publication in the Law Gazette…). Moreover there are also costs connected with the implementation of procedures (e.g. licensing procedures) and with the spreading of information about the new environmental policy. We also take the costs into account associated with the inspections on site and law suits.

Citizens, for example, incur costs when lobbying. Other costs are, e.g., associated with procedural rights (e.g. use the right to look into records, file an appeal concerning licences).

These costs (can) differ from instrument to instrument. The managerial costs associated with monitoring and enforcement will only be attributed to companies that are actually inspected.

Results

In order to be able to compare alternative regulatory chains, the total welfare costs that are necessary to reach one particular level of emissions, are calculated for different combinations of instruments. The choice of the regulatory chain determines how firms, government and citizens act and what the associated costs are. Total welfare curves (firms, government and citizens) of a regulatory chain are the most important output of this model. An example of our results for regulatory chains containing a transaction offer is found in figure 1.

The global welfare functions associated with each regulatory chain lead us to eight key observations.

1. Firstly we see that it only pays to pursue an environmental policy if the resulting emission reduction exceeds a minimum amount. The main reason behind this observation is that there are fixed costs linked with the environmental regulation. Only if the corresponding environmental benefits are high enough and exceed the fixed costs, it is worthwhile to implement an environmental policy.

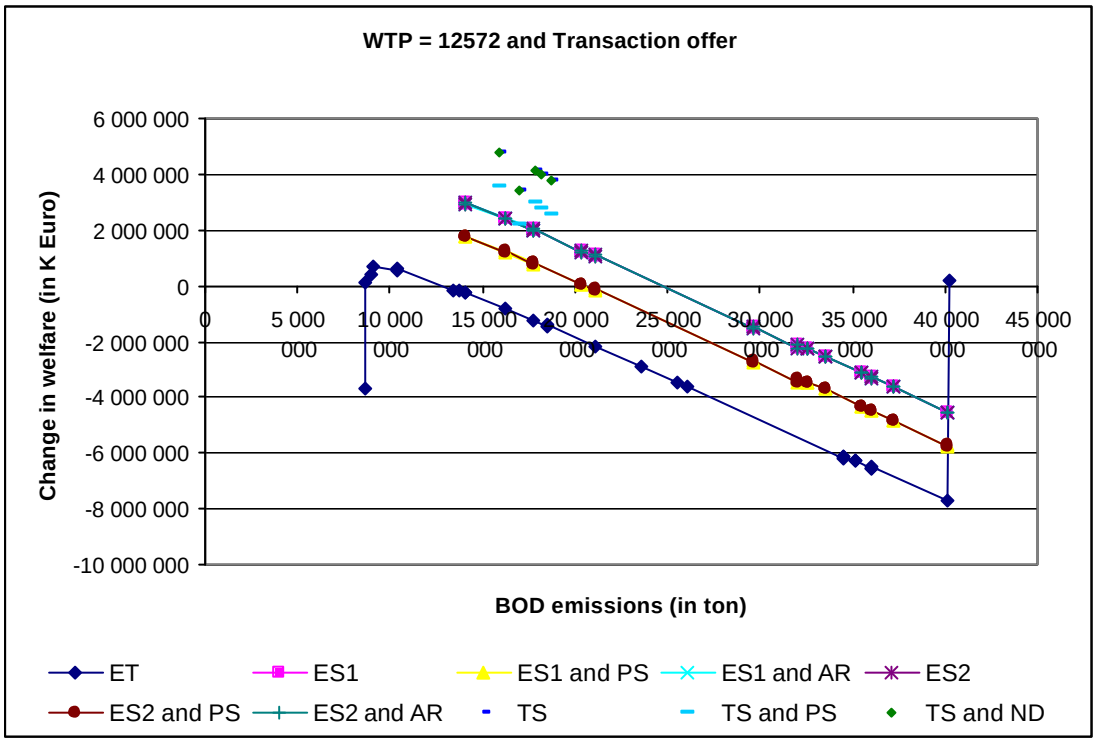

Figure 1[39]

2. Secondly, in order to obtain a given emission reduction, the emission tax turns out to be the most expensive instrument. Using a technology standard leads to the highest welfare level. However, the use of this instrument is extremely limited since it can only reach as many levels of emission reductions as there are abatement technologies. This result is highly sensitive to changes in monitoring and enforcement parameters and to the implementation procedure for emission taxes used in Belgian environmental law.

3. Thirdly we find that, given the currently assumed enforcement policy, an emission standard can only limit emissions to a certain extent. It is impossible to obtain the maximal possible emission reduction even if we set the standard equal to zero

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39 Abbreviations are: emission tax *(ET)*, emission standard version 1 or 2 *(ES 1/2)*, technology standard *(TS),* authorising report *(AR)* and license system *(PS).*

and thus allow for no emissions at all. The reason is that current enforcement is not stringent enough; so that it does not pay for the firms to invest in very costly abatement. They prefer to take the risk of getting inspected and caught.

4. Further we compare three different variations of the emission and technology standard. Adding an authorising notification duty to a standard only minimally increases the associated costs. Including the standard in a license system, on the contrary, markedly increases costs.

5. Costs associated with implementation instruments are generally low but the cumulative effect can cause costs to increase considerably.

6. The criminal fine is by far the most expensive instrument to use and, as could be expected, the transaction offer is the cheapest to use. However, in reality these three instruments are often used as complements. For minor violations, a transaction offer will often suffice. A criminal fine will be used for serious violations or extremely uncooperative firms. The administrative fine also has its specific use. Using an administrative fine avoids the social stigma associated with criminal fines. Therefore we cannot a priori choose one of the enforcement instruments as being 'the best'.

7. Sensitivity analysis shows that the results are – in certain aspects – highly sensitive to the differences in willingness to pay for water quality improvements. The higher the willingness to pay for the improvement in environmental quality, the more it pays to pursue an environmental policy even if emissions are only minimally reduced. Remarkably, the changes in willingness to pay do not influence the relative position of the different instruments. The emission tax remains the most expensive and the technology standard the cheapest.

8. Sensitivity analysis with respect to the enforcement parameters (fixed inspection probability, coefficient of variable inspection probability and the penalty coefficient) shows their immense importance. Choosing the optimal level of the parameters is crucial to the decision of the appropriateness of environmental regulation. Changing the level of the parameters can suddenly make a policy worthwhile pursuing.

In conclusion we can say that a detailed identification and estimation of information, monitoring and enforcement costs associated with an environmental policy, can greatly change traditional results with respect to the relative efficiency of instruments. Our numerical illustration proves this point by showing how an emission tax can be the most expensive instrument to use in order to obtain a particular level of

environmental quality. This result holds even if we include heterogeneity of the industry into our model.

Moreover we have also shown that it is important to use a correct estimate of the willingness to pay for environmental improvements but that is even more important to formulate an appropriate monitoring and enforcement policy. The decision of whether or not to pursue an environmental policy depends on it.

4. PERSPECTIVES FOR APPLICATION

Firstly the project enlarges our knowledge of environmental policy instruments by developing criteria for a systematic assessment of the instruments' performance.

The instrument profiles we constructed for the analysis and definition of different environmental policy instruments, are, without doubt, useful for further legislative work.

The economic conceptual model we constructed, is an instrument to assess and order the relative cost efficiency of regulatory chains. It offers a methodology for further research of other instruments, such tradable emission permits. The systematic investigation of the cost efficiency of policy instruments, is, according to us, an indispensable step in pursuing an efficient and effective environmental policy.

This research also showed that the inclusion of all costs – or at the very least as much as possible – has in important impact on the relative efficiency of environmental policy instruments. Instruments, such as emission taxes, that are traditionally described by economists as being highly cost efficient, become much more expensive when all rule-making, implementation and enforcement costs for firms, government and citizens are included.

One of the most interesting conclusions we can draw from this project is, according to us, the importance of a well-developed monitoring and enforcement policy. Without a clear and effective enforcement policy the impact of the environmental regulation will be minimal. From the results we obtain, one can clearly see that an optimum can be reached when designing an enforcement policy. This optimum is somewhere between the total lack of enforcement and complete and full enforcement. It is, therefore, advisable to weigh benefits of enforcement and associated costs carefully.

This research project has built a framework for interdisciplinary collaboration on the field of Law & Economics concerning environmental policy. The cooperation between legal scholars and economists has provided both disciplines with important insights

and clarifications. We will build on this cooperation when working on the PODO II-project ‘Law & Economics and the enforcement of environmental regulation’ (2001-2004).

HL/01/001

TOWARDS A SOCIAL PACT IN SUSTAINABILITY MATTERS: CONCLUDING RESEARCH REMARKS ON PARTICIPATION IN THE BELGIAN SUSTAINABLE DEVELOPMENT POLICY CONTEXT

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1. INTRODUCTION

The PODOI research project titled “Towards a social pact for sustainable development” has focussed on the study of paricipatory processes in the Belgian policy making context. In the process we have first conceptualised sustainable development as a policy concept and have analysed how it is operationalised in actual policy making on different terrains. That part of the research has been reported in several contributions to the DWTC paper series and elsewhere. In this contribution, we wish to draw a number of conclusions on the participatory context of sustainable development, based on the observations we have made during the last 5 years of research. In that sense it is not a theoretical reporting, but rather a policy oriented set of “reality checks” that build on field research.

The assumption in most literature on the societal and political aspects of sustainable development seems to be that sustainable development in general and environmental policy-making more specifically require a different form of relationships between the state and civil society. The literature often refers to 'green policy-making' as a more participatory and integrated process involving new actors and new forms of decision-making processes. These involve new institutional arrangements, new information needs, a different science base, a shift in the relationship between the state and certain sectors of society which have been previously labelled as 'suspicious' (e.g. the green movement), etc.

Based on an analysis of the Belgian model of state-society relations and participatory practices on environmental issues and sustainable development I will test whether this underlying assumption to which so much lip-service is paid is correct and if so, which form and content this new form of state-society relations has taken.

Important questions for this analysis include whether environmental policy making and/or the wider topic of sustainable development are really opening up the process for new topics, actors, ways of making and implementing policy and finally whether has it led to any results in terms of institutional changes, and the effectiveness of environmental policy-making.

The starting point for my argument is the fact that sustainable development is more than anything else a proces of social change. This supposes that social actors modify their social interaction and behavior in the direction of a more sustainable society. The implicit hypotheses in the discours of most policy-makers and theorists is that this modification can only be attained through a proces of true social participation.

For the purpose of my analysis, we will define participation much broader than what is usually done in the academic and practice oriented policy literature. This literature seems to suggest strongly that participation is a matter of representation of traditional representative groups –social movements- in formal advisory bodies. Participation is thus reduced to a proces for specific groups which provides input in certain policy-making proceses at certain policy-making levels. Although we recognize this form of participation as important, we wish to discuss the limitations of this approach and the dangers associated with it. This will be done in light of the participatory history of another important project of social change from the past wich has largely defined the context for policy-making participation, interest group representation and the broader societal role of social movements in Belgium (and much of North Western Europe), namely the evolution towards a consultative welfare state model. We will compare the participatory logic behind the current position of labor unions and draw a comparison with the current theoretical approaches and praxis concerning sustainable development issues.

2. DEFINING PARTICIPATION IN POLICY-MAKING CONTEXTS[40]

Participation has been central to the development of the concept of sustainable development as a policy discours. The Brundtland report 'Our Common Future' (1987) defined it as a necessary condition for sustainable development. It talked about "a political system that secures effective citizen participation in decision-making"[41]. The same emphasis was present during the UNCED-conference in Rio (1992). In each of the five agreements coming out of Rio the need for participatory decision-making is underlined. Principle 10 of the Rio-declaration puts things very clearly: "Environmental issues are best handled with the participation of all concerned citizens, at the relevant level".[42]

In addition, participation is omnipresent and central in Agenda 21; the concept of participation is woven through the 40 chapters. Chapter 23 is completely devoted to the input of social groups. The idea that development has to go hand in hand with the active input of a well informed society to be called 'sustainable' is increasingly

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40 This part of the paper is an abreviated version of former research reported in light of the PODOI program funded by the OSTC.

41 WCED. Our Common Future. (1987)

42 The Rio Declaration on Enivronment and Development (1992).

accepted. To support this reasoning, a number of 'advantages' of participation are mentioned in the literature.[43] First, the active involvement of civil society brings new ideas, diverse experiences, and expertise to the policy process and hence encourages and supports the development of alternative policy options and outcomes. In this way the knowledge base of traditional policy-makers is broadened. Second, participatory policy-making reduces the risk for conflicts. Third, participation provides the possibilities for cooperation and coordination between governments and civil society, which increases mutual trust and long lasting co-operative networks.
Given the positive expectations attached to participatory processes, "sustainable development" has implicitly become a normative prescription for state-society relations. The official discourse as well as the academic and social movements literatures on sustainable development seem to suggest that the project of sustainable development will *require* not only a change in the content of policy-making (e.g. more attention to environmental issues in economic or energy policies) but also in the form and procedures of the process. Changing the policy process hence becomes a normative prescription to reach the ultimate goal of sustainability.

Examples of this reasoning can be found in the international policy documents which officially define the context for sustainable development policy-making. Agenda 21 defines the problem as follows:

Prevailing systems for decision-making in many countries tend to separate economic, social and environmental factors at the policy, planning and management levels. ... An adjustment or even *a fundamental reshaping of decision-making*, in the light of country-specific conditions, may be necessary if environment and development is to be put at the center of economic and political decision-making. (Agenda 21 chapter 8, 8.2)[44]

The fact that Agenda 21 puts so much emphasis on the participatory role of the so-called 'major groups' underlines the issue at stake. Agenda 21 is full of recommendations to change policy making toward an inclusive process with room for discussion, joint design and joint implementation of policies. It suggests a multi-stakeholder type institutional approach with the goal of empowering citizens and creating social partnerships. This also includes transparency in decision and policy making and an improved and stronger institutional capacity.

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43 Organization of American States (1999).

44 My emphasis

3. THE DEFINITION OF PARTICIPATION

3.1 A broader view on participation

For a concept that is so central to sustainable development, participation is strikingly poorly developed in the literature. The implicit assumption is that participation is primarily or even exclusively played out in the sphere of formal political interaction. That is, a number of groups are chosen to represent society in institutions designed to let them voice opinions which will then be used by politicians and public servants as input in policy-making processes. In the sphere of sustainable development, this approach finds an emanation in a number of traditional advisory bodies for environmental policy-making, socio-economic policy-making and more recently in advisory bodies especially set up for sustainable development issues, e.g. the national councils for sustainable development. This seems to be, as we will try to demonstrate, a rather narrow and in addition not very fruitful conceptualization of participation. Participation according to its ethymological meaning signifies the following: to be a part of, to have a part in, being a member of, to work together on something, consultation, co-decision.

It is important to notice that nowhere have we found a definition of participation that is limited to the dominant policy praxis, namely: “participation is the right of groups to have a seat in consultative bodies where they are allowed to voice their opinion.” To the contrary, from the definitions mentioned above we can conclude that participation is a much broader concept. It includes many more forms and is more action oriented than the dominant paradigm suggests. Using the meaning of participation in “normal” language we translate the aforementioned definitions in the following broad conceptualization of the participatory dimension of sustainable development:

Participation is the fact that social actors are contributing consciously through their social actions to the process of social change in the direction of a more sustainable society.

This approach is also congruent with the history of social movements and their role in processes of social transformation. Starting from this approach a number of issues and misunderstandings become clear and can be eliminated.

1. The participatory dimension is not limited to the political arena: several activities which fall under the term *social actions* can be part of the participatory context of sustainable development: people’s economic activities as producers and consumers, people’s political actions as voters or as public figures, artistic expressions, religious

activities with public orientations, ethical dimensions of all sorts of “normal”activities, etc. This basic point broadens the scope of participation enormously and at the same time puts an emphasis on the responsibility of multiple social activities.

2. The participatory dimension is *not necesarily limited to the activities of collective actors*; individuals are full actors in the process as well.

3. Participation supposes a link with a broader societal context. My definition looks at social actions of people and groups in function of a process of societal change. This presumes consious interaction with other social actors (individuals or collectivities) aimed at the modifications of social institutions. Institutions in this context are to be understood as certain forms of social interaction that are driven by codified social norms. These institutions can be formal (E.g. consultative bodies, the educational systerm) or informal (e.g. the free market economy) and they can be inside or outside the formal political arena.

4. The social institutions and the process of social change can be seen as directly impacting individual social actors or can be defined in a broader social context. This is important because there seems to an underlying assumption that participation is somehow connected to a macro-context and has little relevance for the individual context of social actions of individuals.

5. Participation is explicitly not to be confused with consultation. Certain forms of consultation are participatory in nature, but consultation is just one of the many forms participatory interaction can take.

It is clear that participating in the process of sustainable development is much broader than generally presented in the literature or the realization thereof in participatory practices. This is important because the discourse on participation is largely going in one direction (consultation) and is usually affirming the dominant way of societal organization with a strong prevalence for the state as main actor and point of reference. By explicitly not doing this in our theoretical conceptualization of participation we do not mean to go to the other extreme and claim that the state is not an important actor in or a forum for participatory practices. We wish to look at participation and the state, however, as a form of participation that can or cannot be useful to come to certain forms of desired social change.

3.2 Political participation

After having defined the broader context of participation we can now direct our attention to collective political participation without putting it forward as an exclusive

or even privileged form of participation. From the international reference texts which were mentioned at the beginning of the paper we can distil a number of crucial elements for political participation in light of sustainable development.

1. There is a mentioning of participation as taking place in different *political systems*. Linked to this concept are a number of mostly implicit assumptions about the functioning of political systems. This means in concreto that not all political systems are equally adapted to incorporate the participatory dimension of sustainable development. It is obvious that the permeability of the state and state institutions are very much dependent on the kind of political system. In other words, the institutional setting in which participation takes place has large consequences on its appearance, its form, content, output and effectivenss.

2. The concept of *citizen,* as used in the Brundtland report, is refering to the political-social dimension of each individual person. This dimension can be individually or collectively defined and lived. Agenda 21, however, is priveledging the collectivity by refering to *social groups*. This is important for a society in which a long tradition of collective action exists that is personified by the role of institutionaliszed social movements.

3. The reference to *decision-making* suggests that participation is possible in the full cycle of policy-making processes. It can be therefor be integrated in the agenda-setting, the actual policy development fase, the implementation fase, the control fase, the evaluation and the feed-back fase. This is an important point because most of the literature and most practices put a lot of emphasis on the agenda-setting stage and to a lesser extend on the feed-back fase. The fases of actual policy-making and policy-implementation are much less mentioned when it comes to participatory practices. However, those are precisely the most important fases in terms of impact when it comes to policy-making.

4. There is often mention of *effective* participation. This presuposes two important realities: first, ineffective participation also exists. This seems like a self-evident statement, but the evaluation of many participatory processes suggests that this is often the case. Second, it must be possible to scale participation on an effectiveness scale. This is in however, much more difficult than evident.

5. Agenda 21 refers to the necessecity of *commitment and genuine involvement* by social groups as an important element in participation. The implicit hypothesis is that sustainable development requires a certain underlying and broad societal support. This aspect is surprisingly little researched. It is in addition, rather strange that this commitment and involvement is explicitly expected from “social groups” and seen as

self evident of governments and states institutions. This seems, to say the least, to be a far stretch of reality in a large majority of the countries.

6. Finally, the literature often mentions a *relevant level for participation*. The reference seems to apply to both the level of participation as the level of decision-making involved. These two are however, not necessarily the same for all actors involved. It may well be that the most appropriate level of participation for most citizens is the local level even though the decision-making on an issue is at the higher level (i.e. national, provincial).

Given this approach to political participation we define *collective political participation* (public participation) as follows:

Political participation in the context of sustainable development encompasses every political interaction between the state and civil society or between public actors aimed at solving societal problems. This includes the process by which governments and civil society have a dialogue, form partnerships to solve problems, exchange information and also the interactions between the state and civil society during the development, the implementation and the evaluation of policies, programs and projects aimed at a more sustainable future.

4. CASE STUDY: PARTICIPATION IN THE BELGIAN CONTEXT OF SUSTAINABLE DEVELOPMENT

In light of the previous discussion on participation as a societal goal and a political reality we will now turn to the Belgian situation to illustrate the deficiencies of the dominant approach and point at opportunities for improvement.

4.1 Belgium's form of neo-corporatist state society relations and its implications for participatory practices

The Belgian system of policy-making can be categorized as an almost perfect example of Schmitterer's and Van den Bulcke' neo-corporatist model of state-society relations. In the post-worldwar II period a system of state society relations has evolved based on neo-corporatist interest group participation. A limited number of groups in civil society are privileged by the government as preferential partners to give input on a number on important problems. In exchange for their input (and often control!) over the content of policies on these issues, the interest groups actively defend and sometimes even implement the state's policies. They do this through defending certain policies in their discourse and if necessary by forcing the issue at

the level of their 'members'. This type of policy-making and participatory process which is de facto a special case of state-society relations is largely based on the socio-economic ordering of western societies. Employers and employee organizations are the chosen segments of civil society to participate in policy-making.

The Belgian form of neo-corporatism goes hand in hand with Lijphart's consociational democracy. Given the three lines of division that run through the Belgian polity, namely language, religion and economic differences, the whole state is balkanized into little domains which are then divided almost on a quota system basis by representatives of civil society coming from the different segments of the three divisional lines. This system has led to the pacification of a large number of problems. Indeed for a country with that many serious divisional lines, political conflicts have been fought out remarkably civilized. It has also led, on the other hand to a very special form of state society relations when evaluated from the perspective of civil participation. The state is virtually captured by those groups who have access to the neo-corporatist set of exchange mechanisms between state and civil society. It is closed, on the other hand, for those who fall outside the system.

4.2 Institutional responses to the participatory dimension of sustainable development

Environmental problems and more recently the sustainable development issue have put this system under serious criticism and pressures. Environmental groups, development NGOs, grass roots movements and others who were excluded from the dominant system of exchange between the state and civil society strongly objected to the fact that these new social issues were discussed and framed in a non-representative fashion.

The government has reacted to these pressures rather slowly and generally without much enthusiasm. In recent years, however, it has lived up to its international promises and has created an institutional framework for a more participatory process of decision-making for sustainable development. This has led to the establishment of a national council for sustainable development with representatives of NGOs, consumer groups, industrial groups, employers and employees as well as scientists and public officials. Other consultative bodies which include broad representation now exist at the level of the Regions (Flanders, Wallonia, Brussels).
It is clear that these new demands in content and form on the participatory nature of state-society relations and sustainable development policy-making have led to new problems and challenges as well as frustrations for those involved. Some of the more important problems include:

The new consultative bodies do not have the same standing and possibilities to influence the government. Their place in the decision-making process is rather insignificant compared to the traditional neo-corporatist bodies for interest group-state negotiations.
The traditional interest groups (employers organizations and labor unions) are still rather dominant in the process. They are heading most of the new consultative bodies, and more importantly, they are still dominant 'when things really matter' (e.g. the energy and CO debate).
There is a serious problem for the traditional groups to enter into the logic of the debate on these new themes. Their (mostly 19th century) ideologies are at odds with the new demands, they don't have the capacities to handle their new duties, they have a difficult time establishing working relations with groups whom they considered marginal (or not really important at best) previously.
The environmental, development and other groups which are now included have difficulties positioning themselves in these new participatory structures: on the one hand they see an opportunity to be part of a new participatory process of interaction between the state and civil society. On the other hand they have to decide how much they are willing to be co-opted and where they want to allocate their usually scarce resources.
It seems obvious that the new institutional arrangements have created some opportunity for more inclusive state-society relations and public participation. We have to be careful, however, to distinguish between the formal existence of these changes and their real impact.

4.3 Participation as a *deus ex machina* in policy processes

Through different policy evaluation exercises in the last several years we have come to notice that interest group, social movement or citizen participation is increasingly seen as a sort of magic potion to make policy processes smoother, to make decisions acceptable and to legitimize policy action. At different policy levels and in nearly all policy domains do we find the call to install participatory bodies, mostly of the formal political advisory nature which we have described above. Examples include local environmental councils, the call for local sustainability councils, zoning and spatial planning councils, etc. at the level of the municipality and the province. Newer calls for participatory bodies are for example wildlife councils, water councils, sustainability councils for public (ex EU) funding, nature councils, etc.

The evaluation of the functioning and impact of these participatory bodies is still in its infancy stages. Recent research on Municipal and Provincial environmental councils and on voluntary agreements between the Flemish government and the

municipalities and the provinces demonstrates that the participatory praxis is far from obvious and requires a supportive institutional structure to function well (cf. Infra). It is safe to say for the moment that there is not enough evidence to substantiate the claim that participation per se has a large positive impact on the effectiveness of environmental and sustainability oriented policy programs. The evidence seems to suggest that participatory bodies do perform their formal functions fairly well and have been effective in that sense but that they are still far removed from being catalysts for farther reaching participatory practices. In the following part we will try to demonstrate why that is the case.

5. THE REDUCTIONIST APPROACH TO PARTICIPATION AND THE HISTORY OF LEGITIMACY THROUGH ACTION

One of the consequences of limiting participation to formal presence in consultative bodies is that the emphasis is completely diverted away from participation through action. The fact that a number of groups have the opportunity to participate in debate and the formulation of advises for national policy making has serious consequences when studied from a more action oriented perspective.

Those groups represented in the most powerful advisory bodies in Belgium's policy-making have gained the legitimacy to represent certain interests in society through social action. They were in the most literal meaning of the word social *movements*. The historically most important and impressive example is beyond any doubt the history of the labor unions in that respect. In the 19th and first half of the 20th century they concentrated on action and not on participation in advisory bodies. Indeed, they were not invited, nor wanted in that form of participation. They organized workers, supported actions whether they be strikes or educational activities, they build local organizations step by step, … In other words they participated in the larger project of more equitable socio-economic development and recognition of the rights of 'regular people' by focussing on effective realizations.

It is exactly because they were getting a large impact through their actions and because they were influencing the views and behavior of people that they became organizations that could not be ignored by employees and governments. If they were invited as parties during negotiations, they had earned this right through action, not because the employers or the state were so good-hearted to invite them. The current neo-corporatist system was largely developed after world war II in a number of negotiation and advisory bodies where the 'social partners' (i.e. employers organizations and labor unions) discuss and decide on social and economic matters of the highest importance with the appropriate authority.

This is in sharp contrast with the current vision on participation in advisory bodies. The fact to be invited and represented often precedes any serious action or legitimacy in the field.

Once invited to the table, many groups find out that they don't have the necessary capacity to live up to the expectations. They are spending a large part of their scarce institutional resources on their representation in consultative institutions. They can often not even answer to the question whom they represent. They come to the conclusion that the newer participatory processes are only marginally recognized as really important by the government and the traditional social partners. The question is then: is it all worth the effort and what is the impact.

The link between this rather negative evaluation and the lack of legitimacy through action is striking. The lack of a serious basis of public support that can be demonstrated by for example membership numbers, financial contributions, actual activities on the issues they represent limits the legitimacy they have in the whole process. The fact that they spend so much of their institutional capital on 'sitting in meetings' and 'voicing opinions' prevents them from being more involved in action-oriented activities at the level of citizens or groups.

Many of the environmental groups for example would have a hard time explaining what exactly it is they do that would legitimize their presence in committees and advisory boards except for research and lobbying. It is striking that these activities were developed in the case of labor unions after the public support base was large enough and the membership contributions significant enough to build a professionally staffed organization.

6. LOCAL AGENDA 21: AN OPPORTUNITY FOR DIFFERENT FORMS OF PARTICIPATORY POLICY-MAKING?

Local Agenda 21 is often mentioned in the context of participation and citizen action. In that sense one could expect that LA21 provides the opportunity for different forms of participation. The following assumptions are hence associated with LA21:

- The local level allows for a more participatory of policy-making because of its proximity to the population

- Local governments are not perceived as distant power and control institutions over which no or little control is possible

- Involvement of local groups can be much more oriented towards actual involvement in environmental and other projects

- The link between citizen activity and the results of these actions is much clearer and hence more motivational

These assumptions seem reasonable as the local level of policy making seems to meet a number of the prerequisites often mentioned for more participatory policy-making.

The Belgian reality is unfortunately rather unfit to draw many conclusions on the participatory nature of LA21. Very few cities have a LA21 that is in fact operational and having a significant influence on local policy-making. To associate LA21 to the large input of participatory processes for this moment seems therefor like stretching reality. Recent research on local participation in local environmental policy making suggests in addition that the interest and motivation of many actors is not always very high. Only about one half of the members of municipal environmental council for example are present at the meetings. This number increases to absence rates of 70 and 80% for a number of the groups represented in these councils.

7. CONCLUSIONS

The current conceptualization of participation is based on a narrow definition which leads to a ditto operationilization. What is largely absent is a more action oriented involvement of old and new social movements and of citizens. This lack translates in a lack of legitimacy, a certain laxness, and hence rather limited impacts on actual policy implementation in the spheres of environment and sustainable development.

In conclusion we would like to plead for the following elements to be taken seriously when planning further participation in policy processes:

More attention should be devoted to actually involving social movements and citizens.

Social movements and citizens should be involved throughout the policy process, not only in the agenda setting and planning stages

If governments and social movements really believe in the necessity of strong participation in light of effective policy measures this should be translated in much stronger institutional support for participatory processes: this means investing in training, administrative support, feed-back, communication, etc.

From a researcher’s point of view it also includes increased attention for serious policy planning and evaluation as well as process support of and for public participation.

In other words, being sympathetic to the idea that participation is important and indeed matters, we plead for taking it much more serious as a policy topic and domain. Participation is not a self evident, cheap solution. It is not the deus ex machina or the oil that make the engine run.

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POLICY INSTRUMENTS FOR SUSTAINABLE DEVELOPMENT AND THE CITIZEN'S ROLE

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INTRODUCTION AND OBJECTIVES

This project was a joint effort of two university centres[45] and deals with the different forms of participation or involvement in the implementation of sustainable development policies. "Participation" is an important part of policies like these. It is currently the subject of much analysis and can be expressed in many ways. In this regard, the project has attempted to:

- clarify the concepts studied, referring to existing theories and practices and identifying trends

- understand the conditions and forms of participation in sustainable development policies, in the case of the public authorities and in the case of the different categories of players involved.

These two approaches are different and complementary. The IGEAT team of the Free University of Brussels (ULB) focuses on the institutional dimension (the more organised forms of participation) and on the role of organised social actors whereas the SEED team of the University Faculty of Luxembourg (FUL) is more concerned with the social dynamics and reorganisation resulting from this participation. Also, the first team turned its attention to socio-economic problems while the second team examined territorial dynamics.

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45 For the IGEAT-CEDD of ULB, Ariane Godeau and Vincent Bruyer did most of the research, under the supervision of and with contributions from Edwin Zaccaï. For reasons of space, we are only providing the references of the research work we did during this convention. Several of the publications listed below can be consulted at www.ulb.ac.be/igeat/cedd. The two interim reports can be obtained at the SSTC or upon request from the IGEAT-CEED.

PART 1: THE PARTICIPATION OF ORGANISED PLAYERS (IGEAT-ULB)

1. STUDIES AND CLARIFICATION OF CONCEPTS

1.1 Sustainable development

Extensive research was done[46] on the different interpretations of sustainable development. For this a whole range of documents was consulted: official texts published at different levels (regional to international), reference texts produced by different groups of actors (businesses, associations, various groups) and scientific studies done in various fields (economics, political science, sociology).

By examining this broad spectrum, we were able to obtain a good picture of the players' different perspectives on sustainable development and place these in a certain context. The views were studied in relation to one another and also looked at in terms of where the emphasis lay and how the concept could be understood in different ways. This was followed by a more in-depth and systematic analysis of alliances and oppositions between certain groups of actors, which is summed up below (see table).

This "game" the organised actors play of approaching sustainable development from different angles is an important form of participation. But we have also attempted to analyse the concept per se and how it relates to sustainable development.

1.2 Participation

While the idea of participation is today being motivated by sustainable development policies, the notion clearly existed before sustainable development, and the way in which it is being organised and implemented is changing, in some cases very quickly. These changes are not all connected with sustainable development, and it is important to understand the dynamic.

Belgium has a strong tradition of consultation with representatives of organised groups, essentially employers and trade unions. This neo-corporatist model where

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46 In particular in the doctoral dissertation on the environment (December 2000), "Contribution à l'analyse des conceptions du développement durable" , E. Zaccaï, ULB (IGEAT). A few intermediate elemetns appear in E. Zaccaï, "Sustainable Development: Characteristics and Interpretations", Geographica Helvetica, 1999/2, pp. 73-80

relations with the State were relatively stable has recently undergone some changes that are directly linked to the search for new forms of participation. With the surge in economic deregulation and privatisation and the growing complexity of organisational choices, the State sees itself more as an organiser of initiatives – which includes an increased demand in participation – than the regulator guiding society and watching over it. This trend is continuing today with the rise in the notion of governance.

As far as the representation of social demand is concerned, several factors of change are worth noting: diminishing bargaining power of the trade unions because of the transformation of the labour market (differentiation, increased competitiveness with less redistribution); increased demands related to living conditions and not work (consumption, the environment, 'users'); rising number of non-governmental organisations and associations concerned with specific objectives.

In addition, several interrelated factors have favoured the direct participation of citizens (or at least certain categories), such as direct consultation processes, in particular with regard to the environment; an increased understanding by the public of the problems and a greater availability of information; the rise of individualism; and mistrust of politicians.

Finally, issues concerning technological choices have become more important, and there has been a demand to intervene here, in a context of uncertainty over the impact of these choices and in a situation where the whole idea of 'progress' is called into question[47].

1.3 Participation and sustainable development

Many of the elements referred to above can be examined in the light of sustainable development policies in order to better understand the relationship between the two. Indeed these policies

- institutionalise the consultation (or participation) of different organised groups, as underlined in section three of Agenda 21, which is devoted to this.

- open an area of change in relation to economic and technological progress as a driving force for development, integrating the different components to achieve this (integration that implies representation of the various interests involved), and

- encourage the direct consultation of citizens in certain conditions.

In this context, the role of the environment and environmental protection associations is another element worth underlining. On the one hand, there is a long-standing tradition of direct consultation in this matter through local public inquiries (see on this the SEED research findings, in particular). On the other hand, the environmental protection groups, which have always advocated participation as a way to legitimise their own action, clearly represent the newest component in the game of consultation for sustainable development policies. This can be observed in various new advisory councils dealing with the environment or sustainable development.

It can also be suggested that consultation is supported here because certain authorities want to popularise the very notion (relatively new) of sustainable development and its implications, hoping that they will perhaps enhance their image by calling for "citizen" involvement.

1.4 Justifications for participation

In our research, we have discussed what participation consists in – usually nothing more than consultation – examining the different reasons for it. The idea here is that participation cannot just be judged on the basis of the direct results that it produces for political decisions. Criteria related to the different functions of participation also have to be taken into account (see also in this regard the SEED analyses in this summary).

One of the first justifications for participation that comes to mind is democracy, since these political regimes are based on an expression of their choices by citizens. However, this reason is not sufficient, because in representative democracy, those elected could turn around and claim that they alone are the guardians of the choices expressed, without any additional voting procedures. This justification also led us to discuss the problem of the representativeness of the actors expressing themselves, which cannot be judged according to the same criteria as with political representation. It is worth noting that certain interests promoted by the objective of sustainable development, the long term in particular, will not automatically find "representatives". Yet, the configuration of the new "integration" pursued with this objective depends in part on the strength of the representatives of the different

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47 These themes appear in particular in the various contributions of the volume "Le principe de précaution. Significations et conséquences", published by E. Zaccaï and J-N. Missa witih the Editions de l'Université de Bruxelles (2000).

dimensions to be integrated. Thus we could argue in favour of stronger representation of the community's "weaker" groups and "weaker" interests. This also takes us back to the general interest (including over time) of the public authorities.

Another justification for participation is a pragmatic one: decisions have to better suit the situations and therefore be more effective. In this way, consultations are a way of adapting the planned measures to the opinions taken from the actors who know the situation on the ground, some of whom may be directly involved by the content of the decisions.

A third justification for participation is to educate, raise awareness and inform. This is especially true in today's complex societies, particularly at the legal level. The principle that "ignorance of the law is no excuse" becomes totally unreal in practice. In reality, when a new legal measure is planned, consultation is a way of informing those concerned of the plan. It sometimes leads to debates, sometimes controversies, but one of the consequences is the spread of information on the planned decisions. It is further motivated if there is a lot at stake. So in the best of cases, it encourages a "collective learning process".

Finally, in connection with the previous point, the consultation procedures, if implemented properly, are a way of gaining the support of the actors consulted, more so than had the measure submitted for consultation been imposed on them from the start.

1.5 Forms of participation

One of the initial phases of the research[48] had led us to propose a typology of political instruments (hence the title of the research project). Each instrument has 3 components: a legal component (more or less formalised), a management component (requiring human, technical and financial means), and a communication component (communication towards and with all the players involved). These components can be considered the equipment of the instrument. This vision implies, among other things, that ad hoc forms of participation should each time be attached to the political instruments.

Nevertheless, we then considered specific forms of participation, illustrated also by case studies, because political instruments are almost never used alone. The forms for our study were chosen in such a way so as to cover different moments of the

political cycle (consultation for decisionmaking, management, etc.) and to consider the actors individually or in organised groups.

1.6 An example: public consultation on the Belgian government's preliminary proposal for a sustainable development plan

A double consultation was organised by the Belgian federal government for its preliminary proposal for a sustainable development plan (PFDD "Plan fédéral pour le développement durable" / "Federal Plan for Sustainable Development"). On the one hand, the government sought the opinion of the CFDD ("Conseil fédéral du développement durable" / "Federal Council for Sustainable Development") to which it had to justify the derogations. On the other hand, the public was consulted, and organised groups (with the support of the state secretary responsible for the matter) introduced certain initiatives. The content of the preliminary proposal was first and foremost intended to organise the areas of jurisdiction (including the objectives, procedures…) of the public authorities, with the result that to the public the matter appeared quite technical. The Centre for Sustainable Development ("Centrum Duurzaam Ontwikkeling") of the University of Ghent prepared a detailed report on the results of these procedures and their treatment.

Among the criteria listed above, we will only briefly comment here on efficiency and awareness. Efficiency – meaning the possible final input of the opinions gathered in Belgium – must be considered from three angles, depending on whether the contribution came from the CFDD, organised groups or individuals. The work conducted at the CFDD was deepened, and this Council played one of the essential roles of an advisory body by enabling an exchange of views between groups with different strategies and interests. In contrast, the opinions that came out of the consultation as a whole were expressed by a small fraction of the public, like in previous cases (regional public inquiries). Nonetheless, given the coverage in the media and the exposure through various events, the function of raising awareness went well beyond this fraction.

This consultation was an opportunity to raise a series of questions on possible improvements for a second round: use of documents written for the general public, issues more in line with the possible choices of individuals or organisations, organisation of consultations when drafting the document, greater intervention of members of government agencies and public authorities (who were the main

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[48] See the first interim report (September 1998) of this proposal, pp. 51-61.

recipients of the plan), solutions to increase the intervention of certain interest groups or social groups, weighting procedures for the different types of opinions gathered, etc.

2. PARTICIPATION OF ORGANISED ACTORS

2.1 General model

The forms of participation of organised actors represented by groups were systematically and comprehensively analysed on the basis of the many documents produced by these organisations and on the basis of informal contacts with some of their representatives[49]. The table below provides a summary of this work. Four groups were given particular attention: environmental protection associations, consumer associations, trade unions and businesses.

In the case of the environmental protection associations, issues like the legitimacy of the representatives were examined, and more generally various aspects concerning how they operate were described. Certain comparisons with the general group of associations were made with the consumer associations.

The trade unions, in their relationship with sustainable development, are less commonly studied than businesses, for which there is a vast amount of literature. We have attempted to refocus the action and arguments of the various parties by looking more particularly at the various forms of participation of their representatives but also of their "base".

[49] See the second interim report (March 2000) of this proposal, pp. 24-74

SUMMARY TABLE: 4 GROUPS OF PLAYERS AND SUSTAINABLE DEVELOPMENT

(1)

	Environmental protection groups	**Consumer groups**	**Trade unions**	**Employers**
Definition	Group of persons (or other associations) sharing a common interest (environmental protection) and without a profit-making goal.	Group of persons (or other associations) sharing a common interest (consumer protection) and without a profit-making goal.	Group of persons joined together to defend common interests in their profession. Financial power may be important, but no profit making goal.	Companies: private or legal persons engaged in a profit-making professional activity. Organizations representing employers
Reference values	nature, democracy, transparency, participation, quality of life, strict observance of legislation, safety and public health	transparency, participation, quality of products (in the broad sense), strict observance of legislation, safety and public health, prices, quality of living standards	employment, quality and living standards, strict observance of legislation, transparency, participation, fairness, occupational safety, quality of the indoor environment in relation to quality of the outdoor environment	competitiveness, growth, management, profitability, profits, private interest, technical aspects, stable legislation, competition,

Joint means of action	- information and awareness of members or the public - monitoring of and influence over policy and legislation - participation in advisory councils - legal actions - collaboration and partnership with other actors			
Specific means of action	- limited management (for example, of nature reserves and parks); - promotion, boycott	- tests and comparisons of products - consumer assistance	- organisation inside companies for workers in limited fields - assistance for members - strikes	(for environmental matters) - concrete change in management (eco-management)

SUMMARY TABLE: 4 GROUPS OF PLAYERS AND SUSTAINABLE DEVELOPMENT

	Environmental protection groups	**Consumer associations**	**Trade unions**	**Employers**
Factors favouring the inclusion of sustainable development	- legislation - adapted political instruments - financial means - integration in national and international networks - communication dedicated to different audiences			
Specific favourable factors	Firmly established, representativeness, independence, expert capacity, credibility, role established in advisory councils, use of the media, influence of "environmental disasters"	established, representativeness, expert capacity, credibility, use of the media, established role, influence of consumer problems widely covered in the media, sustainable development as a positioning stake in consumer issues	uniformity, established, expert capacity, use of the media, established role, "social clashes" (Vilvoorde,…), sustainable development as a positioning "stake" on the "social market" (links between the environment, worker health and working conditions)	Insurance (putting pressure on management methods), competition (positioning on a specific market, for example "green products"), brand image, B.A.T., awareness of managers, consumers and "stakeholders", legal actions of associations and public authorities

Possible distortion of actions in relation to sustainable development of a general interest	demands that are too local or too specific; difficulties of public inquiries; idealism and lack of subtle distinctions; dependence on public funding; competition between NGOs; lack of coordination between NGOs;	Dependence on funding, apparent contradiction between "living standards" (quantitative) and "environmental responsibility", risk of encouraging "rampant" competition (to favour price wars) rather than the introduction of restrictive standards (environmental or social) perceived as obstacles to the free movement of goods and services	Competition between employment and the environment, employment blackmailing, competition in terms of the "hierarchy" of interests (environment vs. employment), lack of awareness of trade union leaders of environmental issues and/or North-South fair trade issues (pre-eminence of one over the other)	Lack of awareness of managers and/or shareholders, the environment as a potential threat for the most polluting sectors, the environment as constraint, economic interests too prevalent, action hijacked in the private interest (corporatism), environment used to advertise ("green washing"), competition between clean-up at the source and sale of equipment to clean up pollution
Expert capacity	Very variable; sometimes cooperation with research centres (individual contracts especially); development of counter appraisals	Very variable; sometimes collaboration; counter appraisals; deepening of the notion of "quality" of a product and service	Specialised in their field of action: living conditions (safety, health, living standards, economy)	Specialised and considerable technical and economic expertise; for internal use (audits) or external use (private consultancies)

In these different analyses, participation was considered in the broad sense, which is also the case of the official documents on the involvement of social actors in sustainable development. While it is recognised that common interests favour closer relations between these groups, which is beneficial to the actions, we wanted to go a little further than highlighting "win win" actions and also show causes of tension and closer relations (sometimes more superficial) produced by the polysemy of the "environment" and "sustainable development".

Despite our attempts to establish certain characteristics, it became apparent at the end of the research that a category-by-category approach does not give a complete picture of the specific situations of the players. Although it is possible to generalise to an extent (there is a certain unity within each category), these characteristics are not enough to analyse the diversity of the actions (alliances and opposition) on the ground. That is why the case studies provide a more precise contribution. The tables presented above must therefore be used with caution. Their primary aim is to give an overview of the positions, furnishing a useful element for the study of participation, but with the understanding that major differences are possible depending on the circumstances. It is for this reason, for example, that we studied the strategies of businesses and environmental protection groups and the various ways in which they have been collaborating in Belgium and the rest of Europe.[50]

An example: the opinion of three advisory councils on a legislative bill

A detailed case study[51] was done on three advisory councils in Belgium and their elaboration of opinions (in 1996) on a specific political instrument, ie. the preliminary draft framework law on "product standards". These three bodies were the National Council of Sustainable Development (which became the Federal Council of Sustainable Development, the CFDD, in 1997), the Central Economics Council and the Consumer Council. The method consisted in carefully compiling the available written traces on the work done by these three with a view to analysing them.

Through this study it was possible to

- compare the positions of the opinions of the three councils,

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50 In E. Zaccaï, "Entreprises – Associations d'environnement: coopération et partenariats admis", in Environnement et Société, N°22, pp. 101-106

51 See the second interim report of this proposal (March 2000), pp. 99-141

- compare the positions of the same groups (and sometimes the same person representing them) in different councils

- analyse in detail the inclusion of the different elements of the opinions in the final decisions.

The consensus that is usually reached within each council is worth noting. It facilitates the work of the legislator, even if he has to reconcile the opinions of the different councils, like in the case here. The fact that these are stable bodies where the representatives learn to weigh one another's positions helps to achieve this consensus. Also, when an opinion is reached by consensus, the legislator finds it harder to ignore it, whereas in cases of dissension he feels that he has more freedom to decide.

Our study reveals that these procedures have produced certain substantial changes to the document submitted for an opinion. What is more, the opinions we examined reveal that the public authorities do indeed use the information they gather from the different actors to modify their decisions to fit the actual situations, thereby confirming one of the justifications for participation mentioned above.

It can also be considered that the opinions of these three councils help to define what is in the general interest but also to determine the limits of the operational nature of the planned legal provisions (see, for example, certain specific aspects concerning sanctions). These councils therefore participate "politically" by defining this general interest through the different representatives of civil society, defend special interests (the composition of each of these councils plays an important role) and have an operational knowledge of these legal provisions.

However, this also takes time, especially when more than one council gives an opinion. Should the public authorities free up resources (in time and in expertise) and reduce the number of opinions sought? This question also goes beyond the case under consideration and can be raised for a number of opinions and councils. It is difficult to answer, because despite their compositions (including in terms of persons) and attributions, which are sometimes similar, each council is nonetheless different. The problem should probably be dealt with case by case. Finally, an important question also concerns the relationship, within a group represented, between the expert members of the councils, and the "base" in each of the groups. Here too, depending on the scope of the opinions, it might be interesting to do some studies on this.

With this study, it was therefore possible to complete the general analyses on the dynamics of the groups in question. The "object" of the analysis was difficult, since

we were dealing with debates lasting many hours just in the case under consideration. Nonetheless, we tried to draw certain lessons from this that go beyond the case study, based on the literature and our own personal participation in certain councils. However, it goes without saying that more research would be welcome to complete these analyses (on the contributions, effectiveness, legitimacy, awareness… connected with this form of consultation), especially since the advisory councils, because of their "expert" content, are the easiest way to participate in political decisionmaking today.

3. RESPONSIBLE CONSUMPTION

In relation to the forms of participation already examined, "responsible consumption" appears quite different, which is why we did a certain amount of work on the subject[52]. We defined "responsible consumption" as a way consumers use to participate in tackling social or environmental problems by making specific choices as to what they consume. Other expressions similar to responsible consumption are sometimes used, like "citizen consumption", "shopping for a better world" or in French "de l'éthique sur l'étiquette" ("ethics on the label") or "consomm-acteurs" ("consumactors").

The consumer choices referred to here (which concern both the purchase and use of the products) include motivations having to do with ethics, politics, militancy or citizenship. These motivations are obviously not the only ones to determine an action and coexist with other more traditional factors (eg. the price or usefulness of the good). We have attempted to observe in which cases these "responsible" factors are likely to become more important, enabling those in favour of responsible consumption to consider it one of the ways citizens can promote sustainable development. It is from this point of view that we think it justifiable and interesting to examine these dynamics alongside other forms of participation.

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52 See A . Godeau (1998), "Responsible consumption as a lever for sustainable development: a critical analysis", in "Beyond Sustainability", International NWO Conference, Amsterdam 19-20 November 1998, pp. 40-45; E. Zaccaï (1999), "Jusqu'où peut aller la consommation responsable?", conference proceedings "La consommation responsable pour contribuer au développement durable", CRIOC, 14 December 1999, Brussels, pp. 101-110; and E. Zaccaï (2000), "Ecological oriented consumption: a pluriactoral approach", International Journal of Sustainable Development, Vol. 3, N°1, pp. 26-39. See also the first interim report (pp. 122-156) and the second one (pp. 75-98).

We have attempted to elaborate a model, based on empirical data, in order to identify sectors and products where this approach more or less shows results for purchase choices. In short, the model involves the following four factors:

- A mobilising "cause" is associated with the product
- The product is unquestionably different in terms of impact and information
- It is easy to substitute: price, place of purchase, qualities
- It mobilises a network: NGOs, distributors, producers ...

Several cases have been considered, including the ecotaxes in Belgium, the boycotts against Shell (1995-1996), recycled paper, and in particular the European ecolabel.

From our analyses, it is clear that responsible consumption, understood as a form of participation in the way we defined it, cannot have lasting effects unless it is coordinated with the other players organising production and consumption: public authorities, businesses, distributors, pressure groups, … That explains the relative gap between the great proclamation of support of this approach and its direct effects. However, policies towards "green" products (particularly at the European level) consider it an established fact that more consumer information will mean more responsible choices and influence the market in this way. For this to be true, there has to be a great amount of coordination between the players involved.

These past few years have seen militant organisations waging very selective campaigns that have led to targeted movements on the market but that have also generated debates, which have not left certain large corporations indifferent. Some of these big firms have currently been placing emphasis on improving the overall ecological quality of their products (rather than putting stress on specific "green" products) and on diminishing the risks associated with all their products. A recent phase in the actions in Europe to promote responsible consumption (and ethical investments) has been the attempt to publish purchasing guides for all products.

Responsible consumption as a form of participation also reflects certain strengths and weaknesses of a system where the market acts as regulator, which is increasingly the case today. If in principle this practice is endorsed (according to various surveys but also given the support proclaimed in sustainable development policies), it is based on the observation that economic pressure is a major element when there is strong competition. But responsible consumption also raises questions about the role and complementarity – like elsewhere in this research – of the

missions of the public authorities and about the participation of social and economic actors.

4. USE OF THE RESEARCH

This research work has been published in a certain number of specialised journals (see footnotes of this summary) - some of which have been distributed to political and social actors – and been used in university courses dealing with these issues.

The two promoters of the research participated in the public consultation committee for the Belgian federal plan for sustainable development (PFDD), which issued recommendations on the processing of results and on future operations of this kind. Partial results were also presented to the Federal Council for Sustainable Development (CFDD).

With regard to the work on responsible consumption, research here led to the acceptance and funding by the European Commission of a European project with the "Réseau des Consommateurs Responsables" (Network of Responsible Consumers), the aim being to identify research organisations and centres in Europe working on "socially responsible" consumption (2000-2001). A project was also launched with the "Centre de Recherches et d'Information des Consommateurs" (CRIOC – Consumer Research and Information Centre) to publish a selective purchasing guide. Finally, projects to examine in greater detail the theme of support for a products policy were submitted in reply to the SPSD II call for tenders.

PART 2: SUSTAINABLE TERRITORIES AND PARTICIPATION?[53] (FUL/SEED)

1. THE ISSUE: PARTICIPATION, PUBLIC POLICY AND SUSTAINABILITY

This research explores the forms of participation in sustainable territorial development policies. Participation is an integral part of the political theory of sustainable development. But what is its place in these policies and what form must it assume to be legitimate and effective (the requirements of any public policy)? The problems of legitimacy and effectiveness are often posed and the subject of many a political and legal debate; the assumption here is that legitimacy and effectiveness meet at a certain point and become totally intertwined, because the empirical debates (discussions on the facts) can no longer be rigidly separated from the normative debates (discussions on values). Indeed the definition of a rule – the challenge of any policy – implies in an industrial society that both knowledge (which says who and what is at stake) and values (which say what is important) come into play. In both cases, it is a question of knowing the interests at stake and being able to rank them in an order of importance.

The research is not so much a matter of arguing the pros and cons of participation but observing in an empirical way the processes of participation. First of all, it is important to know, based on observation, *what the participation is doing* and what *forms* it can assume, given the requirements of a sustainable development policy. Then, we have to know what these observations tell us and how they lead us to rethink sustainable development policies.

2. THE THEORETICAL AND METHODOLOGICAL POINT OF VIEW

If coming up with a good suitable rule is what is at stake, then we can return to some of the basic theoretical thoughts about democracy in an industrial society. Durkheim did not believe that regulation could be accomplished by the market or by contract, because for him a contract is always a private norm that has to be guaranteed by collective rules assuring the loyalty of the partners. But he also did not believe in regulation by the State. The main reason is one of order. Durkheim does not believe

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53 A comprehensive report "action collective et territoire durable" may be obtained from SEED, Avenue de Longwy 185, 6700 ARLON. The authors of this research are Marc MORMONT, Catherine MOUGENOT and Christine DASNOY.

that a centralised State is capable of elaborating good rules, because it is too far removed from reality to regulate in knowledge of the facts. He suggests the solution of intermediate organisations (corporations), which have a triple capacity to negotiate these rules: they have a cognitive capacity (proximity to the situations), a political capacity (they have strong representation to negotiate) and what we call a capacity of engagement (because of their socialising role, they give concrete expression to the identity of their members). These two arguments – specialised and tacit knowledge and forms of engagement – forbid any exogenous regulation of "professional relations". Only negotiation, interaction, enables adequate and acceptable regulation. Here we have a fundamental source for forms of social consultation and representation of socio-economic interests in our democracies (neo-corporatists). The State's role is then to encourage and support fair negotiations between the parties concerned in observance of the law.

However, Durkheim did not anticipate two fundamental changes in industrial societies: on the one hand there has been the development of public services and State bureaucracies, which do not go very well with this model, since the State is both judge and party; on the other hand, problems have emerged, which have nothing to do with social negotiation between professions like long-term environmental problems or problems of modern risk. These problems bring to the forefront issues that are *both* industrial issues (because they are related to specialised scientific and technical knowledge and practices) and civic issues, which go beyond the frontiers of functional systems to which the forms of "corporative" representation correspond. The question then becomes which representatives and which methods of representatives are appropriate for interests or problems of this kind?

The case of biodiversity is an almost perfect illustration of this: in spite of uncertainties, there is a sort of consensus on the threat of a diminishing biodiversity, and there are national and international pledges to protect it; but the difficulties begin when conservation policies have to be implemented, involving environmentalists, town and country planners, farmers, etc. What knowledge has to be mobilised, what standards have to be implemented and who are the legitimate representatives of this biodiversity? How can a series of effective and legitimate mediations be guaranteed between such a general objective and specific professional or private practices?

The cases studied all involve territorial management, because it is often in local areas that demands emerge to participate (Nimby phenomenon) or that the authorities propose participation procedures to citizens (river contract, local plans, etc.). The cases studied concern, on the one hand, river management (river contracts) and biodiversity (municipal nature development plans), both semi-

formalised forms of participation, and on the other hand, forms of protest where citizens organise themselves to protect their environment (unfairly referred to as the Nimby phenomenon). In both cases we are dealing with forms of collective or joint action whose aim is to influence policies and decisions.

To understand *what the participation is doing* implies an ethnographic approach that not only observes the interactions between actors, the discussion of knowledge and rules but also the successive transformations that an issue undergoes throughout a procedure, the successive redefinitions that occur in the different phases. To question what the participation is doing is therefore to question how the issues and the actors are *transformed simultaneously*. This is more like analysing from the perspective of collective learning where innovation and the emergence of all things new are what is interesting.

3. THE RESULTS

3.1 Association practices

These forms of joint action develop according to their own logic. This is a kind of logic where individuals and groups come together in a coalition or association to defend or promote a common interest. In this social and political dynamic, we are therefore always dealing with a dynamic of enlargement of the social base of the action. But this enlargement at the same time transforms the demands and proposals.

Enlarging the coalition therefore implies an enormous amount of *association* work, with heterogeneous interests and groups that were in no way predisposed to meet. This association work does not only consist in bringing together parallel interests in a coalition. It also involves transforming the arguments and the very content of the projects or counterproposals. The opponents, for example, are going to do a tremendous amount of work studying the area with other local groups, and the issue is going to become locating a water treatment plant in the most appropriate place in the municipality after extensive exploration. It is no longer a question of refusing the inconvenience for oneself, and the initial claim is left behind. The same process occurs when groups of environmentalists form an association with other social or economic interests to protect sites. By joining forces, the content and end purpose of the projects are also changed. Here, we enter another context, both cognitive and normative, that of an area and a community. But we are within a more general norm, which is the need to treat water or to protect biological resources.

3.2 Defining and redefining the parameters

This can be considered a process of deconstructing and redefining the parameters of the project and action. This defining and redefining are simply operations aimed at establishing the parameters that are to be taken into account in the project or policy. While a nature conservation and environmental protection policy is still largely oriented by an "extraction" of environmental assets outside socio-economic activities, the dynamic of association instead makes it necessary to seek links between natural assets and human activities, to redefine the parameters of nature in a humanised space. In short, the species and protected species have to be reassociated with social practices. Here too the territorial context is fundamental, because it supplies the parameters of the action and links that are being created, for example, between nature, tourism, agriculture and the municipality's image. There is no action, project or policy without these operations, which include and at the same time exclude.

As the joint action widens its social base, it also increases the number of parameters that it takes into account. So it explores the available knowledge, technical alternatives, economic possibilities and relevant legislation and attempts by going back and forth to come up with innovative projects or proposals. These actions are often of a conflicting nature, but the conflict itself generates new ways of approaching the environment.

The conflicts often result in different if not contradictory frameworks of reflection. How is it possible to reconcile a whole series of different, and sometimes conflicting parameters?

3.3 Participation as circulation

Unlike all the approaches that especially highlight, in participatory dynamics, the interactions and exchanges between actors (therefore the deliberative or argumentative dimension), we believe that the *circulation* of the issues is also and above all essential. By circulation we mean that the problems are debated in the scientific sphere (available knowledge is re-examined, experts are mobilised, a controversy is explored from different angles) and in the normative sphere (who can intervene and how they can intervene are discussed). All these issues cannot be discussed at the same time and at the same place.

The development of a protected site where economic activities have to be pursued implies the mobilisation of environmental knowledge (what has to be protected) but also technical and agricultural knowledge (on farming practices) and a good knowledge of legal and financial instruments and therefore the contribution of

different levels of government. If the project encounters opposition, this opposition is going to have to deconstruct and reconstruct this succession of knowledge, rules and commitments made by different actors. The process results in the issue being circulated in these different spheres.

The issue is continually redefined in the process. By circulating the issue, the level changes (from local to regional, or to European in some cases). New economic or ecological parameters are introduced while others are dropped: the parameters of the problem are redefined, and each time the technical and scientific data, the applicable rules and possible commitments of the actors in one direction or another are examined in a specific framework with other actors.

The process is generally completed when a new satisfactory combination emerges. The theories of collective learning are a way of understanding these processes. In this circulation, not only is the knowledge modified but the rules and identities of the actors are as well. The effectiveness of the joint action can be seen here as providing the individuals and groups, by way of this circulation, with the means to learn. But how can a solution negotiated in this way be of any general value and be considered in the public interest?

3.4 Circulation model

These dynamics can be summed up by identifying the different forms of the exchanges. The exchanges occur at three levels: in the forum of discussions, in networks of exploration or in the sphere of the public institutions. The first level is the forum (local in this case). With just deliberation, the forum, organised around a specific objective or policy (biodiversity, mobility, catchment area, etc.), is rarely capable of going beyond the structural conflicts between the established actors. At the level of the forum, agreements are reached through discursive processes where local spokesmen set out priorities, principles and general objectives. The agreement is reached by overlapping priorities more so than by ranking them in any strict order. The unclear nature of this order, the consensual nature of the general definitions of the objectives and the compulsory reference to terms like sustainable development often leave the observers, and in some cases even the politicians, sceptical. But it creates a discursive background whose function is especially to be a common perspective to validate the projects and to examine them in a pluralist manner. This discursive background can, for example, be in the form of a charter (of a river contract), which officialises and brings into play an object of common management. But these forums are seldom an opportunity for real negotiation on the options and decisions that need to be taken.

The joint action therefore occurs on another level. The second level is that of discussion networks, which develop within this general framework. These are working groups, committees or informal groups, set up to examine a particular aspect of an issue. In these social networks, we are instead dealing with specific points, in fact "objects" or artefacts: dams, water treatment stations breeding techniques, natural sites… Unlike in a simplistic vision, these are not simply technical groups, merely implementing general objectives. Rather, for each of the actors concerned the underlying links have to be deconstructed and reconstructed. The actors test the interests in question and see how they can be recombined. These are networks of exploration, which study and experiment new combinations within specific boundaries. The solutions proposed return to the forum when a particular agreement has been found. The role of the forum is then to validate the solution.

Finally, at the third level, most of the solutions that are proposed mobilise resources that go beyond the discussion networks and local forum. Specialised government agencies or local authorities have to intervene and are even parties to these proposals. The debate shifts to the politico-administrative spheres, which again have to debate these proposals to validate them for sectoral policies and general rules of public action. The process here is simplified, but the debate can go back and forth between the levels several times, because at each step the knowledge mobilised and the applicable rules can be discussed again and new actors can be called upon.

This circulation model therefore does not imply negotiation outside state structures and without the elected authorities but a discussion process where the solutions are not negotiated: the authorities intervene to check that the solutions comply with the rules or they modify the rules in accordance with the innovations that are proposed. This dynamic is in part at odds with our specialised politico-administrative systems: it imposes a break with an administration founded on specialised expertise. But it does not break with the principle of a legitimate authority, which gives its collective dimension to the decisions.

3.5 Circulation and learning

A theory of collective learning is needed to understand these processes. In the proposed approach, it is stated that most of the debates actually concern disputed objects: sites, farming or tourist practices, protected sites, etc. Whether we are dealing with a river, a scenic site or the location of a water treatment plant, the great diversity of the underlying relations (of use, perceptions, interests) to this object makes a unifying and comprehensive point of view very difficult. So two symmetric obstacles appear. Reducing these situations to scientific categories means defining

always partially the parameters, and it limits the situation to whatever can be measured. The hydrological model certainly provides an overall picture of the catchment area, but it is also a partial picture that does not show certain uses. Scientific modelling contains implicit points of view and ignores the absent actors and the knowledge of the laymen. By circulating the issue, it is possible to identify these dimensions and hidden actors. The effects of this circulation then have to be examined on different levels: empirical knowledge, public standards and commitments in the action.

3.6 Circulation and empirical knowledge

By temporarily separating the empirical discussion on knowledge of the area from the political debate on the costs and advantages, it is possible to loosen the link that the scientific or technical expert tends to establish between these two levels when developing or defending a project: what is known can be debated while suspending for a certain period of time discussion of the political consequences of these explorations. The empirical explorations then enable certain actors to contemplate other scenarios or empirical knowledge where new technologies would make sense if the rules or forms of cooperation and coordination between the actors were changed.

The action of *association* introduces knowledge that is unknown to the promoters but also introduces knowledge that remains tacit or unexplored. Furthermore, the local joint action goes beyond the boundaries of the disciplines and sectors of public action: by referring to the area as a matter of priority, the joint action shows the need to discuss the conditions for the application of scientific and technical knowledge (which is always very general) to a specific case.

Finally, circulation of the issue reveals the relationship of reciprocal dependence that exists between the actors (eg. it helps to empirically understand the relationship between the upstream and downstream sections of a river). In so doing it creates the conditions for a collective appropriation of the assets of the environment.

3.7 Circulation and rules

The normative discussions also concern the question of the local application of general rules. For the application, the authority has the freedom to interpret the situations, taking into account empirical knowledge (which defines the situation) and the commitments of the authorities in this situation. Thus the protection of a site or water resources can reveal the responsibilities that are connected with an agricultural or regional planning policy. The joint action is therefore often going to question the

coherence of the different policies being conducted by the same authority or by different authorities, question the practical contradictions and impose revisions of these policies. So here too there is a learning effect where the real effects of the policies on the areas are discovered.

Circulating an issue makes it possible to identify the responsible authorities and their commitments in the matter. It is worth noting, in our case, that the acceptance of a rule (or of a risk) is conditioned by this work of identifying and assigning responsibilities: some of the participants in the joint action are going to accept a decision, which is nonetheless for them, because after all the debates that took place the project seems to them legitimate. *Collectively* speaking, this solution seems to them the best one, having considered all the possible cases. Here "collectively" means nothing more than the reciprocal commitments of the actors in an area that is participating in the joint action.

The normative discussions therefore raise the question of those involved in the decisionmaking and who are accountable. In some cases, the joint action moves the debate to a higher level, to the policymaking institutions. In other instances, it takes the issue to a lower level, to the local enforcement of the rules. The top-down versus bottom-up rhetoric is in fact rendered obsolete by this circulation, which goes from one centre to the other.

3.8 Reconfigurations and identities

Do these processes have effects? Of the different cases studied, we can assume that the results translate into reconfigurations (objects, projects, areas) and that these reconfigurations sometimes involve the identity of the persons and groups, that is to say the ways in which the agents become engaged in the action. Reconfiguration is understood to mean, for example, redefining the development priorities of a municipality after a long process where environmentalists and those in the tourist business have been at odds with one another and finally decide to negotiate a joint project: not only has the area changed its vocation and therefore its identity but the actors themselves have changed projects and strategies and are now engaged in a kind of collective management of the area.

The processes of reconfiguration are not original in themselves. They are comparable to the changes in the strategy or technological path of businesses confronted with environmental rules or policies. However, here they are the result of empirical observations, combined with normative debates and socio-political commitments. So what participation does, as a process of *association* and *circulation*, is to create the possibility of reconfigurations, in some cases simply

technical in other cases based on an identity, around objects that are taken on board by collective bodies and governed by rules that are identified and recognised.

These reconfigurations imply taking into account something that is often overlooked in political and institutional analyses, ie. the commitments of people. In an industrial society, these commitments were supposed to be borne by the professional and political affiliations that structure the political field through political discourse. The question of commitments is often dealt with in the somewhat static vocabulary of identities; but it can be worded as the answer to two questions: who in the situation is capable of acting and who has motives to act? In the case of the protection of biodiversity, for example, rewording the question at the local level is likely to lead to new configurations of action. Here, we are mobilising a whole range of knowledge, ecological but also agricultural, tapping into relationships of proximity as well as professional groups (for example, agriculture) and taking advantage of day-to-day practices as well as road maintenance techniques. The reasons for acting can be many: a concern for comfort, economic interests and a concern for joint management. As soon as these processes of reconfiguration get under way, they often lead to these questions in a way that is often difficult to predict. However, these commitments, as soon as they are no longer only or mainly found in conventional forms of political representation, appear in all kinds of actions ranging from local action to improve living conditions to mobilisation for general if not world causes. Participation, if our idea of "circulation" is accepted, then becomes the process that disconnects and reconnects the affiliations and practices to the recognised rules and know-how.

4. CONCLUSIONS AND DISCUSSION

"Participatory" approaches are often interpreted in terms of political "communication" where, according to Hagerman, the logic of systems is contrasted with the logic of the world as it is experienced. However, our analyses show that the joint action of citizens and laymen also mobilises technical and scientific knowledge, modifies it and creates new contrasting knowledge to demand discussion of the rules that are to be applied. We have therefore proposed a new model to analyse the functioning and effects of participation that we can call a "circulatory" model of learning. Joint action, because it involves circulation and association, refuses to definitively separate these two levels. Instead it seeks to explore all the possible connections between what is known, what is desired collectively and what the actors are capable of and want. But what form then should be given to the discussion, what procedure should be adopted?

Society is like a huge forest or immense scenery. Since it is not possible to understand it from a single point of view, it has to be explored and observed in different places, at different levels. And all the results obtained have to be compared to arrive at a better understanding, to validate the most interesting points of view. Participation is nothing more than a stimulus for this circulation and this comparison of points of view.

To what extent can this circulation dynamic satisfy the requirements of sustainability? In the case of territorial issues, it is clear that joint action could be, like with Nimby, an action centred on the quality of the local area, although this raises two criticisms. The first criticism concerns the risk that areas with the most resources (the rich neighbourhoods) will protect themselves against any pollution and in so doing increase ecological inequalities. The second criticism is that sustainability cannot be reasoned at the local level but at the global level and must accept, for reasons of global efficiency, a distribution of costs and pollution. The two criticisms are precisely only relevant if the circulation of the issues stops at the borders of a local area, contrasting it with the global and completely separating it, which necessarily amounts to externalising the costs and responsibilities. Our analyses show on the contrary that the participation dynamic, if it follows (deconstructs and reconstructs) the collective bodies covering the problems and solutions, instead opens the local area to hidden interdependences, to the underlying systems of rules. The role of the State as a place for the elaboration of rules is crucial here. The contribution of processes like these makes no sense unless we accept the following idea. We of course know what the major objectives and challenges of sustainable development are, but we do not know how they can be translated into day-to-day management and decisions in the different sectors so that fairness and efficiency are preserved. We also do not know how the changes we are seeking in our methods of production and consumption will change identities.

Another answer is to be found in the need (that any sustainable development policy has to satisfy) to ensure the viability of all the collective bodies participating in development. If the objective is a more environmentally responsible management of waste, then there has to be a coherent change in technologies, cost standards, economic sectors and everyday practices. The viability of each step has to be properly ensured. Everyone has to be given the opportunity to adapt, and especially the underlying links have to be made visible and understandable. This visibility of the collective body is a condition for people's confidence and commitment. If participation can contribute to sustainability, it is also because of the capacity for collective learning found in participation and that can lead to other ways of conducting public policies.

4.1 Perspectives

Participation is not a substitute for democratic forms of representation, which must remain the way to elaborate legitimate arguments and produce collective rules. Otherwise participation undermines democracy. Instead it implies that the public authorities lay down rules and objectives that stem from a political will and that serve as a reference for actions and are a recourse for those who would otherwise be excluded or suffer all the disadvantages. But the joint action can be seen as another way of conducting public action. How then can participation be included in a vision where the political and administrative authorities remain responsible for rules and objectives? The "experimentalist" vision (Sable) of public policies outlines a different way of devising and conducting a sustainable development policy. The main problem on a cognitive level is the feedback of experience. On a normative level, the problem is that of the limits and borders of the collective bodies concerned.

In the case of protecting biodiversity, for example, an objective where it is easy to reach a consensus but whose actual implications stir up all kinds of controversy and conflict, is it better to rely on the (very) partial knowledge that we have concerning the disappearance of a few endangered species, on existing conservation rules, on a few adapted agricultural or forestry techniques that we have, all partial elements heavily laden with sociocultural contexts, to impose a system of constraints and regulations? The will to protect, to develop a conservation policy, often leads to a situation where the knowledge and rules are rigidified or hardened to better legitimise and validate the project. Here we enter contexts of strategic negotiation where the partners also harden their know-how and identities. Or is it better to have the general ambition of preserving ecosystems and encourage local exploration, coalitions and joint actions that mobilise scientists, political players and various users (people living there, hunters, fishermen) to invent – in a collective body in the making – new relationships with nature? All these players have partial knowledge and reasons to act that can be reconfigured in relation to one another. In this second case, a mechanism has to be set up to circulate the issue locally and in economic sectors, with the idea of innovating and coming up with solutions.

This probably implies modifying – to give the participation its scope – the politico-administrative institutions and the forms of the public action. Perhaps the first thing to do is loosen the too strong ties the government agencies have with specialised networks of information, techniques and professions. The way in which public institutions are managed often links them too closely to rigid know-how and socio-professional commitments that represent pre-defined frameworks for public action. The politico-administrative institutions would then have to "circulate" the issues more

than manage them, an obligation that still has to be defined in the light of all its consequences. The model of experimentation – because experimenting always involves circulating between theory, hypothesis, mechanism and reality – is the one that is needed as a possible model.

An experimentalist concept of public policies puts the emphasis on evaluation, meaning on the State's (or government agency's) capacity to stimulate, monitor, record and compare the different experiments. The collective bodies that are engaged, mobilising the actors concerned, must clearly be given the empirical and economic resources to create forums and networks of action that are capable of innovating and regulating in an autonomous and decentralised manner. It is then up to these collective bodies to define the limits of their action, the rules of their cooperation. These bodies develop – through forums, networks of exploration and action – experiments to recombine know-how and rules through actions in specific contexts and outline the different ways of defining the parameters. This experimentalist model can, in our opinion, be favoured by the current tendency to decentralise, or even privatise, by the tendency to develop policies in the form of calls for initiatives or calls for proposals, because these trends open up areas for experimentation. In the case, for example, of companies or economic sectors, which elaborate their own codes of good practice or systems of environmental management, these instruments would have to be publicly circulated and discussed with the locals and with consumers. It is then up to the State to ensure (what is most lacking in most of our observations) an accumulation of experiences and a comparison of results. In short, the State would be responsible for the evaluation, designed as part of this circulation. The evaluation has to result in either a change in the rules, or a redistribution of resources or a modification of the knowledge of the actors. The evaluation mechanisms will clearly be mechanisms of circulation if they record and compare the experiences, if they compare them with the normative purposes in a political debate and if they redistribute what has been achieved among all the participating parties.

However, this experimentalist vision is not a return to a rationalist and positivist vision of public action. The experiments as we describe them here cannot be falsified in the sense of positive science, but they can be compared, combined and especially used to draw lessons. If the notion of experimentalism has a meaning, it is an educational and not a "scientific" meaning.

This circulation model then has implications for the social sciences, because it implies that the researcher also agrees to move around in the social area to look at these issues and examine their many ramifications and resurgences. He has to agree to follow and establish a link between the ethnographic observation of local or

ordinary practices, the analysis of institutions and scientific constructions and political discourses and then return to the reconfigurations of practices. The science of politics has to switch from a positive conception of observation and the building of models to a model of a science of learning through combined experiences.

5. USE OF THE RESEARCH

Results from this research have been published in various scientific journals (see below) and used by C Mougenot in the work of a committee of the Council of Europe for which she published a guide entitled "Instruments sociologiques de la gestion de la biodiversité" ("Sociological instruments for the management of biodiversity").

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ENVIRONMENTAL DECISION-MAKING: METHODS AND TOOLS

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1. SUMMARY OF THE FINAL REPORT ON "ENVIRONMENTAL DECISION-MAKING: METHODS AND TOOLS"

Continuing debate and uncertainty with regard to possible environmental damage caused by the release of GMOs; increasingly congested traffic despite ozone alerts; the lack of adequate measures to curb the emission of greenhouse gases; a pile of radioactive waste but (as yet) no definite storage place; controversies over the health threats posed by the emission of pollutants, etc. These topical issues suffice to call into question the effectiveness of environmental policy.

This assertion constituted the starting point for the project on "Environmental Decision-Making: Methods and Tools", which was carried out by STEM within the broader framework of the programme entitled "Levers for a policy aimed at sustainable development" of the OSTC (Federal Office for Scientific, Technical and Cultural Affairs).

In the initial phase of the research project, the problems with which environmental policymaking is confronted were placed within the framework of a broader social analysis. This resulted in, among other things, an essay by former STEM-researcher D. Holemans: "Ecologie en burgerschap" (*Ecology and Citizenship*). The analysis of the environmental crisis presented in this publication provided the cornerstones of our search for effective support tools for environmental policymaking.

Furthermore, developments in three decision-supporting scientific disciplines were examined, namely Technological Assessment Research, Formal Analytical Decision Science, and Quantitative Environmental Assessment.

On the basis of observed developments and a broad social analysis, we were able to formulate criteria which innovative approaches and tools for environmental policy must meet.

Further, we drew up a draft guideline for developing a 'tailor-made' policy supporting process.

After all, each problematic situation has a 'unique' combination of characteristics, so that it is impossible to put forward a single procedure or method for dealing with policy issues relating to sustainable development.

The guideline is intended to provide a solid starting-point for a thorough analysis of problems and contexts that gives due consideration to the advantages and drawbacks of the methods to be employed.

The activities of STEM within the framework of a number of policy-oriented research projects for various government bodies allowed us to ascertain both the feasibility and the practicability of the proposed approach.

In the following paragraphs, we shall elucidate some of the results of the research project.

2. THE SOCIAL CONTEXT IN WHICH TOOLS FOR ENVIRONMENTAL POLICY MUST BE APPLIED

The issues which current environmental policy faces, including those already mentioned, are extremely complex, not only from a policymaking perspective, but also from a social and scientific viewpoint.

2.1 Policy-related complexity

None of the above listed issues is related exclusively to environmental policy: other areas of policymaking, such as technology, infrastructure and transport, agriculture and economics are equally relevant. Therefore, sustainable development must inevitably entail an integrated approach to the effects of decisions in each of these policy areas. Conversely, it must consider the environmental consequences of decisions in any other policy area. It speaks for itself that this increases the complexity of decision-making.

2.2 Scientific complexity

Health threats posed by pollution, global environmental change through human interference: man-in-the-environment is such a complicated system that complete knowledge of all influencing factors is out of the question. It has emerged that the request from policymakers for certain problem analyses and solution proposals was based on unrealistic expectations. In recent years, many ecological issues have been hotly debated by disagreeing scientists.

2.3 Societal and ethical complexity

However, not only scientists are disagreed on the nature and the cause of problems as well as on how they should be resolved. Citizens and groups in society have equally disparate opinions on ecological issues. Some believe firmly that a ‘bio’ lifestyle is the right solution, while others believe that business can carry on as usual,

provided that certain ‘green’ corrections are made. This broad range of responses is occasioned by disagreement within society on values. The farmers’ union and consumers, the business manager and local residents, the driver and the cyclist, the plastic producer and the environmentalist: each actor emphasises different aspects of the same policy issue. Their positions are based on deeper, sometimes diametrically opposed, convictions and values. In short, society is made up of a multitude of perspectives on environmental issues.

Moreover, as the German sociologist U. Beck rightly asserts, in late-industrial society such underlying value systems are increasingly interpreted in a personal way. Tradition and institutionalised bodies have largely lost their significance as beacons, or pioneers or representatives of public opinion. Citizens increasingly respond to policy issues that affect them by forming ‘temporary coalitions’ in order to influence the policy agenda and to exact measures by means of ‘subpolitical’ actions. This is especially apparent in the environmental policy arena. Although this dynamics can be very positive, its unpredictable nature can represent an additional problem for a decision-making process that is geared to solution schemes.

2.4 The end of technocratic temptation

These fixed solution schemes usually attribute a dominant role in decision-making to technocratic expertise.

It would appear that policymakers, scientists and interest groups continue to believe that policy is based on so-called ‘objective’ knowledge. Scientists are expected to defuse or neutralise the debate on values and social objectives, and to treat problems that present themselves as purely technical issues.

This ‘linear’ solution scheme is untenable, not only because of the incompleteness and uncertainty of knowledge, but also because scientists themselves work within paradigms that offer different perspectives on the world. And these perspectives, which help determine the premises and hypotheses of experts, are not incorporated into such schemes as points for debate.

There is a real danger that using linear schemes may actually give rise to lasting controversies. Value-related concerns are not discussed in the ‘objectified’ discussion, but they may result in lasting debate on the scientific findings. The result is a purely strategic use of scientific information.

3. TOWARDS A MORE PARTICIPATORY AND INTERACTIVE POLICY DEVELOPMENT

More participation and interaction can offer a way out of the complexity and lasting controversies.

By 'public participation', we mean that policymaking processes should be made accessible to groups and individuals who are 'traditionally' not involved. Decision-making will thus become less elitist and less '*we know best*'. Public participation is a process that supports decision-making by allowing interest groups, consumers, citizens, employees, voters, victims, target groups, … to provide information, put forward possible solution, or contribute to decision-making.

This differs in terms of form, participants and content from current procedures within advisory councils. In order to motivate citizens to participate in decision-making, a number of new forums are required. At its very best, participation may after all be conceived as genuine 'interaction' between the different perspectives involved in a policy issue, so that innovative solutions become possible.

In the light of the problems outlined above, the argumentation in favour of participation and interaction is threefold:

- Content-related argument: content of policy is defined more clearly

  Social and ethical considerations, experiential expertise and other forms of knowledge that are not involved in technocratic decision-making are now called upon. Through participation, a whole array of existing perspectives may be considered in the decision process. Under normal circumstances, this would be restricted to the perspectives of institutionalised discussion partners or appointed 'objective' scientists. Policy will ultimately be based on 'better' and more complete knowledge; its analytical power will be enhanced.

- Instrumental/pragmatic/functional argument: more efficient policy

  Participation leads to broadly shared responsibility for policy choices and possible unforeseen effects; it thus enhances the acceptance and robustness of decisions. By involving all relevant actors in the various phases of policy formation and policymaking, one increases the chance that the eventual measures can count on broader support and will meet with less resistance during implementation.

- Moral argument: a more democratic governance

Participation enhances the legitimacy of decisions. From the perspective of democratisation, it is often argued that political decision-making is too elitist and technocratic. In participatory initiatives, all parties concerned are given access to decision-making.

It would however be premature to regard participation as a 'paved road without obstacles towards a cleaner environment'.

First, it should be pointed out that it concerns social experiments whose dynamics and outcome are unpredictable.

Moreover, participation is not guaranteed to result in the most environmentally sound decisions.

It would however appear that increased participation is essential to developing environmental policy.

Another central question in this STEM-project was which elements of existing solution schemes and approaches are worth retaining?

4. DEVELOPMENTS IN A NUMBER OF DECISION-SUPPORTING DISCIPLINES

The altered context we have just described (policy-related, actual and social complexity) also affects evolutions that we were able to ascertain in different disciplines. The assessment of these disciplines and reflection on what they might and should be able to contribute has prompted change in these areas.

Technological Assessment Research: from early warning to interactive development

Technological Assessment Research focuses on interactions between (desirable) social and technological developments, with the purpose of tuning them more closely to one another. TA consists in a collection of strategies, all of which are aimed at improving the functioning of technology in society, and increasing the impact of society on technological development.

TA emerged in response to questions regarding possible unforeseen negative effects of new technologies on public safety, health, employment, the environment etc.

The purpose of TA has always been to help influence technological choices in society. But the formula that is applied has changed quite significantly. TA has, over the past 20 years, developed from a rather objectifying social cost-benefit analysis of

technological developments (by determining impacts and advantages) to a strategic activity for the benefit of decision-makers and policymakers. This evolution within the field of TA was influenced by changing views on technology (technology as a complex social construct whose consequences are not easy to predict) and society (society as a network of interacting players).

In the course of the past 20 years, the following shift of emphasis has taken place in TA:

- Early warning TA (EWTA). Originally, the aim of TA was to identify as quickly as possible all possible unintended side effects of technological development. EWTA ties in with technocratic decision-making. It produces scientific reports in which predictions are made of the societal impact of technological developments. Politicians can use such neutral, matter-of-fact information in decision-making. Neither the scientists working on technological innovation, nor the public at large are involved in TWA.

- Constructive TA (CTA). From the 1980s, attention shifted to TA as an activity that can help steer the development process of technologies. The conviction grew that good TA must be based on deliberation between the various perspectives on the societal impact of technologies. Thus, the emphasis shifted towards the active involvement of all possible actors participating in the development, implementation and consumption of technologies. But CTA still represents a rather slow response to technological developments that are already underway. It is kept outside the laboratory and strategic decision-making.

- Interactive TA (iTA) or Participatory TA (pTA). In the current variants of TA-research, multiple perspectives are assumed, including those of laymen, the corporate world, environmental organisations and authorities. In other words, one takes due account of the viewpoints of all actors: those who are affected by the technology (the stakeholders) and those playing an active role in its development, implementation and incorporation into society (e.g. suppliers, sponsors, and implementers). Thus, the actors are able to work on development trajectories that are meaningful from the various perspectives. This far-reaching involvement in iTA produces more reliable and more robust results and recommendations. In this approach, one works on methods such as citizens' juries, consensus conferences, focus groups…

Formal decision science: from selection to support for debate and communication

Formal decision science is concerned with the application of formal rationality on complex problems so that the key elements in the decision –the goals, alternatives and uncertainties- are determined explicitly.

It concerns methods -often of a mathematical or numerical nature- such as multicriteria analysis, computer modelling, Delphi method, scenario analysis, cost benefit analysis, value tree analysis…

Using the above methods was long seen as a way of rationalising policy choices as strictly as possible. Multicriteria analysis was intended to determine mathematically an 'absolute' hierarchy of policy options. It was felt that, in this manner, one could ascertain which option was objectively the best and should therefore be chosen. Cost-benefit analysis, on the other hand, was intended to reduce all consequences of policy options to their monetary equivalent in order to determine which option would be optimal.

It speaks for itself that such a naïve outlook on policy issues conflicted with the observations regarding complexity described above.

A calculation of the optimum, an objective ranking, is hard to achieve as not all impacts of options can be assessed correctly beforehand. Matters become even more complicated if certain presuppositions of such methods are called into question after societal debate.

Therefore, there is a feeling, including within the field itself, that a different outlook on these methods is required and that they should be used in a different way in a decision-making context.

Consequently, more emphasis is now put on the possibilities they offer for structuring the debate and for supporting communication. These methods can indeed be incorporated into a participatory decision-making process, providing the required methodology and transparency. Policymakers, experts, stakeholders and citizens can, by means of some of these methods, be involved in an interactive process that takes due account of the reality of societal and ethical complexity. Participating actors could, for instance, select experts to evaluate the consequences of policy options. And these experts could debate possible effects and uncertainties (e.g. in Delphi rounds) in order to arrive at a realistic assessment. Actors could also be involved actively in the selection of criteria for analysis and evaluation.

Of the available methods in decision science, some are more suitable for such incorporation into an interactive process than others. For example, value tree analysis, which makes more explicit value-oriented concerns and priorities, can offer valuable support for an open and inclusive decision-making process.

Another example is multicriteria analysis, provided that it puts more emphasis on connecting scientific information with value-oriented arguments than on finding the optimal solution.

Cost-benefit analysis, on the other hand, would appear to be less appropriate in a context of multidimensionality, incomparability and value judgements – all of which are characteristics of the complex reality of decision-making.

Integrated Environmental Assessment: robust vs. contested knowledge

In environmental science, too, many methods have been developed for supporting decision-making. These include life cycle analysis, substance flow analysis, materials flow analysis, indicators, and risk assessment.

All these methods have in common that their implementation involves a 'system definition' phase (i.e. determination of the boundaries of the 'system' that one wishes to examine) and, after data collection, an interpretation phase.

In both phases, one is confronted with the phenomenon of complexity, the incompleteness of data and the uncertain nature of certain conclusions.

It is therefore not surprising that generating robust knowledge by means of these methods is no straightforward matter.

Research on the role and the use of such assessments in policy issues has shown that robustness of knowledge is, however, not solely dependent upon the quality of the actual data, but is also influenced by the existence of different perspectives (or mental frames) from where these issues are approached.

The Dutch researcher A. Tukker, for example, distinguishes between three perspectives in debates on the toxicity of chlorine and PVC in the Netherlands and Sweden:

- The 'business as usual' mental frame, which largely follows the traditional risk assessment approach (great confidence that people can acquire adequate knowledge regarding emissions and impacts, great confidence in technological interventions aimed at restricting emissions and their consequences, great confidence in the 'resilience' of nature in dealing with human 'errors')

- A ‘strict control’ mental frame, which recognises the limitations of risk assessments (moderate confidence in the knowledge capacity, great confidence in technological solutions, belief in the vulnerability of nature)

- A ‘phase-out’ mental frame, which gives preference to a preventive and prudent approach (little confidence in human knowledge of emissions and effects, little confidence in technological solutions, belief in the vulnerability of nature).

If one wishes to acquire knowledge about complex systems, one must inevitably make choices and assumptions, formulate hypotheses… This process is however ‘coloured’ by the mental frames in which it unfolds. And the knowledge thus generated will therefore be contested by certain actors, if these choices are incongruent with their own mental frame. For this reason, robustness of knowledge, i.e. its capacity to remain ‘standing’ within the societal arena, depends upon the room that the debate creates for mental framework-related elements and arguments.

Tukker was able to conclude from his analyses that it is still possible in complex environmental issues to identify robust knowledge. Substance flow analysis data, for example, is almost always accepted in debates. Only a few elements from LCA and RA studies were also retained as robust: it concerns small amounts of data (e.g. about emissions), which can help shape a debate by establishing a link with other information and knowledge. A so-called linear application of RA and LCA (‘LCA indicates that with regard to the chlorine-chain the best option is to …’) appeared to be impossible. The reason cited by Tukker is that RA itself is situated within one of the above mental frames. Therefore, the results obtained can only be applied to a limited extent in socially charged debates.

Consequently Tukker argues in favour of a limited use of such methods and, first and foremost, in favour of their incorporation into a process in which all perspectives are taken into account.

5. PLURALITY AND METHODOLOGY: CORNERSTONES FOR THE DESIGN OF OPEN KNOWLEDGE AND POLICY PROCESSES IN SUPPORT OF A SUSTAINABLE DEVELOPMENT.

It is apparent from the description above that these disciplines have undergone a number of similar evolutions. The realisation of uncertainty and incompleteness and the necessity to broaden participation in the decision-making process are the driving forces behind these evolutions.

It therefore appears to us that there is a real opportunity for a synthetic approach whereby the best aspects of all these different disciplines are united into a 'tailor-made participatory decision-supporting process'.

The two keywords for shaping this process are: plurality and methodology.

Plurality

The approach must explicitly recognise and honour the existence of different mental frames.

The development of pTA and iTA is a good example in this respect. This kind of TA is a good way of looking for appropriate methods for making more explicit the arguments of the various actors involved regarding problem definitions, solutions, ways of thinking and deeper preferences. Gradually, through repeated confrontation, this approach can lead to an innovative synthesis offering new solutions.

Methodology

The approach must be transparent, among other things in terms of the method used in the assessment of options.

The methods used in formal decision science and integrated environmental assessment are intended to evaluate policy options by means of economic, physical, and administrative criteria. If applied correctly, they exhibit scientific earnestness; where possible, they provide arguments based on the persuasive power of data.

Furthermore, tools have been developed in this tradition that allow one to present differences between expert opinions to the public in an understandable way (scenario building, multicriteria analysis, Group Delphi…).

Confronted with topical issues in environmental decision-making, this tradition has opened itself up to a more qualitative and interactive approach.

Criteria for a synthetic approach

At best, a synthesis of the two above traditions would imply a mutual enrichment of the social, policy and scientific discourse. It could lead to evaluations that integrate values and scientific knowledge and that are useful to policymakers. It could, for example, provide knowledge about more options, insight into the criteria that are relevant to decision-making, as well as insight into the source, the nature and the perception of uncertainties.

The purpose of a synthetic approach is to provide a framework for learning processes as well as a systematic exploration of issues. Key concepts are therefore: transparency, scepticism, independence, responsibility; but also: a broadening of the approach, taking due account of alternative options, plurality of societal perspectives, recognition of uncertainty and ignorance, and taking into consideration the question of usefulness and merit.

In order to attain these goals, we have, on the basis of our broad societal analysis and developments in decision-supporting disciplines, drawn up a list of relevant criteria that a synthesis must meet:

- Flexibility and a broad focus.

  The approach and methods as such should not impose restrictions in terms of the kind of criteria and arguments that one wishes to use for the assessment of policy options.

- Openness with regard to choices, values, mental frames and assumptions.

  It should be possible to take account of a great variety of interests, values, priorities and assumptions. There should also be openness with regard to possible policy strategies and options.

- Honesty with regard to uncertainty.

  Uncertainties must be recognised and studied. The analysis must ‘explore’ a wide range of possible outcomes.

- Heuristic exploration rather than unusable precision.

  The methods used should not be regarded as an ‘analytical fix’ which itself determines a specific ‘rational’ decision. They must also provide support for the acquisition of relevant knowledge and an exploration of policy strategies.

- Analytical discipline and sincerity

  The methods used must have an adequate theoretical basis. Their application must be systematic and verifiable.

- Transparency in order to allow review

  A form of audit must be possible in order to connect the results with different ‘inputs’, assumptions and parameters.

- Openness towards broad participation

  The methods must allow an open, participatory and argumentative approach.

- The possibility of incorporation into regulatory processes.

  The requirements that methods impose must be ‘realisable’, their implementation must not be excessively expensive. The dangers of ambiguity and non-robust results must be minimised.

- Feedback, iteration, reflexivity

  A successful approach to dealing with complex issues must allow learning processes, and thus provide feedback.

- Stimulate multidisciplinarity

  The incorporation of different disciplines is necessary for dealing with such complex issues. The approach must enhance co-operation between these disciplines.

Toolbox

Methods from these different traditions, which we have retained for a tailor-made process, have been collected in a tentative ‘toolbox’.

- Consensus conferences
- Citizens’ juries
- Scenario workshops
- Focus groups
- Interactive surveys
- Value tree analysis
- Decision analysis
- Multicriteria analysis
- Sensitivity analysis
- Scenario analysis

- Delphi

A tailor-made decision process

The above list of methods to be used should not create the impression that one can outline ex ante the entire approach to any decision-making process in relation to sustainable development.

The list merely represents a set of approaches, methods and tools that can be applied flexibly. An analysis of the problem and the policy context constitutes a necessary phase and will provide a guideline for the eventual shaping of the decision-making process.

Therefore, in the next phase of our research, we dealt at length with the characterisation of policy issues and contexts.

To this end, we consulted the literature and conducted a transversal analysis of a series of case studies in which STEM was involved. All of these cases were relevant to policy issues relating to sustainable development.

The characteristics of policy issues and contexts that were considered to be important were:

- whether or not the policy issue was structured (which is determined by the uncertainty over facts and values involved);
- the development stage of policy issues (is it at an exploratory phase, the policy formulation phase or the policy implementation phase?);
- the maturity of technology development and its position within the policy debate;
- the socio-political context of the policy issue:
    - Who are the stakeholders?
    - To what extent has the issue been institutionalised?
    - What is the extent of antagonism? (i.e. are there very obvious differences of opinion and/or interests among the actors involved?)
- the public and the political agendas:
    - Is the issue visible and has it drawn much interest?

Taking into account these characteristics, a number of choices need to be made with regard to the design of the process, including:

- the selection of participants in the process: should participation be limited to experts or stakeholders, or should the public at large also be involved? How should the notion of 'representativeness' be approached?

- the intended role of the policy-supporting process in decision-making: does one wish to achieve direct policy support or is the process meant to keep a certain distance from political decision-making?

- the rules of interaction and communication: what is the role of the various participants?

- problem formulation.

The choices that are made in the design will therefore determine the selection of supporting tools.

Building on the emphasis that we put on the need for interaction and debate, and in order to guarantee the legitimacy of the decision-making process, we believe that it may be necessary for the shaping of the process itself to proceed on the basis of a so-called 'open and exclusive design'.

6. PUTTING THEORY INTO PRACTICE

In the international literature, a number of examples can be found of policy-supporting methods that combine plurality and methodology.

The British researcher A. Stirling, for example, proposes a multicriteria mapping process involving participation by stakeholders. He has tested the method on applications in energy- and technology-related policies (including with regard to GMOs).

The German researcher O. Renn, for his part, developed a three-phased approach in which stakeholders, experts and citizens all play a role. This model, too, has been implemented in the context of energy policy.

STEM uses the acquired expertise on innovative decision-making in a number of policy-oriented research projects on the environment and technology, including with regard to biotechnology, environment and health and sustainable mobility.

A good illustration of this approach is the design of a participatory concept for the design of a Strategic Environmental Impact Assessment (S-EIA). STEM developed this concept as part of the Draft Mobility Plan for Flanders (Ontwerp Mobiliteitsplan Vlaanderen).

We shall elucidate some relevant aspects of this plan.

Decision context

Decision-makers in Flanders put forward certain views on 'sustainable mobility', which have been translated into five strategic goals with regard to reachability, accessibility, liveability, environment and safety. Generally speaking, this view is shared by the stakeholders.

However, a consensus is still lacking on the actions and measures required for reaching these goals.

In this instance, the political objective of the debate will be: how to filter the proposed approach scenarios in order to arrive at a mobility plan for which there is sufficient support?

Question put to STEM and consortium of environmental experts:

How should the legal procedure of an S-EIA be used in order to filter (i.e. to evaluate and to select) the proposed scenarios (i.e. packages of measures) in an effective and pluralistic way?

- Effective: supporting the policy option for a scenario that offers the greatest likelihood that the goals set will be realised, by incorporating all relevant knowledge and perspectives;

- Pluralistic: broadening of perspectives (i.e. taking due account of social and environmental considerations besides economic factors) and involvement of more actors in the debate (i.e. specific target groups and individual citizens besides established stakeholders).

Suggestions from STEM with regard to the concept of participation (draft)

The participatory concept within the legal frameworks of S-MER (European Draft Directive on Planning and Programmes) is vague with respect to the following questions:

- Who may participate in which phases of the design of an S-EIA?

- What is meant by participation, and which participation strategy may be followed?
- What will be the impact of participation on the various decision moments in the planning process?

One of the basic principles of an S-EIA is that the entire planning process should be made transparent for a broad public. This translates into a necessity of communication about the different phases of the planning process with a broad public, and participation in analyses, choices and decisions on the part of organisations and citizens involved.

Assessing the future effects of existing mobility scenarios involves two types of uncertainty:

- with regard to knowledge: scientific uncertainty about the prediction of the scope of effects;
- with regard to values: uncertainty about the importance that is attributed to different impacts.

Therefore, there is a need for participatory methods that take due account of these two types of uncertainty.

STEM makes a number of other suggestions with regard to the interpretation of the notion of participation in the different phases of an S-EIA.

1. Screening:

In this phase, one needs to answer the question: is an S-EIA required for this plan? And if it is, then which procedure should be followed for drawing up the report?

At present, screening procedures are often conducted by the authorities, without any involvement of the directly or indirectly affected public. By involving the public at this very early stage, one creates trust and a basis of support for subsequent decisions.

Proposed method: experts as well as laymen should interactively fill in a matrix, in which horizontals represent the proposed activities for the mobility plan, and verticals represent the significant social and environmental impacts. For each intersection, one debates whether there are likely effects, and how significant they may be. On this basis, one can decide whether or not an S-EIA should be carried out.

2. *Scoping:*

In this phase, one determines which environmental and social impacts will be considered and which frame of reference will be applied for the assessment of different options or scenarios. We suggest that value tree assessment be used to this end.

Value tree analysis is based on the assumption that all concerns can be structured within a generally accepted framework. It is therefore a tool for enhancing communication and interaction between stakeholders in their search for shared solution strategies.

The product is a value tree consisting in a hierarchically structured list of values or criteria that represent the concerns of the stakeholders. The criteria retained are translated by the research team into indicators (and their targets), so that the performance of alternative policy options could be assessed. These indicators should in turn be presented to the stakeholders and, if so required, adapted until they are approved.

3. Impact assessment

In this phase, scenarios are generated and assessed.

Principle: do not work towards one preferred option too quickly, but proceed gradually, and try to acquire better insight into alternatives and their consequences through debate and negotiation (with experts, stakeholders, policymakers). Or: not the solution is central, but the process of scientific knowledge-building in relation to the values and concerns of stakeholders.

Proposed method:

- future-oriented workshops with participation by experts, civil servants, stakeholders, with a view to generating scenarios;
- A Delphi Round to provide performance profiles for each scenario: with contributions by different kinds of expertise (various disciplines, different perspectives within one discipline, professional experience, anecdotal knowledge and experiences…) and with explicit mention of uncertainties and mental frames.
- Multicriteria analysis and mapping: citizens' panels to assess proposed scenarios by means of criteria that appear in the value tree.

4. Review:

This phase provides an opportunity for voicing critical comments on the S-EIA. At present, this is seen primarily as a matter for the public administration. However, it is very important that a broad public also be given an opportunity to formulate remarks. Besides independent experts, interest groups and the general public need to be consulted. The report on this phase should be made public and any remarks should be incorporated into decision-making on the plan.

Proposed method: assessment of the report may happen on the basis of a checklist of topics referring to the quality of the analytical and the participatory process.

5. Decision-making

We propose that a report of the decision-making phase be drawn up that contains a justification for the choices made: why were environmental and societal factors balanced against other factors in this particular way? And why was a choice made for the plan in its present form, considering the possible alternatives?

This report, too, should be publicised broadly.

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BETWEEN GREEN WORDS AND GREEN DEEDS …: OVERVIEW OF RESULTS AND PRACTICAL IMPLICATIONS

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1. INTRODUCTION

In the present project, we investigated one very important aspect of sustainable consumption, namely domestic sorting of garbage for separate collection and recycling. For households and individual consumers, sorting waste has higher energy and time costs than non-sustainable ways of garbage disposal. Every citizen experiences a social dilemma, between an easy solution that minimizes personal costs but harms society, and a sustainable solution that is more expensive for oneself but minimizes the societal cost. The government acts as a social marketer with the difficult task of making citizens choose for the collective sustainable interest and against strict self-interest.

To encourage domestic waste sorting, the government can use two types of marketing instruments: communication-instruments and instruments for direct behavioral manipulation. Among the direct instruments to encourage waste sorting are 'obliging citizens to sort their waste in several waste fractions' and 'introducing a pricing system that promotes better waste sorting by making bags for recyclable materials cheap and bags for nonrecyclable rest materials expensive'. Programs that used these direct instruments have been induced in Belgium during the 1990s. By using these mandatory programs, government can achieve a change in behavior without achieving a change in mentality. However, this may cause long-term problems, because mandatory participation to sustainable consumption requires airtight control on citizens' behavior, which may be unaffordable over time. Moreover, in a democratic order, government policy needs the support of a majority of the population (which is often not the case). Therefore, the government complement carrot and stick approaches with communication-based social marketing, which strives to achieve a real change in mentality of citizens (which is also an explicit objective of Agenda 21 of the United Nations, 1992). To achieve a change in mentality, authorities may use classic advertising channels, but may also use messages that can be posted on product packaging, on garbage containers, etc.

Previous research on waste sorting behavior was solely oriented on evaluating voluntary recycling programs (for an overview see **Part 1**, Smeesters, Warlop, & Vanden Abeele, 1998a). Hitherto, no research has focused on the reality of mandatory programs and some very important questions are still unanswered. In the present research project, we raised three specific questions: (1) how do citizens experience mandatory recycling programs? (2) which motives underlie people's waste sorting behavior; can we subdivide citizens in different groups with different motives?, and (3) are there any appropriate ways to promote desirable waste sorting behavior? These three important questions structure our research project in three

main parts. Our answers to these questions are reported in seven papers, consisting of two 'overview papers' (see Part 1 and Part 6), two qualitative research papers (see Part 2 and Part 3), two quantitative research papers (see Part 4 and Part 5) and one experimental behavioral paper (Part 7). This summary provides an overview of our work and briefly outlines the most important results and implications of our studies. The reader can find a more extensive description of our studies in the respective papers of this research report.

1.1 How do citizens experience mandatory recycling programs? Qualitative research.

A first step in our OSTC-research project comprised the creation of a database containing the relevant academic literature on recycling behavior. Based on this literature we wrote a review, summarizing and integrating more than 70 academic papers (see **Part 1**, Smeesters, Warlop, & Vanden Abeele, 1998a). Almost all of that research has been carried out in the context of voluntary recycling programs. There was one general finding common to all these studies, namely that environmental values are people's major motive to sort their domestic waste. This is related to the 'voluntary' character of the investigated recycling programs. It is not really surprising that only citizens for whom ecological goals were salient and important recognized the usefulness of these voluntary recycling programs sorted their domestic waste. Nowadays, recycling programs in Belgium (and increasingly throughout Europe) are mandatory. Consumers are requested to follow the rules of the current recycling programs and to sort their domestic waste in a nonrecyclable waste fraction and into several recyclable waste fractions. Research on domestic waste sorting in a context of mandatory recycling programs is lacking in the academic literature. Our research project was one of the first attempts to study mandatory recycling behavior and we hoped to make a significant contribution to the academic literature on recycling behavior.

Our empirical research started with a qualitative study in which several citizens were asked to tell about their experiences in mandatory recycling programs. We conducted focus groups interviews and individual depth interviews. The results of this study are reported in **Part 2**, Smeesters, Warlop, & Vanden Abeele, 1998b, and also partially in **Part 3**, Smeesters, Warlop, Vanden Abeele, & Ratneshwar, 1999). The analyses of these interviews are based on narrative data of 71 respondents, coming from rural regions (Zoutleeuw), suburban regions (Machelen and Deurne), and urban regions (city of Antwerp). We conducted semi-structured interviews, trying to leave as much room as possible for each respondent to tell his/her story.

Afterwards, recycling themes were labeled in all interviews according to the grounded theory approach.

Our results can be summarized into three major themes. One of the central themes in citizens' stories was the habitual nature of their waste sorting behavior. This was especially striking in Zoutleeuw and Machelen where mandatory recycling programs were initiated several years before. In Antwerp, mandatory recycling programs were initiated shortly before we collected our data. Although Antwerp citizens reported more difficulties in their recycling activities compared to citizens in regions where mandatory recycling programs had been operational for several years, most of them had also developed routines in all their waste sorting tasks. As a result of these routines, daily waste sorting activities (like gathering waste, sorting waste, disposing waste) require less problem-solving thinking. Despite the routine nature of waste sorting activities, almost all respondents also reported on practical difficulties (lack of space, odor, insufficient frequency of curbside collecting…), on insufficient recycling information, and on a number of unfair situations (see further). Apparently, our respondents experienced these 'obstacles' as stable over time and had incorporated them in their waste sorting routines. We concluded that domestic waste sorting is a 'habit under pressure'. Citizens develop waste sorting habits, but at the same time are still sensitive for events that may disturb their behavior. Most of these disturbances are only temporarily: they do not affect people's recycling motivations, but they can result in a decrease of people's waste sorting accuracy.

Some of our interviewed respondents in Antwerp lived in city quarters (Schelde left bank, 'Seefhoek') with a lot of garbage problems (littering, waste dumping). Even the Belgian press has been reporting on these issues. In these quarters we found some incidence of strong negative motivations for participation in mandatory recycling programs: these citizens only sorted their waste in order to avoid fines, and looked for ways to evade the recycling rules. But even in this neighborhood, only a minority had these negative motivations. Most of the other citizens reported positive motivations.

A new factor that has never been reported in the context of voluntary recycling programs is the omnipresence of 'civic duties' in mandatory recycling programs. About half of our respondents thought it is their civic duty to sort their waste accurately. These citizens assume that the government asks them to sort their waste for good (collective benefiting) reasons and they find that every good citizen should take his responsibility. Typically, these 'civic duty' respondents do not spontaneously report environmental reasons to sort their domestic waste. The other half of our respondents did spontaneously report environmental values as their major driving force, and possibly (but not always) civic values as a secondary (but less important)

motivation. Obviously, the voluntary participants in our interviews are not necessarily representative for the Belgian population. We will investigate this issue in the second part of our research.

Positive motivations do not imply that people always sort their waste very accurately. Almost all our respondents spontaneously reported events that interfered their self-imposed recycling routines. These events can be categorized into three themes. A first interfering factor is a lack of recycling information. Doubting about where (i.e., in which waste bag) to throw a specific waste fraction may interrupt people's routines. Our respondents clearly indicated that they were not willing to inform themselves better. They do not consider searching for information a personal responsibility; they hold the government and producers responsible. Apparently, their sense of civic duty is restricted to implementing clear instructions that require no further elaboration. A second source of interference is the perception of successful defection by other citizens. Perceiving other people's successful dodging of the rules of the mandatory recycling system might temporarily disturb the personal motivation. Examples are perceptions of illegal waste dumping (in city or suburbs) and waste burning (in rural regions). Our respondents' reactions to these perceptions of defection were often very emotional. Finally, almost everybody evaluates the own recycling system as more difficult and more expensive than the recycling system in neighboring regions or municipalities. People always pretended to know all the rules of the 'neighboring' recycling systems, compared the own system with the neighboring systems, to finally conclude that their own system made them worse off compared to citizens living in the neighboring regions or municipalities.

Implications: The most important implications can be found in the several disturbances of habitual waste sorting behavior. Interviews with communication managers from two garbage collection agencies (e.g., Interleuven , Incovo) indicated that these organisations hope and wish that citizens take their own responsibility in acquiring appropriate knowledge for accurate waste sorting. The agencies consider it as their task to provide citizens with recycling knowledge, which citizens have to learn and memorize. To us this looks like a very optimistic attitude. In our opinion one has to strive for solutions that require less cognitive effort. Several essential changes may help citizens to sort their domestic waste more accurately. Standardization of recycling programs across Belgium can reduce perceptions of unfair situations. The introduction of a coding system (a color code on the packaging that matches an identical color code on the waste bags, e.g., a red code for rest waste, a blue code for PMD-waste) that indicates in which waste bags specific waste fractions have to be thrown may facilitate accurate waste sorting. These changes

imply standardization of recycling programs and a commitment by producers to introduce color codes. Both implications appear feasible in the long run.

A second implication is that the government should remove every source of subjectively justifiable infraction (e.g., "if other people burn their waste in the backyard, I am allowed to do that too"). Initiatives like the 'white tornadoes' in Antwerp may be very helpful. Littering garbage may be interpreted as a free-for-all and, therefore, litter should be removed as fast as possible. The most important motive for recycling efforts may be the perception of a clean environment. Very few people will be the first to disturb this clean environment.

1.2 Motives/goals underlying citizens' waste sorting behavior and segmentation on basis of these motives/goals

We found evidence for three qualitatively different motives underlying our respondents' waste sorting behavior, one negative motive (saving money) and two positive motives (civic duty and environmental values). In the second phase of our research we wanted to use more quantitative methods to segment the population in different groups, with groups differing in motivational patterns.

The construction of the second research phase of this research project used the findings of the first phase. We used the narrative data of the first phase to construct 'motivational ladders' (see Laddering research in **Part 3**, Smeesters, Warlop, Vanden Abeele, & Ratneshwar, 1999). We pre-tested these ladders with a sample of administrative and technical personnel of the KULeuven. Later on we also applied a more structured classification technique (HICLAS) (see **Part 4**, Nys, Smeesters & Warlop, 2000).

Laddering searches for maximal variation, and therefore probably overestimates the amount and the importance of motives underlying waste sorting behavior (Cohen & Warlop, 2001). HICLAS searches for maximal overlap between the model and the raw data, and because of that may exaggerate the scope of the underlying motives. Nevertheless, both methods find the same three initial motives: avoiding fines and penalties, civic duty and environmental values.

In the second phase the laddering-elements from **Part 3**, Smeesters, Warlop, Vanden Abeele, & Ratneshwar (1999), were used as statements, e.g., "I sort garbage to fulfill my social duty", or "I want to fulfill my social duty because I want to be a good citizen". These statements were submitted to a sample (N=317) of the Flemish population (+18). Respondents were personally interviewed and were asked to indicate for each statement whether it could be applied to them. Besides the

statements, the survey also included several standard scales of relevant personality variables, an extensive self-report of waste sorting behavior, and several socio-demographic variables.

We applied standard data reduction techniques (factor analysis and cluster analysis) to discover our final solution. The best solution for the data reduction problem represents a threefold segmentation (see **Part 5**, Smeesters, Novoseltsev, & Warlop, 2001). A first group was mostly oriented by environmental values. This group is relatively small (24% of all respondents) but is the most accurate waste sorting group. A priori one might have thought that the ecologically oriented citizens would be younger and higher educated. Somewhat surprisingly, the members of this group are relatively older and lower educated. They have a smaller family load and a relatively high income. A second group (34% of all respondents) is characterized by negative motivations and inaccurate waste sorting. Citizens in this group display a proself value orientation, which means that they are only concerned about their own outcomes and pay no attention to outcomes of others. Members in this group are younger, higher educated and predominantly male. Families in this group are rather small and the available space per family member is rather large. This means that this group's inaccurate waste sorting is not a consequence of practical restrictions. The remaining 42% of respondents formed a third group in our sample. Compared to the other two groups, this group scored medium on waste sorting accuracy and on the several motivational measures. Especially civic duty differentiates this group from the 'proself' group. In our complete sample, we never found any differences between citizens living in rural and urban regions, which is not surprising because it is largely known that socio-demographic characteristics are very weak predictors of recycling behavior.

Implications: Our survey-research confirms but also shades the findings of our qualitative research. We found three qualitatively different groups in terms of psychographic and demographic variables. Most of our predictions were obtained, although not all relations were expected. First of all, we expected citizens in the proself group to be lower educated and short of waste storage space. However, these predictions were not confirmed. Our three different groups were also not localisable in rural or urban regions. This finding hampers the practical use of these segmentation schemes. In order to conduct differentiated campaigns one should be able to distinguish these groups more easily. What remains is a more varied image of different recycling motives than has been found in previous research. In previous research, conducted in the context of voluntary programs, it turned out that primarily environmental values predicted accurate waste sorting. Our research, conducted in the context of mandatory recycling programs, found that also civic duty and

punishment-avoidance motives can stimulate citizens to sort their domestic waste. Together, citizens driven by civic duty or by punishment avoidance constitute about 75% of the population. Both groups of people react, both in their own manner, to the societal requirement to sort waste. Probably only citizens driven by environmental values would sort their waste in a context of voluntary recycling programs. These findings confirm the need for mandatory systems as one of the only possibilities to stimulate everybody to sort their domestic waste. Furthermore, our findings also suggest that, besides ecological themes, civic duty themes should be developedt in contemporary recycling communication campaigns.

1.3 Subtle influences to promote desirable waste sorting behavior?

In the third phase of our project we investigated the effect of an alternative communication strategy to introduce more sustainable behavior for citizens that have selfish alternatives to behave. The government's role has always been that of an advocate, trying to convince the consumer to take the collective interest into consideration instead of their self-interest. Convictions can only be changed by offering convincing arguments. For example, in April 2001 a traditional TV-campaign tried to make citizens conscious of the negative consequences of not accurately sorting your waste for future generations. In our opinion, we think that this strategy is probably not the best strategy. Reflecting about several behavioral options activates not only the pros of a behavioral option but also the cons, and consequently also the pros and the cons of selfish behavioral options. This strategy may be effective for radical decisions (e.g., deciding to use alternative energy to heat the house). However, we suppose that this strategy may be very ineffective for simple waste sorting behaviors, which have to be carried out several times per day and which occur in a context of time pressure and mental load. Consumers and citizens probably will not extensively consider these decisions, and if they think about them they will probably come up very easily with counter-arguments. The self-interest (e.g., saving money) will always be more salient than the collective sustainable interest.

Therefore, we proposed an alternative, rather subtle form of communication. We assume that most people have knowledge and latent motives at their disposal to behave in a durable manner, although these motives and knowledge do not always become activated. This alternative strategy does not urge citizens to think about arguments but instead uses simple situational cues that may promote durable prosocial behavior. These cues may 'command' habitual decisions, without the consumer actively thinking about these decisions. 'Priming' or subtle activation is capable of activating latent motives, which may be incorporated in the simple

decision processes of habitual waste sorting behavior (see **Part 6**, Warlop, Smeesters, & Vanden Abeele, 2000). Practically, this implies placing of simple pro-sustainable messages on packaging, in stores, on garbage containers, … which do not try to persuade, but instead try to activate some simple concepts in citizens' minds. In a series of four experiments we tested the hypothesis that priming can influence cooperative behavior in a social dilemma. We succeeded to make people behaving more prosocially in prisoner's dilemma game, even if they were unaware of the influence of simple cues on their behavior (see **Part 7** Smeesters, Warlop, Van Avermaet, Corneille, & Yzerbyt, 2001).

However, we found one group of people for whom this strategy did not work. A classic typology (and accompanying test; Liebrand, 1984) divides the population into people with a 'prosocial' or a 'proself' value orientation. People can also behave very consistent or rather inconsistent with their own value orientation. We found that consistent proselfs acted very selfishly towards prosocial primes. We replicated our findings in several experiments and we could also demonstrate that the effects of primes on behavior are mediated by expectations of other people's cooperative behavior (people that were also involved in the game). Thus, for most citizens the spontaneous expectation that other people will act in a cooperative sustainable manner is a stimulation to behave in the same cooperative sustainable manner. However, the expectation that other people will cooperate stimulates consistent proselfs to free ride on the cooperative efforts of other people. This means that for a limited number of people prosocial communication has a contradictory effect!

Implications: Our experimental results have been obtained in a laboratory setting, using a social dilemma task that only conceptually corresponds to a domestic sorting task. Future research should investigate whether our results are applicable to real-life waste sorting behavior. However, our results are very consistent with the findings in the first two phases of our research project. Our research findings indicated that improvement in accuracy of waste sorting behavior of motivated citizens is possible. Nevertheless, even motivated people make mistakes and even sometimes they prefer the self-interest over the collective durable interest. In some cases, this is inevitable, but in most case we attribute these incidents of suboptimality to thoughtlessness, or to the absence of situational cues capable of promoting prosocial behavior. Using pro-waste sorting cues (e.g., on packaging or on garbage boxes or containers) should realize a stronger consistency in citizen's waste sorting behavior.

However, every form of pro-waste sorting communication is a double-edged knife, and has positive and negative consequences. It has positive consequences for people with a (latent) pro-waste sorting motivation but a small group of consistent

proselfs will react against these messages. Our own field research has indicated that about 30% of the population has negative motivations (saving money, avoiding fines). These citizens are characterized by proself value orientations (see **Part 5**, Smeesters, Novoseltsev, & Warlop, 2001). Probably not all these citizens are consistent proselfs but even a small group of people can disrupt the behavior of larger group of people. Consistent proselfs react very individualistically towards prosocial primes and their selfish behavior can urge other (prosocial) people to also behave in a negative selfish way (a rot apple effect). Our qualitative research has also demonstrated that even cooperative citizens are very sensitive to defective behavior of other citizens in their environment. Some people will try to beat the system (by littering, illegal waste dumping, waste burning, etc…) and their environment will notice that these people's behavior will not be punished. Prosocials are very sensitive to feelings of injustice and may probably react by behaving less prosocially.

If these results can be confirmed for real-life waste sorting behavior, implications are not really optimistic. In social psychology, it is generally known that people may react negatively towards explicit attempts to persuade them. In these cases, people react against the content of the message, and especially if the content of the message does not match their own conviction (as is the case for people with more punishment avoidance motives). Our research indicated that some people might also react very negatively towards subtle messages. Moreover, the findings of our experiments indicated that people's reactions are automatic and mediated by perceptions of an ambiguous environment. At this present moment, our research team is trying to find ways and strategies to eliminate these negative reactions.

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PROGRAMME
“SUPPORTING ACTIONS”

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SCIENTIFIC COMMUNICATION IN THE FIELD OF SUSTAINABLE DEVELOPMENT

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1. INTRODUCTION

Nowadays, communication on research is a problem both for researchers and policy-makers in the field of research. Research programmes dealing with sustainable development are even more problematic.

Scientific methods naturally tend to reduce problems to a limited number of variables that can be examined in a framework that often refers to one discipline. This approach is hindered by the diversity and complexity of problems, all the more since sustainable development implies very vast time and space scales. We could plea for a more holistic or global approach, but, more fundamentally, the relevance of existing mediation practices or the practices that should be established between research and sustainable development could be questioned. On what grounds and in which conditions can research be linked to the notion of sustainable development? Scientific communication can only progress once these questions are answered.

The situation is all the more complicated since it is not limited to the communication flow between researchers within the scientific community or with a handful of clearly identified decision makers (support to the decision-making process) but also involves communication processes with the public. The public is not an abstract notion, several groups are likely to be concerned and mobilised, and research can, at times, lead to the definition of new groups when health hazards of threats to the environment are at stake.

In such a context, research communication is moving further and further away from the model of popularisation or dissemination to turn into complex interactions between research and social practices. The aim of this research work is to gather knowledge, experiences and proposals with a view to developing the mediation model between research ant social or political actors. We do not intend to focus mainly on tools or recipes but rather to identify the possible incentives for a communication between research and sustainable development.

2. OBJECTIVES

The object is not to define tools or recipes. There are methods and models that can be used as references but our hypothesis is that communication between research and society is mainly a process that requires researchers to adopt premises that match the problems that are examined and the expectations of society.

Consequently, the aim is, first of all, to build up a basis for reflexion and knowledge that will nurture experiments and debates.

The first step has been to draw an inventory of the various forms of scientific communication patterns that have been experimented recently and classify them.

Secondly, two case studies have been carried out by partners to the project, focusing on cases more or less directly linked to the OSTC programmes, in order to make a diagnosis and put forward guidelines applicable to scientific communication. Since the diagnosis tries to determine the communication supply and demand, it is also a basis for discussion in future exchanges between researchers, decision makers and the civil society.

The third step consists in a more general methodological reflexion on the tools that would allow for the design and management of research programmes in which the will to communicate would be one of the objectives. Eventually, a series of recommendations are to be suggested.

3. METHODOLOGY

We suggest an inductive, progressive and experimental method. The point is not to suggest a unique model or to define simple recipes. There are, of course, a series of communication tools and techniques -that will be listed here- that could be used more widely in our country. Nevertheless, experience tells us that, for tools to be efficient, they have to be accepted and meet the expectations. The idea is to contribute to a trend that matches the relationships between researchers, decision makers and the variety of actors from civil society.

Consequently, after drawing an inventory (see 4.1.) of communication models, we have decided to study two themes: on the one hand, sustainable development indicators, since they are a field of investigation in which the translation of results into decisions and/or communication tools is provided for in the research itself. On the other hand, we consider sustainable food as a topic standing for a situation in which a whole diversity of researches are being carried out, in different fields, by different actors, and that represents a major challenge to development.

The investigation method consists in making interviews that will be the starting point for questionnaires that are, thus, made up of open questions (see annexe 8.2). Two questionnaires have been drafted, aimed at two categories of actors : people coming from a scientific research background (researchers and research promoters), and

social actors in general (federal and regional administrations, consultative councils, environmental associations, consumer associations, aid organizations, trade unions and industrial unions). The list of interviewees (75), classified by category, topic and language is appended to the full report. The sample includes very diversified actors concerned with the issues dealt with in the research (sustainable food and sustainable development indicators) but respects the time frame set in the contract (one year all in all). All the interviews have been recorded and retranscribed.

The datas have been analysed with reference to the theoretical approach of the sociology of innovation. It establishes a distinction between the reference frames and the usage frames. This distinction makes it possible to differenciate between the research findings and the changes that they may induce.

4. RESULTS

4.1 Inventory of the scientific communication patterns

We should start with a few preliminaries to explain what we mean with communication *patterns*:

- Communication patterns cannot be understood only as information « channels » (written press, audiovisual medias, the internet or conferences). These channels –or medias- are defined once the object and the target group of the communication flow have been decided on ;

- Institutions are not patterns. An institution can resort to several communication patterns as, for instance, the 'science shops' that supply information (*offices, model 3*), publish datas (*dissemination, model 2)* or do research *(desks, model 4*). This is the reason why we thought it was preferable to classify the multiform bodies in the models in which they fit best.

- One pattern does not automatically correspond to one tool. A distinction should be made between the use and the production of tools. In certain contexts, the production of tools is a form of communication that is more efficient that the result as it obliges different actors to meet (river contracts, some indicators, etc.).

We have distinguished between six patterns of scientific communication that are summed up in the following charts.

1. *Communication within the scientific community*

Aim	- For the community : to strenghten and confirm new knowledge, to achieve progress on specific matters; - For researchers : to increase their credibility or their influence.
Intended for	Other researchers specialized in the same -or a similar- field.
Who participates	A group of researchers within a scientific community (together with the sponsors, in a finalized research).
method	one researcher (or a group) is in charge of the knowledge → it belongs to the community as a whole.
Representation	colleagues, egalitarian relationships.
Specificity of the channels	Allows for speed and bilateral interactions.

2. *Sponsored research*

Aim	To meet a demand.
Intended for	The sponsor.
Who participates	Scientists and sponsors.
method	Technical demand → answer.
Representation	Decision-maker, producer, user.
Specificity of the channels	Favours lasting relationships between researcher and sponsor.

3. Popularisation

Aim	To create a general culture.
Intended for	The general public (individuals).
Who participates	Journalists, scientists, public authorities.
method	Specialized knowledge → simplified knowledge.
Representation	Teacher and student.
Specificity of the channels	Must enable to reach out to a vast public.

4. Information offices

Aim	To supply precise datas.
Intended for	Those looking for information.
Who participates	Private and public to a certain extent.
method	Scattered datas→simplified knowledge.
Representation	adviser and user.
Specificity of the channels	Quick and precise.

5. Science desks

Aim	To increase the knowledge of communities.
Intended for	communities (local authorities, associations, enterprises, …).
Who participates	Researchers and interviewers.

method	Social and technical problem→solution.
Representation	Interlocutors.
Specificity of the channels	Make dialogue possible.

6. Public debates and project consultations

Aim	To design acceptable scenarios.
Intended for	A group.
Who participates	different actors : individuals or representatives
method	Political and technical problem→ consensus opportunities.
Representation	Amongst experts (including « non scientific » experts)
Specificity of the channels	Make debate possible

These six forms offer numerous variations and methods. In the sixth pattern, the consensus conference is a very popular method that consists in organizing a public debate where lay people and professionals meet to clarify scientific and technical choices.

These six patterns are the chapters of a directory to which public authorities and scientists can refer, according to the situations that they meet.

4.2 Sustainable food

The communication pattern will be directly linked to the topic of the research itself, i.e. :

- What it analysed (that can be summed up through the operating frame that is geared at) ;
- What it aims at contributing (the knowledge that is produced aims at modifying the reality or, at least, the knowledge of it. At times, the goal is to bring something

genuinely new to light, a new technology, a standard or, more simply, a production or consumption model). The knowledge is not less valuable if it is (whether the researcher is aware of it or not) linked to real or potential usages.

- The potential relevant research target group. This implies a representation (exact or vague) of the characteristics, identities and competences of the « target group ».

We insist on these aspects because they determine the shape and content of research communication. It goes without saying that research financed by private actors, whose objective is to design a specific technology for which a market has been identified (i.e. the reception conditions are known) does not raise any big communication problem.

In the sector of sustainable development, research is problematic because of definition issues : what aspects of the environment, the social and economic surroundings, are studied ? What contribution do we want to pay ? How is the link established with one –or several- dimensions of sustainability ? For whom is the research relevant ? Let's not forget that the questions cannot really be answered through a standard general definition of sustainable development. Abstract definitions do not permit the weighing or connection of these dimensions.

Here are the main problems that have been identified and the proposals that can be put forward.

4.2.1 The problems

The concept of 'operating frame' refers to the 'system' that is chosen for the research (human metabolism, climatic conditions, a drainage basin, etc.) on the basis of which sustainability can be studied. The operating 'laws' of these systems can be deducted from the standards or the objectives that serve sustainability. The 'usage' frames are the actors' practical frames related to the systems (farming practices, consumption habits, management practices). This distinction is useful in the analysis of the answers gathered during the survey, as all the actors define (at least implicitly) what system is relevant to them (that they take into account) and what are the usage frames that they refer to or think of.

PROBLEM 1. BREACHES BETWEEN THE OPERATING FRAMES THAT ARE TO BE TAKEN INTO ACCOUNT

The survey led to the conclusion that what is important for the different actors varies greatly and is perfectly mirrored in the wide range of definitions of sustainable

development. To a certain extent, all the actors have their own definitions of sustainable agriculture and chose one type of research accordingly. There is no general all-embracing framework for sustainable agriculture (unless an endless list of requirements is drawn). Here are a few prevailing and concerning elements :

- The lack of interest in research for the dynamism of international politics that condition the drafting of standards and policies. Consequently, on the one hand, research might be useless because of the evolution in standards and, on the other, Belgian negociators might lack scientific backing. The situation highlights the need for strategic research (or for a strategic discussion on research).

- The major discrepancies observed during the interviews as to the role of consumers and their influence on the situation. Should they be educated ? Should they be given a greater role to play in decision-making processes ? It is a key question since consumers, informed by the medias and consumer associations, greatly influence markets and political decisions, in recession periods, for example.

- Despite polite and moderate answers, actors who were interviewed do not really agree on the sanitary and environmental dimensions. This holds particularly true for biotechnologies, field in which there is a wide gap in perceptions between associations (environmental, consumer and even professional associations) and researchers or some civil servants.

- The 'social' dimension (i.e. the interest of small producers, rural development) and the economic dimension (production costs, competitiveness) are considered very differently. Should we take into account the contribution paid by agriculture to some environmental aspects (biodiversity, landscapes, rural dynamism)?

It might be important to recall that research tends to define a precise object, made up of a limited number of variables rather than to try and encompass it all. The specialization in research is normal and, in our opinion, unavoidable. Let's not dream with a kind of 'global' scientific approach that could include all aspects. Nevertheless, it is important to make it clear that research and research programmes, in defining their objectives, take a certain number of facts for granted ('other things being equal', 'in the current context') that are, all in all, determining variables for the communication processes.

It seems difficult to overcome this obstacle as long as researchers and actors do not undertake a two-sided initiative. The problem here lies in defining a strategic framework that would be a reference for researchers and decision-makers (or users) alike and that would, for instance, define what approach to adopt on environmental

issues, the type of farm production that should be prioritize or how to envisage food safety.

We think that, when it comes to communication, one (or several) strategic forum (a) on (sustainable) agriculture should be opened up (whatever their shape).

We can't certify that this type of fora can realistically be planned at national level or throughout all the sectors. Embryonic forms of fora (CWADD, WERVEL, consultative Councils) already exist and should act as relays for a genuine public communication.

PROBLEM 2. TENSIONS BETWEEN DISCREPANT DEMANDS AND THE COMPATIBILITY OF DIFFERENT DIMENSIONS

Nowadays, environmental and sanitary dimensions are mostly tackled through the standardization of foodstuff production/processing/distribution. This trend raises certain problems amongst which the most concerning certainly is the compatibility of standards. Environmental standards (recycling, cut down in packaging) at times contradict sanitary measures (hygiene, global quality). If, moreover, economic obstacles experienced by producers and induced by agricultural policies are to be taken on board, the problem is to harmonize heterogeneous measures.

The problem is even more acute when one considers, for instance, that health measures are drafted from evolving scientific datas; that standardization does not examine the production conditions and that consumer choices are based on a series of very heterogeneous criterias. The harmonization of standards goes through a complicated process in which, to be consistent, a dialogue should be established between producers (all the actors of the production chain) and representatives of the medical sector, and of consumers.

In this context, research communication should set a series of priority tasks such as :

- the synthesis and update (scientific monitoring) of medical datas ;
- the establishment of a correlation between this knowledge and consumers' choices;
- the debate between health actors and partners from the agronomic field (sensu lato) on the priorities that can be turned either into standards or into advice to the consumers.

PROBLEM 3. DIFFICULTIES TO INCLUDE THE USAGE FRAMES THAT ARE AIMED AT

We have to emphasize this fundamental issue. In research (its planning, materialization and communication), not sufficient attention is paid to the practical relevance of the research results for the « users ». How can farm producers think of the leaching of nitrates ? is one example amongst others as these:

- Food safety is based on the hypothesis that consumers are competent enough to behave in a way that does not jeopardize the quality efforts invested in the food chain ;

- The standards imposed on farmers are of little efficiency if implemented mechanically. Models should better reflect the reality in order to be controllable by producers;

- The harmonization of environmental, sanitary standards and economic requirements presupposes the creation of a tool in co-operation with producers. Otherwise, they will not be used.

This is the very paradox of global problems (such as the quality of water) that scientists know well and that are well documented. Nevertheless, management issues are not paid enough attention, and, at times, standardization goes beyond the skills of producers and/or control possibilities.

In terms of research communication, we think that the only possible way consists in elaborating research models that would be close to a model of co-production of knowledge, methods and even standards. Proposals have been put forward and examples of this co-operation can be found.

Similarly, consumer behaviours are underrated and the communication patterns aiming at them are still in an embryonic state (amongst other reasons because we do not know what makes up for the credibility and the relevance of messages).

PROBLEM 4. THE DISTRIBUTION OF RESPONSIBILITIES AND COMPETENCES IN THE FOOD-PROCESSING INDUSTRY

The *distribution of tasks* alongside the production/marketing/consumption chains partly linked to the two previous questions. The sharing out of missions asks the following question : who does what in order to meet a given objective (quality, low environmental impact, safety) ? two questions can be asked :

- firstly, who is responsible for what ? this question refers to the distribution of costs to be paid for.

- secondly, it is also a matter of sharing of useful competences and knowledge (referring back to the previous question).

In terms of simple economic reasoning, each actor in the network has an interest in having the others bear the cost of quality (requiring more efforts from the others) but should also understand that the quality assessed by consumers is global and beneficial to the whole network (that will be materialized in market shares).

The following question illustrates our words : should small farm producers be obliged to implement the HACCP standards (in order to guarantee the perfect quality of products supplied to the processors) ? It goes without saying that the answer will have a substantial economic impact.

The acceptablility of standards and their efficiency is partly conditioned by the fact that actors accept to take up a shared responsibility and enjoy the necessary cognitive and technical knowledge to do so.

This is where the way decision makers envisage the actors' logics has a strong influence. The fact that many decision makers consider farmers as pure homo economicus who only react to financial incentives/threats might be detrimental because this conception leads to measures that send farmers purely economic messages, weakening the legitimacy of measures and standards.

PROBLEM 5. ADAPTATIVE OR ALTERNATIVE MODELS (STRATEGIES)

On the basis of the various opinions expressed on the previous questions, three underlying matters can be diagnosed that, even though they are not incompatible, differ dramatically in their answers :

- The adaptative model is the view shared by many civil servants who consider that we should move towards sustainable agriculture through progressive modifications in practices, steadily edicting standards which efficiency and adequacy (economically viable) should be systematically checked by the actors. For instance, the new industrial breeding methods, effluent management or the fertilization techniques should be questioned in identical economic contexts ;

- The alternative model is generally adopted by the defenders of organic farming, short networks and environmental associations that ask for changes in policy - and, consequently research- orientations. Public research is lagging behind in

those fields even though there is an interest in the new alternatives to the prevailing model. In this context, reflexions are carrried out in a new political context. Science is supposed to legitimate the context and provide it with the necessary management tools;

- The « innovation » model is half-way in between the two previous models. It is a model of action that grants priority to a high level of integration of the technical research and other dimensions (economic, social, legal or even consumption) with a view to defining new methods, new products and new channels. It is a compromis, since it aims at operating progressively but agrees on the necessity to modify the policital and economic background (i.e. the marketing patterns). This approach defends innovations that are technical, social and political, and aims at building supply, demand and the adapted techniques in co-operation.

These different models can be linked with the research communication process. The first two will easily follow the pattern of popularization of scientific knowledge, whereas the third one will opt for the joint construction of knowledge and techniques. The first model will present research as a neutral process and highlights its operational dimension whilst the other two will grant much importance to strategies and support policies focused on agricultural models that are, initially, marginal.

We do not think that one of the approaches should be favoured a priori. A research programme should equally meet the three types of demand that embody three strategies, non better than the others. Their co-existence would probably grant the food processing industry a greater flexibility, and enable it to :

a. get adapted to more or less foreseable political changes ;

b. have producers shift from one strategy to another or combine strategies ;

c. gain experience in the different strategies.

PROBLEM 6. WHAT IS TRUE OR FALSE IN THE SCIENTIFIC COMMUNICATION KNOWLEDGE

The previous issues are underpinned by a core concern that emerges in most of our ideas: the major uncertainty around relevant knowledge that should be deemed as true to orientate policies and consumer choices alike. For instance, dietary councelling varies greatly in time (according to “fashions”). It also holds true when risks are misjudged and might, thus, generate enormous costs or for new technologies that -despite the firm belief displayed by scientists and industrialists- are not really accepted by the public opinion.

This question is to be tackled. If it is not, consumers' confidence will sink further and all the actors in the food processing industry will experience uncertainty.

The communication method to be developped is neither unique, nor simple. At first, it implies that a number of actors from different backgrounds accept to discuss and do so publicly, doing away with polemics. The involvement of decision-makers (administrative and political) has to be specified (they should, at least, commit themselves to consider the debate).

4.2.2 Proposals specific to the issue of sustainable food

Food is everybody's concern and is more and more worrying. It is, therefore, all the more necessary to intensify the communication vis-à-vis the 'general public' and to disseminate clear and precise information amongst the consumers. More specifically, it is essential to publish works that summarize the knowledge (for instance medical datas, in order to define dietary standards). This work of synthesis is, of course, of interest to consumers (associations).

Producers'representatives (agriculture and food processing) are very eager to take part in the discussions on standards to be edicted, and question their compatibility with production standards (how to introduce these datas in production management mechanisms ?). Variables that are relevant to the standardization process are to be determined prior to the definition of food-processing standards.

Several 'communication' requirements are stipulated, related to the problem of standardization:

- communication amongst doctors and agronomists (health and production) as these standards can only be compromises between producers' demands/possibilities and sanitary requirements ;

- communication amongst health experts in order to reach a consensus on saniraty requirements (is this possible ?) ;

- comparison between environmental demands and health requirements (that can be contradictory: i.e.: need to reuse packaging and necessitry of perfect hygiene conditions).

The fact that the activities at stake are spread apart makes research communication very difficult as the interest of consumers differ considerably from the producers'.There can be no communication on research if there is no communication flow between stakeholders. It would be useful to secure communication through a

‘forum’ that would gather a maximum number of stakeholders. In Wallonia, the Coalition Wallonne pour une Agriculture Durable is currently the only space where producers, consumers and environmentalists (and scientists) meet and exchange. It would be useful to refer to their debates.

It seems to us that such a forum is essential to discuss issues as the definition of agricultural development ‘standards’. These are inspired by sanitary, environmental and production concerns and are, thus, discussed in different spheres. It is necessary to harmonize the standards and, therefore, to establish a communication between the various spheres to come to standards ‘acceptable’ for those who are to implement them. Actors are faced with a “prospective scenario problem”. For instance, how industrialized can a poultry farm become, considering the environmental restraints? This is a topic for research that should be studied and negociated together with the actors.

The challenge of biothechnologies is first and foremost a problem of discrepancy in the way the risk is assessed by the actors rather that a problem of popularization. SSTC (sustainable development) is responsible (if it so wishes) for the creation of a discussion platform (not for popularization or dissemination). It is, therefore, suggested that a initiative be launched for debates amongst stakeholders (producers, consumers, researchers, foor processing industry, administrations) which task would be :

- to identify priority problems ;

- to transmit the information from one sphere to another ;

-to figure out scenarios (new operating frames) ;

-to look for convergences.

An other problem lies in the transmission to the producers (farm procuders and SMEs) of ‘technical’ datas on production models that encompass ‘environment’ and ‘health’. Techniques, knowledge have to be adapted to production practices. The conclusion is that it works more or less but that the ‘co-production’ model of knowledge is to be developed and supposes an investment in the definition of research projects (the separation between the definition of the problem and the dissemination of solutions should be suppressed). In other terms, it is certainly interesting to encourage scientists and users to define some research programmes together.

For researches to be usable, communication should be determined on the basis of the principle of a joint construction of the research. In order to do so, the identification of users and the scientific assessment should be clearly distinguished.

5. SUSTAINABLE DEVELOPMENT INDICATORS

5.1 Sustainable development

It appears, from the interviews that were carried out, that the concept of sustainable development is relatively well understood by the different actors interviewed. Indeed, they almost always refer to the three pillars (economic, environmental and social, and less often to the institutional one), as well as to equity and the relations between generations, and to a lesser extent international relations. However, interdisciplinarity and social groups participation are issues that are hardly mentioned, yet these two aspects can not be separated from the concept and its implementation.

Nonetheless, just a few interviewees seem to have a « practical » perception of it. In other words, to which extent does sustainable development contribute to the economy, the environment and the social conditions, both from a debate point of view as well from the point of view of its implementation (what practical actions need to be put into practice) ? Indeed, after reading the different proposed definitions, that sustainable development is mainly seen as a political concept with low impact on the changes brought to the former practices of the different actors, be it researchers or social actors. As we've realized, in the mind of some researchers, sustainable development is seen as a « political slogan » allowing, among other things, to get research funds from sleeping partners. As a researcher puts it : « sustainable development is a matter of decision itself ». Besides, the risk associated with that concept, is that it is still too abstract for the population and the social actors because it lacks visible concrete applications. We think that issue relates to the representation of sustainable development as a subject matter, whereas as pointed by an interviewee, sustainable development is an objective (or a process) which aims at the balanced integration of different matters, from a political, scientific and economic (in the broad sense) point of view.

Although the issue of participation of actors in sustainable development is seldom mentioned in the interviews, we notice that a lot of interviewees are members of consultative committees dealing with sustainable development. In this respect, we may say that sustainable development has enabled (or at least provided the opportunity) to some actors to be represented in some institutional fora around this

theme (for instance, NGO's representation within CFDD) which brings about a debate with sometimes different interests, and hence it represents a real potential of communication about this matter. For some, sustainable development plays the role of mobilizing people.

It has to be noticed that few interviewees have really built a reflection about it, sustainable development seems to be accepted as a « new concept », but it does not lead to much change and/or reflection in people's jobs (apart from some participation in consultative bodies) So, when asked about the priority with sustainable development, there are two groups of answers. On the one hand, those who assert that no aspect prevails upon another (otherwise it wouldn't be sustainable development any longer), what needs to be looked for is the integration of the various components (but nothing is said about how it should be done) This is mainly the opinion of public authorities (in the broad sense : all institutions financed by public authorities, public services as much as councils or survey public centers) On the other hand, another set of answers relates the priority aspect to the business of the social actor or to the favourite subject of the researcher. This is how sustainable development is taking shape as a positioning challenge on a « participative market » in so far as the reference made to this concept in the business of a social actor may secure his participation in a public debate (within consultative councils) about the issue by integrating the main concerns (his business) of that actor in question. As to researchers, making reference to sustainable development may also be seen as a challenge since it is taken into account in the funds granted for research work, even if the concept does not completely change the professional practices of researchers.

Even if sustainable development has « *institutionalized communication* », it does not seem to have significantly changed existing communication practices, namely the media, speeches and several kinds of publications. However, it has increased the number of places and opportunities to meet with various actors through conferences, seminars, etc.

5.2 Perception of actors about one another

The way the actors perceive each other is a major indicator in the field of supply and demand of scientific research work on the one hand, and on the problems of communication among actors on the other hand. Indeed, as we will see later, scientific communication problems are two-fold : either we find structural problems with regard to the organizational and operating mode of the actor in question, or punctual problems relating to actors considered in isolation or to some specific communication modes.

On the whole, researchers are perceived (and that's how they see their peers) as little accessible because they use a hardly accessible language. This confirms social actors' opinions about researchers who say that academic scientists are in *« their ivory tower »*, carrying out some disembodied research, «*not enough concerned about people's daily lives »*, mainly theoretical whereas practical and applicable results are expected. Some research work is deemed as *« being too far from the management political reality »* and the many scientific controversies on a given matter do not help make decisions. Researchers not trusting those who are not part of their world have also been denounced.

As far as they're concerned, researchers denounce the fact that some financed research is discouraging, and the results, even if well received, « *end in a drawer* », with no real use of them afterwards. To simplify, we have on the one hand, research which is seen as being too far from the practical field work of social actors, and on the other hand scientists who regret the lack of practical follow-up of research.

Besides the issue of the language used by scientists, there is also a problem of corporatism among faculties and a clear-cut separation between subject matters themselves within one university, and between universities for the same subject matter. This is all the more deceiving with regard to research work carried out within the framework of sustainable development which claims to be in keeping with interdisciplinarity in research and in the implementation of the research results. Apart from that problem, universities do not offer enough career opportunities to researchers because of lack of financial resources dedicated to research. In this respect, all actors are pointing at the problem of financial resources for research in Belgium. Because of the situation, research centers have started a « race » for grants and start competing with each other, which does not encourages openness among faculties and universities. Moreover, this lack of money raises the issue among social actors of the social use made of a research carried out for the private sector. What is emphasized here is the question about research done in the general interest of society. What underlies this irrefutable fact, is the lack of transparency of some research works that are published « just too late », because of exclusive information retention by the sleeping partner. Finally, if a lot of research works are financed by the private sector, social actors demand that double checks be done by a public research work. There seems to be too little of these double checks. The « race for grants » leads to a lack of job stability for researchers and of future prospects, and hence it weakens the research centers. So, some research centers regularly lack scientific staff, all the more since if we take the environmental sector only, which has become increasingly attractive for the private sector, these research centers start competing with the private and public sectors on the employment market.

Some social actors regret the fact that « *research workers are regrouped according to their abilities »,* some elements of the research may be biased because the sleeping partner's request is not clear enough. That perception of research reinforces the feeling of a gap between scientific research and the needs of public authorities who expect applied and practical products.

Public authorities have also been criticized. First, with regard to university faculties, public authorities are also seen as too compartmentalized and not sufficiently pluridisciplinary. Besides, the different actors complain about the lack of transparency and availability of research carried out by public authorities. But more significantly, the little use which is made of research carried out by public authorities is precisely what is questioned here. Moreover, still according to some people, politicians in charge seem to use the results of financed research only when these confirm the ideas that they had before the research was actually undertaken.

Public services have also been criticized because of the rigidity of the management levels, considered as an obstacle to innovation and change as that does not encourage individual initiatives. Likewise, the unwillingness of public servants to communicate to the external world has also been stressed.

5.3 Proposals aiming at improving communication on indicators

Indicators are supposed to translate data into succinct information easily understood and used by different groups of people. The three main purposes of indicators are to simplify, quantify and communicate[54]. The existing controversy among interviewees relates to the fact that indicators simplify too much a reality which is complex. As to quantifying, there are things that cannot be directly quantified. As to communication, indicators are not enough : they have to be complemented by the appropriate comment in order to be well understood by the different potential users. And there lies a problem : knowing the way to communicate depends on the kind of target groups, it is important to identify who are the potential users of such tools before proposing these tools to them. When in fact, most interviewees have reminded that the groups of potential users are highly diversified : decision-makers, public services, researchers, NGOs, the public at large and the industry. That's what the issue is all about. How communicate these indicators and how will they be understood, or not, by these groups ? It seems that, in the view of most interviewees, the gap between research and civil society hinders communication. Besides, some data collection

[54] See in this report the introduction on indicators

methods with some professions (the example of farmers above) seem to be contrary to their practices. And this just one of the examples of the gap that exists between these two worlds. In order to solve the problem, we could encourage researchers to draw up indicators with the real users, rather than with potential users, who are in other words the representation that researchers have of users. In addition, it would allow to adapt indicators, or at least the way to present them, to each kind of public groups they're aiming to.

The major reason of having indicators is because they are a communication tool that also helps make decisions, so that they won't lead to scientific publications in the usual meaning. Since communicating knowledge is as important as producing it and in order to enhance « communication » within scientific research, we could envisage (this is a more general comment) to increase the weighting of « popularisation » work of researchers in the evaluation processes. Besides, a broad information collection on indicators could also be something to consider ; indeed, a lot of social actors have raised the issue of access to understandable information.

During the interviews, many remarks were made about the difficulty to get access to existing information sources. With regard to indicators, some proposals could then be made in order to try and meet that requirement ; by using better and more often the media with, for example, headlines indicators (as it is done for the GNP or the employment rate) like those that Germany and the AEE is trying to implement ; by making the summary and the content of surveys available « on line » ; by making a quality summary of surveys that could be easily used and applied in Belgium[55] : as well as by setting up both interfaces to transfer electronic knowledge and communication platforms between the different actors on the web. We could also consider have the information translated into several languages (among which English), be it information that comes from the public services of from research. It would also be quite important to make an effort as to the way to present the information, for example by combining each research work with relevant key words for users and by involving them in the definition of these key words.

One of the requirements of public services in relation to indicators is to use them to solve part of their management problems. However, setting an indicator does not allow as such to solve a problem. To achieve this, two pre-requisites need to be fulfilled: a) the set indicator has to be a response indicator, meaning that the data it presents have to enable to assess the implementation of a policy (for example, data

[55] Inventories exist (for the OSTC for example, « Environmental Compendium »), these are database inventories and not indicators inventories, but it is a first step.

on the pollution of ground waters by nitrates in relation to the implementation of vulnerable areas) ; b) local authorities/politicians have to take into account the data presented by the indicators. It would, therefore, be interesting to carry out a survey on the « communication performance » of the indicators (are they used, by whom ?, have they led -or not- to a change in policies ?)

As we've noticed above, one of the criticisms towards local governments relates to the fact that they work too much in isolation dealing with specific matters and communication between departments, or between departments and universities is bad. We could, among others, suggest that a dashboard of indicators be drawn up and co-signed by the different regional local authorities, including by those in charge of other issues than environment. The cross-sectoral and interdisciplinary aspect would that way be underlined, while fostering a beginning of a « culture of communication » between public services. The same could also be done for the three regions. Focus groups could then be set up to exchange data and set the trans-sectoral indicators. An indicator forum for sustainable development could also be created. It would bring together all the actors involved : public services, researchers, NGOs, the media, the industry, trade-unions, etc. The objective could be to integrate into the indicators a multi-sectoral approach, to standardize the existing indicators and to develop different levels of indicators for different target groups.

6. SUMMARY AND RECOMMENDATIONS

6.1 Summary

The communication of research in the field of sustainable development raises new and difficult issues. These cannot not be tackled if researchers do not clarify their own stances, namely where they stand in relation with the potential users of their research work. But at the same time, researchers cannot be more specific as long as the expectations of the sleeping partners, professionals, public services and the associations are not clarified. That boils down to saying that one shouldn't expect communication to improve if communication is not present right from the start, when the research project is being outlined, designed and negotiated. In some cases, this implies setting priorities, objectives and even research projects.

6.2 Recommendations to research programme managers[56]

1. In the calls for proposals in the field of research, the applicants should be asked to explain the answers given to the questions. The answers have to be quite specific to allow for evaluation.

2. Researchers should be asked or left with the possibility to dedicate part of their research time to answer these questions and to validate the answers they suggest. It is better not to wait till the development phase before asking the questions ; they should be raised as from the beginning of research.

3. We should differentiate between assessing the relevance and the use of research from assessing its scientific quality. A research could well be considered as very relevant, while not being innovative, and vice versa, be innovative while not being relevant or with no potential user. However, it is often possible to negotiate these two aspects. Too often, support committees confuse both, whereas they should be kept apart while providing for some space of discussion between the two points of view.

[56] The report includes other recommendations aimed at both researchers, public authorities and civil society actors

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COMPOSITE URBAN ENVIRONMENTAL INDICATORS: TOWARDS SUSTAINABLE URBAN DEVELOPMENT

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1. WHAT ARE "SUSTAINABLE URBAN DEVELOPMENT INDICATORS"?

Indicators are measurements (or series of combined measurements) whose changing values are monitored and which are compared with reference values (in terms of policy objectives, upper or lower limits, guideline values, etc.). Indicators are not abstract in nature: they depend on the context which has given rise to them. They are neither neutral nor universal. They are based on the decision by a person or group at a particular geographical or political level to ask a particular question, with a particular objective in mind. They also depend on the availability of the human and material resources needed to calculate and analyse them.

Composite indicators, by analogy with composite materials, are based on the early integration of raw data originating from various disciplines (such as ecology, sociology, economics and urban planning) so as to give rise, after processing, to multidisciplinary data.

Sustainable development seeks to bring together three policy areas which have hitherto been regarded separately in most cases: human development, economic development and environmental protection.

Putting the concept of sustainable development into practice involves numerous choices based on a new development model aiming at an integrated policy approach.

It means managing resources on a sustainable and rational basis and limiting pollution so as to protect the well-being of the population as a whole, while upholding the principles of civic responsibility and social justice.

The urban environment, i.e. the "environment" in which a town or city's inhabitants live, comprises physical elements (such as energy and materials, climate and topography), living elements (humans, animals and plants) and elements associated with well-being and culture (such as information, health and safety). All these elements are involved and interact with one another in the highly complex make-up of the "urban system". However, the "urban environment" is more than just the sum of the various characteristics of a town or city: synergies between these characteristics are observable, synergies which lie at the root of its positive aspects, its distinguishing features and, indeed, its drawbacks.

Environmental management thus extends a considerable way beyond its traditional definition, and has a clear impact on other political parameters.

2. WHY SHOULD URBAN INDICATORS BE DEVELOPED?

Currently, most sustainable development indicators fail to take account of the local urban context in terms of the underlying concepts, the calculation methods or the standards applied.

A good example of a typically urban environmental problem is the quality of areas within blocks in the street pattern (taking into account the rate and density of vegetation, the ambient noise levels, etc.) The specific concerns of local urban managers are rarely taken into account in the definition of environmental conventions, programmes or agreements at the international level (such as Geneva orRio).

Our study revealed that sustainable urban development indicators have all too frequently been created by "armchair" theoreticians. They turn out to be of little use as instruments for local decision-making. Another problem is that they are often developed on the basis of the available data rather than the actual issues.

In order to create a set of more concrete indicators, then, we had to do more than simply compile all previous work on sustainable development indicators and pass these on to Belgian urban managers. Rather, we had to conduct original research revolving around the definition of new indicators, so as to analyse areas that had not previously been dealt with.

3. OBJECTIVES SOUGHT THROUGH THE CREATION OF SUSTAINABLE URBAN DEVELOPMENT INDICATORS AND THE SETTING UP OF A NETWORK OF TOWNS AND CITIES

3.1 The OSTC-BIME research project

The aim of the project is to devise a realistic set of composite urban indicators from the environmental viewpoint. In its first phase, the project set about integrating the various issues relating to towns and cities on the one hand and the environment on the other. On this urban environmental basis, it then went on to develop composite indicators, incorporating social and economic issues and seeking to get as close as possible to the principles of sustainable development.

This set of indicators is designed to be a tool for local decision-making and the evaluation of progress towards sustainable urban development. Describing positive and negative trends in resource management, efforts to combat pollution, the quality

and pleasantness of the urban environment, these indicators are tools with a twofold purpose. Firstly, they may be used to monitor a town or city's environmental, social and economic evolution within its own specific context, and hence to impart focus to planning and management policy in the context of the town or city's current and future projects. Secondly, they enable good practices to be transferred between relatively similar towns and cities.

The project involves setting up a network of Belgian towns and cities as a means of validating the indicators proposed by the researchers, establishing partnerships and facilitating the exchange of experiences among urban managers.

The following objectives lie behind the creation of a set of urban sustainable development indicators and the associated task of setting up a network of urban managers (based on the voluntary involvement of towns and cities) have the following objectives:

- *Situating indicators within the context of towns' and cities' specific concerns*

As the indicators should be decision-making tools contributing to the sustainable management of towns and cities, we invited urban managers to take part in the project in order to confirm the validity of our proposals. The experts appointed by the municipalities are mainly environmental consultants and town planners. Obviously the consultation process should ideally be extended to include other urban managers, such as senior officials or members of the population, health and employment services, etc., as well as other relevant parties such as elected officials, members of consultative committees (NGO representatives, grass-roots activists, etc.) and local residents.

- *Setting up a forum in which urban management specialists can meet*

The formation of the network of Belgian towns and cities gives managers from different departments and indeed from different towns and cities the opportunity to hold discussions with one another. These encounters lead to contacts being formed and experiences being exchanged among specialists. The direct "return" produced by these discussions and contributions is hard to measure, but their usefulness is undeniable, in view of the complexity of urban management.

- *Organising a network of towns and cities*

Another indirect objective of setting up a network of towns and cities is to give them increased legitimacy, and hence to impart more balance to the dialogue with the regional and federal authorities.

4. CONSTRUCTING SUSTAINABLE URBAN DEVELOPMENT INDICATORS: CREATING A METHODOLOGY

Indicators are measurements that are invariably carried out within the context of currently accepted scientific or political concepts or theories. This is why it is important to specify the methodology used both for the research into indicators and for the formation of the network.

The aim of the project is to construct composite indicators integrating the urban environment with the two other poles of sustainable development (the social and/or the economic). Nonetheless, this overall approach to sustainable development has from the outset not proved possible, due to the lack of experts and of previous work specifically treating the urban environment in an integrated manner. The research therefore started with a "conventional" thematic approach, enabling basic "tools" to be collected and current lines of research into indicators to be summarised. The methodology then set about redefining lines of approach that were too subject-specific to suit the context of the overall functioning of towns and cities.

The methodology was worked out in detail by empirical means, as the research progressed, and there was cross-fertilisation between the different stages. We aimed to restrict the inevitable element of subjectivity by meeting large numbers of experts and describing the choices made during our research with as much clarity as possible.

4.1 Listing of existing indicators

A listing was made of the main environmental and sustainable urban development indicators, in order to maintain or create links between existing indicators (of a sector-specific nature) and the new, composite ones. This work also revealed that entire areas of the urban field have not been dealt with by existing indicators.

4.2 Identification of urban environmental issues through interviews with experts

Our approach right from the start involved consulting numerous experts and specialists in the urban environment, in the areas of waste, air, water, soil and nature. This approach quickly proved to be a fruitful one, highlighting critical developments from the point of view of the urban environment and the specific issues that managers encounter, including the priorities and the new developments needed if towns and cities are to be managed in a more sustainable manner.

4.3 Integrated consideration of the ways in which these issues interact with one another in the overall functioning of the town or city

An urban matrix was designed for the systematic overall analysis of the impact of the urban factor on environmental subject areas (air, water, waste, etc.). This is not an urban model, as the links are not one-to-one and relationships are complex. However, it does represent a tool for imparting some structure to integrated reflection on towns and cities. Each of the issues raised by the urban experts was analysed using this matrix, a sort of check-list enabling issues to be situated within the overall context of the urban dynamic, and hence providing support to the process of integrated reflection.

This structure makes it easy to see at a glance the different environmental effects, of an antagonistic or combined nature (e.g. air/noise, noise/nature, etc.) which the same action may lead to.

By way of example, maintaining aplot of undeveloped land between two houses involves positive and negative effects and opportunities. On the one hand, plant-life starts to grow up; on the other hand, a whole series of different problems may be caused: people may choose to dump rubbish there, or noise may penetrate to the interior of street blocks.

4.4 Urban analysis matrix

TOWN/CITY	***AIR***	***WATER***	***…***
PHYSICAL CHARACTERISTICS			
Morphology			
Microclimates			
…			
SOCIO-ECONOMIC CHARACTERISTICS			
Population (demography, health, ...): ***density*** *of urban population*			
Land utilisation*: degree of mix in nature of the urban fabric (plus its two corollaries: spatial* ***proximity*** *of different activities and of population groups and* ***dispersal*** *of similar elements throughout the town/city);* ***Scale*** *of the town/city: presence of specific facilities (universities, teaching hospitals, large theatres, etc.);* ***Impact*** *made by the town/city outside its own administrative territory*			
Main economic activities			
Main socio-cultural activities			
…			

MANAGEMENT OF FLOWS WITHIN THE TOWN/CITY			
Energy: energy vectors in the town/city (electricity, gas, oil, etc.) and energy transportation infrastructures, rational energy use, etc. *Materials (including waste): production, circulation and processing of materials in the town/city, maintenance of stocks, waste generation and management, etc.* *People (mobility): distances, destinations, frequencies and modes of transport in the town/city (road, including tram and underground; rail; river; air), etc.* *Information: sources (different media, whether supplied by cable or otherwise, education, etc.), events (fairs, exhibitions, shows, etc.), etc.*			
Differentiation of the various parties (households, authorities, companies) and of their various responsibilities			
Households are responsible (in part at least) for their choices in terms of consumption and waste production, the type of jobs their members do, the type of housing they occupy, the investments they make, for the services they receive in terms of information, education, culture, and health, for the sports they practise, etc. They pay taxes, elect their leaders, etc. *Companies are responsible for their production (of materials and waste), for their investments, for their consumption, for the jobs they offer, for the information they receive and produce, for their technological choices, etc.* *The authorities are responsible for the investments*			

they make, the technological choices they implement, their consumption patterns, the jobs they offer, the information they produce or handle, the creation of financial incentives (tax breaks and grants/subsidies), and the legal and planning instruments they employ			
Development and management of infrastructure and public facilities; running of technical networks			
***"Throughputs" and "peaks and troughs"**: quantitative approach to flows of energy, water, information, etc. (in kWh, tonnes per year, or even BEF year) and description of their transport rate/rhythm (continuous/discontinuous; average, minimum and maximum values, etc.)*			
***Supervision: good citizenship**, safety, etc.*			
...			

In addition to the points listed above, this table was highly effective as a means of generating ideas. It also turned out to be particularly useful in the follow-up to the project, as a means of specifying the limitations and conditions of use of particular indicators when compiling descriptive documents about them.

4.5 The DPSIR (Driving forces - Pressures - State - Impact - Responses) model, and how it is used

The D-P-S-I-R (Driving forces, Pressure, State, Impact, Response) model was used as means of structuring information (see diagram opposite), making it possible to process the large quantities of information that were gathered during the preceding stages and to compare different approaches.

The model is built around five elements connected by causal links: a Driving force – i.e. some human activity or development – creates Pressure on the environment that may be characterised in both quantitative and qualitative terms. This pressure leads to a modification of the general State of the environment, which may have an Impact on man, the heritage, the economy, etc. This impact leads to a Response from society. These responses involve the use of instruments acting on the preceding elements (D, P, S and I).

Each of these elements has indicators corresponding to it. Those associated with the driving forces express underlying tendencies that are normally lacking in elasticity but which represent the bases for long-term development scenarios. The pressure indicators translate these activities into emissions of pollutants or resource consumption. The state indicators represent the changes observable in the environment and permit an initial evaluation of the situation. The impact indicators describe the ultimate effects of the environmental changes; they frequently react even more slowly than the state indicators and one is often faced with difficulties in establishing solid statistical correlations because of the time-lags and the non-environmental variables that also play a part in the process. The reaction indicators are more connected with assessing the effectiveness of environmental policies.

The value of the DPSIR scheme is thus a twofold one: it helps clarify a series of complex issues and enables those involved in urban management to identify their respective roles in the elaboration of an integrated strategy.

The DPSIR model is the subject of a BIME technical report entitled

Structuration de l'information environnementale - Le modèle DPSIR et son adaptation au milieu urbain

Approche méthodologique et application à la Région de Bruxelles-Capitale ["Imparting structure to environmental information. The DPSIR model and adapting it to the urban environment. A methodological approach, and an example of its application to the Brussels Capital Region"]

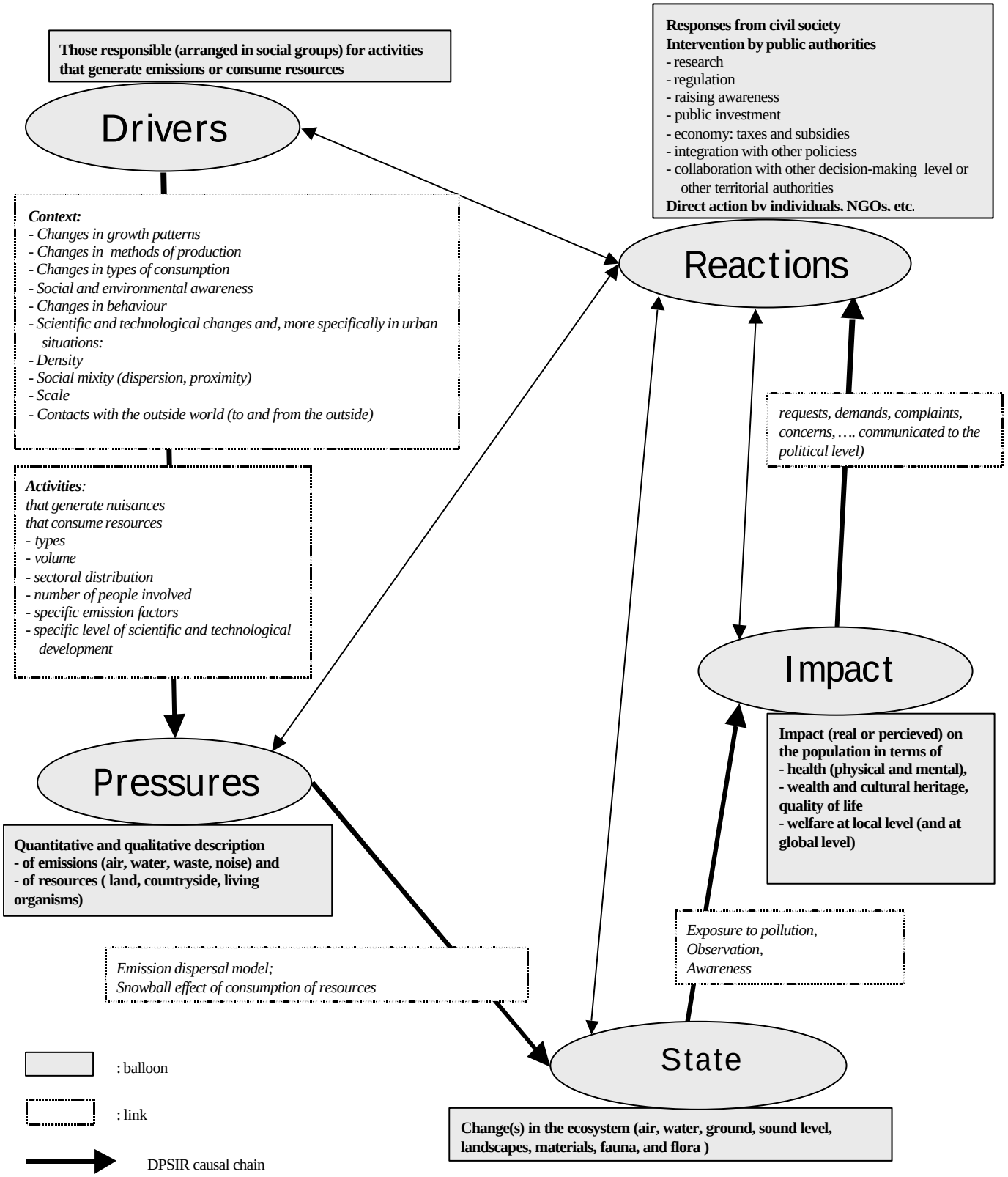
BIME – Environmental Data Observatory - 1999

4.6 Compilation of descriptive documents

The sustainable urban development indicators created by the research team using the methodology described above are described using methodological documents. The point of these is to provide an exhaustive and clear definition of each indicator, and to present various kinds of information systematically. This represents a key element in the proposal of indicators. Unless the reality that an indicator is supposed to deal with is defined precisely, it is impossible to assess its relevance. Unless it is defined unambiguously, different towns and cities may intepret and calculate it differently.

The DPSIR in general

Last updated: 20/02/00



5. THE INVOLVEMENT OF PARTNER TOWNS AND CITIES

Towns and cities participate on a voluntary basis: there is no obligation to take part in the project, but, equally, no financial contribution is made in return for participation.

As a result, those towns and cities that do participate are highly motivated, but there are also problems associated with an overload of work without any additional funds or resources being contributed.

The methodology was therefore devised taking this factor into account and seeking to optimise the involvement of representatives from towns and cities.

Partner towns and cities in the sustainable urban development indicators project

Brussels Capital Region

City of Brussels

Schaerbeek

Region of Flanders

Kortrijk

Leuven

Region of Wallonia

La Louvière

Liège

5.1 Validation of indicators by urban managers

The process of validating the indicators proposed by the researchers takes place in several stages, and includes group discussion, spontaneous reactions and considered responses, and a points-based evaluation of the proposals.

Based on all of this input taken together, the researchers pull various threads together and fine-tune each indicator's definitions and parameters, reformulate it more precisely or even throw it out if most of the managers regard it as useless or irrelevant. This group work is a key element in the methodology for creating sustainable development indicators intended as decision-making tools.

The evaluation process as a whole includes both qualitative and quantitative commentary, and seeks to make the most of all inputs so as to situate these

indicators within the context of specific urban management concerns.

This approach also allows room for dialogue of a more general nature, concerning good practice or different people's experiences. The evaluation process thus becomes an opportunity for different urban management specialists (environmentalists, town planners, etc.) to swap experiences with one another.

Typical structure of indicator description document

<table>
<tr><td colspan="3">Indicator no.</td><td colspan="4">NAME OF INDICATOR</td></tr>
<tr><td colspan="2">composite intuitive</td><td>prospective decision-making tool</td><td colspan="4"></td></tr>
<tr><td colspan="3">Environmental area

Noise, air, water, waste, soils, nature, green areas</td><td colspan="4">Key words
environment
sustainable dev.
town/city
socio-economic</td></tr>
<tr><td colspan="7">Objective</td></tr>
<tr><td colspan="3">Definition / calculation method</td><td colspan="4">Representation</td></tr>
<tr><td rowspan="2">Unit</td><td colspan="6">Type of data</td></tr>
<tr><td>measurement</td><td>survey</td><td>estimate</td><td>model</td></tr>
<tr><td colspan="7">Reference data, guideline values, etc.</td></tr>
<tr><td colspan="2">Definition and value</td><td>Status: guideline value, compulsory min./max.</td><td colspan="4">Source</td></tr>
<tr><td colspan="7">Type of indicator and DPSIR element</td></tr>
<tr><td colspan="7">Geographical zoning</td></tr>
<tr><td>statistical unit</td><td>municipality</td><td>town/city</td><td colspan="4">other</td></tr>
<tr><td colspan="7">Update frequency</td></tr>
<tr><td>year</td><td>five years</td><td>decade</td><td colspan="4">other</td></tr>
<tr><td colspan="7">last update</td></tr>
</table>

Coherence between objective and indicator	Data a. Title Definition
Title of data a. b.	Measurement methods: counting - estimate - sampling Unit
Comments difficulties encountered, precautions re use, limitations, etc.	Frequency (and/or date of last update): Time taken to obtain result: Smallest geographical unit covered: individual plot – side of block – section of highway – statistical sector - municipality
Additional information Explanation of result: context, etc. Extension of result to another idea	Data published – available on demand – needs investigation Producer of data organisation (address, tel, fax, e-mail) contacts (nom, address, tel, fax; e-mail)
Connections with other indicators	Holder of data organisation (address, tel, fax, e-mail) contacts (address, tel, fax, e-mail) Comments
Bibliographical source for the indicator	

6. WORK IN PROGRESS (DECEMBER 1999 – MARCH 2000)

6.1 Evaluating the overall cover offered by the indicators

Having taken into account the comments made by the various towns and cities involved, the researchers are considering the indicators taken as a whole. The following questions are being asked:

- *Do the indicators cover most of the subject areas contained in the notion of sustainable urban development?*
- *Is there any overlap between indicators?*

Two tools are used in this connection: the DPSIR and key-words:

- the indicators are placed in urban DPSIR diagrams for air, water, waste, etc. This exercise makes it possible to see how they divide up among the different subject areas of the urban environment.

- each indicator's description includes a series of key-words divided into four categories: town/city, sustainable development, social and economy (see table opposite). The indicators are sorted out and gathered into key-word groups, which are then examined to see what kind of a distribution there is among the various environmental subject areas.

The conclusions drawn from this evaluation of the fields covered by the set of indicators will lead to superfluous indicators being scrapped and/or indicators for subject areas not dealt with being added.

Once the initial set of indicators has been settled upon, the research team will then work with the other partner towns/cities in the network to create a tool-kit that is of practical value in the light of the data that is available.

6.2 Calculation of sustainable urban development indicators

It is anticipated that the partner municipalities and towns/cities will calculate the indicator values for their own communities. The work involved in researching and collecting the data needed to calculate the indicators will have to be done using various sources, chiefly at municipal level. Towns and cities often have a considerable quantity of raw data available, but unfortunately this is usually not categorised in any way. The research for the data needed to calculate the indicators thus involves a considerable amount of work, calling for collaboratoin between different departments and a substantial investment of time.

Given the excessive amounts of work with which most urban managers are already confronted, and the fact that no human or financial resources are provided in the project to help calculate the indicators, this stage in the process is likely to present a problem.

Depending on their individual characteristics, the towns and cities may be able to approach the indicators on an "à la carte" basis, only using those that they deem relevant to their own context.

6.3 The set of indicators evolves from a basic set to a realistic set

At the end of the first phase of research, the tool-kit included some 120 indicators. A number of them were reworked or scrapped during the process of compiling the description documents, if their object turned out to be unrealistic. The number of indicators was further reduced following discussions with the urban managers (for example where particular issues were judged to be irrelevant at their level of action, or where indicators failed to add any value in terms of management). The evaluation of the fields covered by the indicators and the process of researching the requisite data will also have the effect of reducing their number.

However, it should be stressed that an indicator may be of indirect use to the urban manager, even if calculations are not immediately possible: it may draw the attention of other managers or relevant parties (particularly politicians) to the importance of a problem, and the need to deploy resources in order to gather the data needed to calculate it, or to consider setting up partnerships or policies in response to the issue the indicator has raised.

Key-words used to characterise and sort the indicators

Town/city
Mix: proximity
Mix: dispersal
Facilities of public value (public or private) / infrastructure
Street furniture
Sustainable development
Utilisation of resources
Environmental pollution
Social justice - Fairness
Civic responsibility

Social
Employment (unemployment)
Housing / habitat
Health
Culture
Leisure
Heritage
Education
Economy
Mobility
Transport
Businesses
Secondary activities (industrial activity)
Tertiary activities (services)
Safety
Quality of (urban) environment

7. SUSTAINABLE URBAN DEVELOPMENT INDICATORS: DIFFICULTIES AND LIMITATIONS

A number of difficulties and limitations have been encountered during the research. These are due not just to the way the project is defined and the way that Belgian institutions work, but also to more fundamental questions concerning the state of scientific knowledge and the devising of urban policies.

One important limitation presented by the project is its concentration on the **environmental aspect**. To some extent, this restricts the issues that are covered. A series of fundamental aspects of the way towns and cities work have only been dealt with indirectly by the indicators because of their essentially socio-economic character and the insignificance of their environmental impact. However, social problems are taken into account when it comes to explaining such phenomena as the different perceptions local people have of green spaces, or the problems they experience in sorting their household waste (e.g. lack of space, language difficulties, etc.); they thus appear as explanatory factors.

Analysis of the urban environment often serves to underline the **drawbacks** of life in the town or city (noise, waste, poor air quality, etc.) rather than its advantages. Thus, apart from the presence of green spaces, one environmental aspect which is definitely regarded as positive, the strict environmental approach ignores the advantages of city life, such as proximity (of housing, workplace, shops, entertainment, healthcare facilities, etc.), the abundance of cultural and social activities, the rich historical heritage, direct accessibility of information and education, the concentration of research and development facilities, and so on. These parameters are taken into account by certain of the indicators, but it may be argued that their overall place is excessively marginal.

Other equally decisive aspects that do not make a direct appearance in the formulation of the indicators include the impact of **administrative, legal and institutional demarcation** or of the **means of financing** of towns/cities and regions, the impact of the deterioration of the urban environment and of green spaces, etc.

Certain issues that were raised have proved difficult to analyse due to **lack of expertise** or lack of consensus – or the lack of adequate exchanges – among the specialists.

One example is the question of biodiversity in the town/city. The experts agree on the importance of this issue, but there is no clear definition of the notion of "sites of great natural value", either in the Brussels Capital Region or elsewhere, and no agreement

about planning options. The question often arises of whether it is only surviving sites that should be preserved, or whether the appearance of new microclimates should be encouraged.

In terms of the overall way the town or city works, the questions of mix of land utilisation and of office-blocks are both subject to debate, about how to define and about the planning choices that should be made in connection with them. These are difficult questions on which a decision has to be made. As regards offices, not to make any decision would have disastrous consequences. Yet there are drawbacks to deciding in favour of single-function areas of office buildings, as this has the effect of creating areas that are deserted and unsafe outside of working hours. Then again, introducing office buildings into residential areas also brings with it a number of problems, related in particular to increased traffic and to upwards pressure on property prices. Accordingly, it is hard to settle this question and point planning policies in one direction or the other.

The **definition of operational objectives** against which the indicator value that has been calculated can be compared is a major problem. Few towns or cities having planning that defines operational objectives precisely. Given this, they will find it even harder to establish composite indicators involving the definition of multi-disciplinary operational objectives.

8. (PROVISIONAL) CONCLUSIONS AND THE WAY FORWARD

8.1 Regarding the compilation of composite urban environmental indicators

From the start of the research, and in line with the project's defined framework, stress has been laid on consulting urban environmental experts above all, and composite urban *environmental* indicators have been devised. The research should now go on to apply the same methodology to social and economic issues, so as to be able to consider the urban system as a whole. For this to be possible, partnerships will have be established with new kinds of urban manager. In this way, we will be able to treat certain important urban issues such as mobility more directly.

We believe that *composite* indicators are vital if certain urban issues are to be taken properly into account. For example, the issue of noise in the town or city has to be evaluated using indicators associating noise, land utilisation and population: it would make no sense to look at noise in the abstract. In some cases, there is less need for

composite indicators, and, indeed, these may even make an issue harder to understand. However, the construction of consistently *composite* indicators throughout this research project has had the invaluable effect of raising awareness of the genuine interactions that exist between different urban issues.

8.2 Regarding the methodology

The input obtained from working in a network are crucial to the quality of the results, not least because this input has ensured that the work has been firmly rooted in the reality of towns and cities. Nonetheless, the time spent by both the network organisers (i.e. the research team) and the participants on working in this way should not be underestimated. The lack of specific funding to support this work is relevant to the way the results must be evaluated.

We believe that the contribution in terms of methodology is as important as the concrete outcome, i.e. the creation of a set of indicators. We hope we have been able to prove the effectiveness of the empirical method as devised in connection with this project in constructing composite indicators for sustainable urban development, and above all that we have succeeded in relating the reality of our experience by describing the approach we have adopted and its associated problems and advantages.

APPENDIX 1. Example of the use of the urban matrix

EXPOSURE OF POPULATION TO TRAFFIC NOISE	
Physical characteristics of the town/city	
Morphology housing	**Pressure ® State** - the nature of the frontage along major road axes (e.g. motorway junctions) affects the degree to which noise is reflected or absorbed **Reaction** - problem: sound insulation: old buildings pose problems as regards sound insulation …
Microclimates	**Pressure ® State** - air humidity levels and wind affect the extent to which noise is carried
Socio-economic characteristics of the town/city	
Population	**Driving force (= causes of population)** - number of commuters in cars (from inside and outside the BCR) **Impact (= effects on the population)** - problems with hearing, cardio-vascular problems, **disruption of sleep**, loss of concentration (impacts at work and in school), etc. - evaluation of the fairness of population distribution compared with traffic noise (e.g. no. of households with no car in areas subject to traffic noise pollution) **Impact ® Reactions (= how the population reacts)** - complaints (influence of the social and professional status of those making complaints) …
Land utilisation, de facto and de iure	**Driving force ® Pressure** - night shopping: double parking and engines left running at night in quiet areas (noise) **State** - urban mix: location of noise-sensitive areas: housing, green areas; location of highways generating significant levels of traffic noise - housing density along busy roads …

Main economic activities	**Pressures** - types of road traffic generated by different activities …
Main socio-cultural activities	**Driving forces** - leisure activities generating recurrent traffic (e.g. theatres) or intermittent traffic **Impact** - noise affects the quality of certain activities that need peace and quiet: teaching, concerts, hospital care, etc. …
Management of flows within the city (energy, materials, people, information)	
Parties and their various responsibilities	**Pressure - reaction** - choice of transport mode, "choice" of where to live (in relation to noise and to length of journey to work), **fairness (cf. house prices)** - quality of driving (stressed or calm) affects levels of traffic noise …
Development and management of infrastructure and public facilities; running of networks The consequences of local policy choices as regards patterns of movement	**Reaction ® Driving forces** - parking choices: capacity of carparks, entries, exits and ventilation in underground carparks (driving force: individuals) - choice of public equipment, e.g. public transport vehicles, garbage trucks (driving forces = local town/city authorities) - ***k. Reaction ® State*** - infrastructural choices affect the overall quality of the acoustic environment, e.g. for roads: status of highways, surfacing, local traffic-calming measures (sleeping policemen, chicanes), width of lanes, surfacing, number of lanes, speed limits, one-way systems, road signs directing heavy goods vehicles, road signs indicating location of carparks in town/city centres, etc., especially as regards noisy vehicles such as public transport vehicles and heavy goods vehicles. Heavy goods vehicles: transshipment facilities, itineraries, timetables ….

"throughputs" and "peaks and troughs" in patterns of movement (quantitative evaluation of traffic flows to which the above infrastructures are subject)	**Driving forces** - nature of traffic flow: intermittent or constant, times of day: rush hours, day/night, number of vehicles per category, vehicle speeds, modal characteristics **State** - traffic noise measurements …
Monitoring	- general public: parasite traffic in residential areas

Appendix 2 – List of sustainable urban development indicators

1	Complaints about noise and vibrations
2	Exposure of population to traffic noise
3	Population subject to significant noise pollution from traffic
4	Noise in the tertiary sector
5	Population exposed to noise from railways at night
6	Aeroplanes passing overhead and causing noise problems at night
7	Complaints about evening/night activities (restaurants, cafés, concerts, sports, etc.)
8	Complaints about HVAC systems
9	Heavyweight vehicles passing through residential areas
10	Air pollution from traffic
11	Ecological management of green areas
12	Number of persons who visit urban green areas
13	Accessibility of green areas
14	Maintenance of flower beds and facilities in public parks
15	Green spaces remodelled after consultation with local residents
16	Quality of playgrounds
17	Training for park-keepers and gardeners
18	Public hygiene: annoyances resulting from the presence of animals in the city : 1. dogs in the city
19	Public hygiene: annoyances resulting from the presence of animals in the city : 2. feeding of wild animals in the city
20	Public hygiene: sweeping of public roads
21	Public hygiene: level of public satisfaction with public hygiene
22	Environment oriented education in schools

23	Prevention of waste via information campaigns
24	Effectiveness of waste recovery via selective collections
25	Use of recycled paper by local government departments
26	Practicability of composting at home
27	Production and use of compost and/or mulching by local services
28	Water leisure facilities for local residents
29	Restoration of lakes and waterways
30	Conservation of urban facilities associated with water
31	Facilities and techniques ensuring the reintroduction of rainwater into the water cycle
32	Separation of the rainwater collection network from the waste water collection network
33	Efficiency of the drinking water distribution network
34	Investments made by the municipality to encourage sparing use of water
35	Rehabilitation of wasteland
36	Rehabiliation of abandonned buildings
37	Pressure from cars on public space
38	Seepage prevention measures
39	Internal effort : percentage of service contracts with ecological and/or social clauses
40	Internal effort : percentage of specifications for public supply contracts with ecological and / or social clauses

AS/12/12

INTERDISCIPLINARITY, A TOOL FOR SUSTAINABLE DEVELOPMENT

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1. INITIAL QUESTIONS

In a nutshell, the starting point of the research rests on two general assumptions which raise theoretical as well as empirical questions.

1. Public policies on sustainable development require that an interdisciplinary approach be outlined in order to reduce the structural uncertainty due to the complex and open systems involved in building the sustainable development concept. The practice of interdisciplinarity would be one of the requirements to optimise both the heuristic quality of research - be it fundamental or applied- and the use which is made of applied scientific research by politicians and also scientific experts, who are to use that knowledge within the state apparatus , and more particularly within public services.

What are the elements of the theoretical thinking and of observation that allow to assume that interdisciplinarity, as a research practice, can help politicians make decisions that meet sustainable development requirements ?

2. If so and if the increasingly cross-disciplinary questions raised to politicians and the review of the criteria applied by the decision-maker to the scientific knowledge he is to use, are reflected in the political and scientific agenda of interdisciplinarity, support and facilitation methods of interdisciplinary practices still need to be found. It is because we wanted to go further than theorising about the good manners in the field of interdisciplinarity, that we started a research-action, which allowed us to assess the feasibility of one of its solutions -the Delphi technique- and to understand to which extent that group communication method does really contribute to helping participants confront their points of view about the interdisciplinary approach. It is somehow a minor research-action in so far as we use the results of the Delphi technique that has been used for the practices and the issues self-reported by the actors, to know more about the impact of the learning and unlearning processes triggered by the interactions that this technique creates either to adjust the common stance of the actors involved or to sharpen their analysis and confirm them in their initial position.

The first empirical part of the research aimed at knowing more about the way the actors involved raise the issue of interdisciplinarity in relation to their actual experience and personal pathway in order to clarify or even qualify the theoretical « inventory ».

Self-reporting research practices then becomes a compulsory step since the final goal of that applied research work is to pre-assess the feasibility and efficiency of a

facilitation method applied to interdisciplinary practices. It is a compulsory step because the objective is not to suggest the right way to do or things to implement in accordance with objectives or ideals to reach and that will have been set on the basis of the theoretical analysis only, but rather on the basis of the issues raised by those involved. Otherwise, objectives set following a specific and required method- and hence the good manners linked to that- are likely to be meaningless to those who are supposed to use them.

2. EMPIRICAL RESULTS

2.1 Outcome of the first two phases of the Delphi survey

2.1.1 First phase

A first questionnaire is sent to a panel of 600 people working directly or indirectly in the field of research in French-speaking Belgium, from files from the OSTC. The sample is made up of people working for universities (45%), public services (22%), associations (15%), research centers (10%) and the private sector (8%). The challenges relating to the interdisciplinary practices go far beyond the context of scientific research only. This is why we've decided to extent our research to all the users of research programs and results.

The first questionnaire is quite general in order to be accessible to the diversity of groups. However, it is divided into four main lines : the challenges relating to the interdisciplinary research, obstacles, means of action and practical experiences with a participation rate of +/- 25% (160 people replied). It's not much, but the response rate is always lower in the first Delphi phase, since those who are not interested withdraw right from the beginning. Moreover, there are some methodological weaknesses, such as the length and the complexity of some questions.

What comes out from that first phase is that there is a consensus about the objectives, namely about the need to develop and promote interdisciplinary practices, but no consensus about the resources that need to be implemented. The first information confirms the validity of the research, whereas the second one introduces what's at stake in the debate on which the rest of the research will focus. In addition, a lot of people sounded pessimistic as to the likelihood of success of such an exercise. Indeed, two kinds of hinderances have been highlighted : psychological or individual ones, and structural or institutional ones. The Delphi survey process can then be continued to identify with more accuracy the hinderances and the resources,

the practical solutions for the development of interdisciplinarity, but can also be continued as a learning process for participants.

2.1.2 Second phase

The second Delphi questionnaire, based on the first outcome, aimed at going deeper in the issue of identifying the hinderances, and in relation to this, the means and resources to be implemented. Moreover, in light of the diversity of responses that we got in the first phase, we deemed it necessary to dedicate the first part of the second questionnaire to the definition of interdisciplinarity in order to make sure that in the answers given we all speak the same language. The participation rate is 30% (49 people answered).

There was some ambiguity in the definition. On the one hand, a so-called realistic definition - a kind of makeshift definition according to which interdisciplinarity is the summation, the pooling of a posteriori results used to draft a report common to the different partners of a research program. And on the other hand, an ambitious one, which advocates for co-operation and integration during the collaboration process, rather than mono-disciplinary research and then juxtaposition, in order to better come to grips with the complexity and richness of what's real. That perilous attempt aiming at giving a definition has highlighted the strength of the balance of powers and the implicit levels of management that organise and underlie the relationships of scientific disciplines among themselves. That's why the need to create an environment, which avoids turning the confrontation among disciplines into a balance of management powers, is made a priority with a view to encouraging the setting up of interdisciplinary practices. According to a famous French sociologist of science, the challenge raised by the interdisciplinarity is therefore an ambitious one : getting sciences into democracy !

That tension is part of the issue regarding the means and resources that need to be implemented to foster interdisciplinary practices, between a top-down approach feared but necessary and even claimed for under certain conditions and a preferred but inadequate bottom-up approach. Actually, a balance between these two approaches would be the best solution. Safeguarding the independence of mono-disciplines and hence securing the integrity of research, while fostering the development of interdisciplinary approaches through concrete and structuring measures, such as training, awareness raising, learning, promotion, individual and group benefits, enhancement, dissemination and sharing of results...

Eventually, what is interesting for us to know is that the Delphi method implemented in that research has been well received, a lot of people find it original and interesting,

and at the same time it represents a highly potential learning tool which triggers a debate...Thus, the Delphi method is appropriated within the framework of training, awareness raising and the debate about interdisciplinary practices.

2.2 Outcome of the third Delphi survey phase : support and facilitation tool for interdisciplinarity

The Delphi process divided into three steps was to end with a final meeting. So, the results of this third phase were presented during that final meeting, which was held as a focus group or workshop at the OSTC, with a founding theme : « The Delphi method as a facilitation tool for interdisciplinary practices ».

The second empirical part focuses on the feasibility conditions and the assessment of the « Delphi group » technique , as a technique which organises communication in a group, as a tool that facilitates the interdisciplinary practice of researchers. The idea is to develop tools that will enable and facilitate the change of practices for these non organised groups. How can we make sure that a laboratory and a fortiori a network of labs will, for example, think of communicating their results to their peers first but also make a recommendation for action (linkage of knowledge by researchers) ?

We made the « strong » assumption that Delphi is an appropriate choice. Indeed, the method has a lot of advantages, especially with regard to its impact on learning and on the ability to set up common systems of references. Through its latent learning and socialisation functions, it can contribute to forming a relatively homogenous vision in non organised and diversified groups. That assessment comes from the comprehensive analysis of the objectives, needs, constraints and experiences of the different actors asked to compare their disciplinary viewpoints on interdisciplinary in the course of a research action.

2.2.1 Outcome

During that meeting, some methodological weaknesses inherent to both questionnaires were underlined. Then, a debate started about the outcome of the previous Delphi phase, and finally a kind of focus group took place to tackle the very specific and concrete issue with regard to applying the Delphi method to an interdisciplinary research program, namely looking at the way the Delphi procedure, as a development and facilitation tool for interdisciplinary collaborations within a research program bringing together partners from different disciplines, could be applied. The research program co-ordinators all have their own methods and communication tools, and in particular some experience as to how to set an agenda

and facilitate a meeting. This method does not aim at replacing the existing tools, nor is it imposed. It is just proposed to the co-ordinator as a tool enabling to structure and systematise -all partners receive the same information at the same time- the communication and exchanges among partners within a research program.

2.2.2. The feasibility of Delphi

Let's go back to feasibility. Who is going to implement that tool ? It should be for the co-ordinator to choose this method or another one. What would be the added value of Delphi when compared to his/her own method ? If we are so much in favour of the Delphi method, it is not because it's anonymous - that does not matter here- and so would allow to avoid any face-to-face relationship with higher levels of management, but rather because it enables to structure and systematise the exchanges. Indeed, during a Delphi, all participants and their staff members receive simultaneously exactly the same information, - no omission is possible. Clarity is the principle that governs the communication process and the exchange of information, which makes it easier to collaborate and reflect upon issues.

The Delphi method applied to the research process led to a lot of debates as to the need to resort to a third person, either to train the co-ordinator, or to directly implement the tool, which poses a financial problem as well as problem of intrusion in the autonomy of a research program. The role of that third person would be to make the links and bridges and to do some popularisation work.

3. A LIGHT VERSION OF DELPHI : A TRACK WORTH EXPLORING

On this occasion, a light version of Delphi was submitted in order to suit the constraints inherent to the management of a interdisciplinary scientific collaboration, which is very often scattered geographically. Once it is implemented in a research program, the Delphi can be refined by leaving aside some of its usual characteristics that are useless here, such as anonymity.

The Delphi can then be organised through e-mails. 10 to 20 minutes are enough to fill the questionnaire and send it back to the sender. This way, the procedure is significantly lightened, shortened, cheaper and quicker. No mail, no stamps, no copies, not having to go a letterbox. For example, it happened that a questionnaire was filled but the person didn't find the time or just forgot to post it. By the way, the process is less *chronophagous*, allowing to manage agenda and to improve communication exchange and debate. Even for the manager, this version is particularly cheap and takes a bit of time : the time to write the questionnaires and to

send them, the time to receive and summarise the answers. That represents one day during the launching phase and a few hours for the successive steps. The questionnaire has to be short, specific, accessible, clear and simple, without any usual methodological weakness, such as a double question in one, inducing a standard answer...

This light version is particularly appropriate for co-ordinating a research team within a interdisciplinary program. It organises the communication and exchange of information. It avoids having to go through the boring exercise which consists of finding a meeting date that suits everyone, it allows to set up a distance and rational debate on the content, and to go increasingly deeper into in. One of the major assets of Delphi in a research program that brings together partners from different scientific backgrounds, or even sometimes from different countries, is that each and everyone of the participants is given the same information at the same time, and they are all informed about the state of progress of others's debate on the proposed themes. No omission or part of the information, no groups or sub-groups. Implemented within an interdisciplinary research program, integrated within the very research process, the method could then contribute to co-building common notions and concepts, or at least to reach an agreement on their definition and content, while sharpening their description and complementing the justifications and reflections throughout the successive retroactions. That can be done for any issue deemed necessary for the good progress of the research work : methodology, strategy...So, the Delphi method is a tool that structures and systematises the exchanges, and when implemented within the very interdisciplinary collaboration process, it could enhance the internal consistency of the program, make the different research works of the program more homogenous, and allow to integrate the results in the course of the research process, rather than after when a final and mainly rethoric report, with some summations, juxtapositions and repetitions, is drafted. The genuine goal of Delphi is to be able to improve and facilitate interdisciplinary collaboration, and consequently to enhance the quality of reports that better reflect the complex reality while being more accessible to research consumers : sleeping partners, public authorities, decision-makers, citizens, journalists, etc.

However, even if people showed some interest in that light version, there are still questions about the feasibility, the technical implementation and the financial setting up of the Delphi light procedure for which there is no answer yet. First, Delphi is a support tool to help the co-ordinator co-ordinate and manage a team. As such, it seems obvious that it is up for him/her to choose to use, or not, the Delphi tool, or any other tool. If the Delphi method is chosen, who is going to implement it ? The co-ordinators themselves ? Do they have time enough for this ? Do they have to be

trained or supported ? Should part of the research program budget be dedicated to the Delphi follow-up ?

4. A RESEARCH-ACTION

The SPIRAL lab is currently launching a research-action which aims at implementing the « lightened » Delphi procedure within a European research program (SUIT : Sustainable development of Urban Areas through an active Integration within Towns, EESD-ENV-99-2) that brings together eight partners from different nationalities and languages, in order to test and validate its relevance and efficiency. It is indeed by applying the tool under real conditions within an interdisciplinary collaboration process that it will be possible to assess to which extent it really enables to structure and improve communication and the exchanges of information among partners, to trigger a group debate on common issues, notions and concepts, to make research more homogenous, and to allow a better integration of the results in a common and final quality report.