“Methodological problems of assessing the economic impacts of EU chemicals policy”

Summary results of the conference of experts at the Umweltbundesamt (Federal Environment Agency) on 6.2.2003

1. Reasons for holding the conference of experts and its aims

The European Commission has elaborated the principles of a new chemicals policy in Europe in its White Paper on “Strategy for a future Chemicals Policy” (European Commission, 2001).
Studies have since been published for Germany and for the EU which look into the potential economic repercussions of future policies on chemicals. These examine very different aspects using different methods and based on different assumptions concerning the design of future EU chemicals policy.
In this respect it is important to clarify the underlying causalities and interrelationships and to evaluate the strengths and weaknesses of various methods for estimating economic consequences associated with EU chemicals policy. To initiate a process of consultation and benchmarking based on both existing and conceivable methodological approaches to the determination of the economic impact of future EU chemicals policy, the Umweltbundesamt (Federal Environment Agency) held a one-day conference of experts representing various institutions with relevant expertise in the fields of environmental economics (especially economic impact analysis), innovation research and/or chemicals and substances policy (cf. Programme and List of Participants in the annex). In particular, the following points were discussed:

- starting points for an economic impact analysis,
- the methodological approach and information base,
- possible methodological advances.

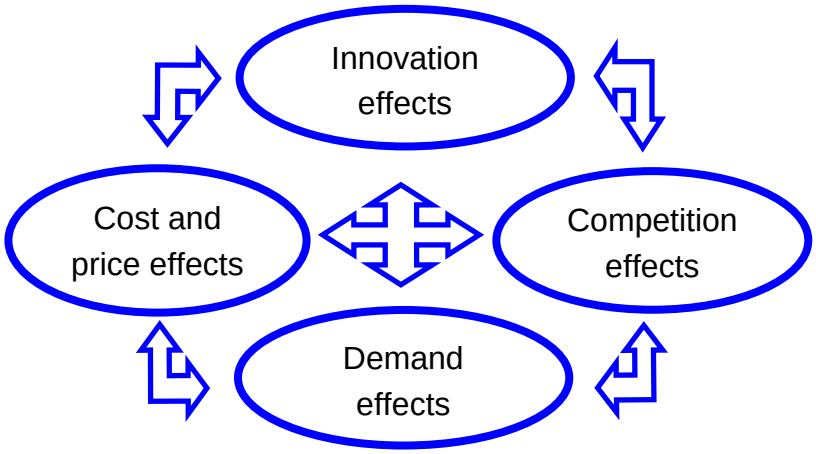
2. Starting points for analysing interrelationships

In the opening session, the conference participants began by attempting to sketch out the possible starting points for an economic impact analysis for developments in the chemicals policy field.
The relevant interrelationships affected by chemicals policy were brought into focus by considering the terms “innovation”, “competition”, “cost and price structures” and “demand factors” (cf. Figure 1). Within this set of relationships it is possible to trace various lines of argument:

- Costs and prices influence innovation activity (cost-push hypothesis); and conversely, a high (low) level of innovation activity can lead to cost advantages (disadvantages) vis-à-vis competitors.

- Cost increases (decreases) can lead to a price-induced fall (rise) in demand; conversely, rising costs lead, on the one hand, to higher revenues and demand pulls elsewhere (circulation mechanism).
- Innovative (less innovative) companies can generally compete better (worse); while stronger (weaker) competitive pressure can stimulate (retard) the innovation activity of companies.
- Good (bad) national or international conditions for competition enable the existing demand to be served appropriately (only by having to accept welfare losses); a higher (lower) level of demand (e.g. for environmentally sound products) can activate (dampen) competition.
- Innovative (less innovative) companies are better (worse) able to open up new markets and demand segments (demand-pull hypothesis); changing demand behaviour can influence innovation activity positively or negatively.
- Cost pressures can influence the conditions for competition positively (e.g. "desired" rationalisation and market adjustment) or negatively (e.g. "distortion" in the market); increased (decreasing) pressures on companies from national and international competition is generally likely to lead to more cost-sensitive (less cost-sensitive) management.

Figure 1: Illustration of causalities



With these "theoretical" interrelationships in mind, the experts discussed the question of which economic effects have so far been examined by available empirical studies or are currently being examined. The conference noted that,

for the case of the German economy, the only relevant study so far available was the ADL Study[1], and this would have to serve as a benchmark.
On the positive side, it was found that the ADL Study provided, in certain areas, a very detailed investigation of potential impacts resulting from the new REACH system on company value chains. In particular, its presentation of the textile chain was seen as very useful. The information generated was found to provide important practical indications as to the relative significance of various parameters of EU chemicals policy. It enabled the implementation of the REACH concept to be improved (fine-tuning) and excessive hardships for particular product groups and added value sectors (e.g. downstream-users) to be avoided.
On the other hand, the discussion showed that there is still a great deal study to be done before we can arrive at a comprehensive economic impact analysis from which meaningful conclusions can be drawn. In particular, the following questions were identified for further analyses:

1. inclusion of other important causal chains;
2. verification of underlying impact hypotheses;
3. definition of the reference scenario for the case of a situation without any reform of EU chemicals policy;
4. thoughts on impact hypotheses that reflect a dynamic economy.

On 1) Need to widen the field of enquiry

In order to identify the economic impacts of a new EU chemicals policy as comprehensively as possible, consideration must be given to the relationships sketched out briefly above:

- *circulation processes*,
- positive *innovation effects* of the White Paper (in particular due to quality as well as cost competition; due to potential influences on other regulatory regimes),
- *future* and emerging *patterns of demand* and *market trends* or stimuli (including effects of the unification of the European Market), and

[1] Referred to here as “ADL Study”: Arthur D. Little (2002): Wirtschaftliche Auswirkungen der EU-Stoffpolitik; English summary “Economic Effects of the EU Substance Policy”, cf. www.bdi-online.de.

- *economic benefits* of the REACH concept (cost savings from improvements in environmental, labour and consumer protection, e.g. in the form of a lowering of occupational health costs etc.) (cf. Rühl, 2002).

If certain fields are not surveyed or certain aspects not included in an assessment, this should be made clear when interpreting the results and formulating practical recommendations.

In the course of the discussion, the following main criticisms clearly emerged:

- The *title* of the German study gave the impression that the White Paper had been analysed in an economically comprehensive manner, yet the aspects referred to above are either dealt with only cursorily or not mentioned at all;
- The conceptual limitations of the study's design (as an attempt to identify possible negative effects on production and employment in certain key sectors) is not made sufficiently clear when it comes to the presentation of *policy recommendations*.

On 2) Need to verify hypotheses

While the validity of an economic impact analysis depends on the inclusion of the many different positive and negative, direct and indirect, short, medium and long-term effects in the investigation, it is equally important to examine the plausibility and validity of the underlying hypotheses concerning causality. In this connection, the discussion of the ADL benchmark study brought up the following questions:

- The estimated costs that are set for the risk assessment procedures (exposure assessment) were considered by several experts to be far too high. There was no reason to assume, they argued, that new measurements would have to be made for every workplace or that one could not make use of existing data or simplified, computer models.
- As for the costs of characterising substances (testing costs), it was also argued that the companies in the German chemicals industry already had a minimum set of data (under the VCI voluntary commitment of 1997), so that any additional costs, particularly for small-volume substances (< 100 t), would remain within narrow margins. The experts also noted that the White Paper envisages that the information generally, or even exclusively, required

for quantities between 1 and 10 t/a be based not on expensive animal testing but on low-cost in vitro methods.

- The experts doubted whether the disclosure of information automatically led to higher net cost ("transparency costs"), let alone production losses. The disclosure of confidential information to government authorities was, they said, common practice and secrecy is maintained without difficulty. The multiple use of test results can be regulated through the obligations to provide information, copyrights and cost sharing (formation of consortia). Furthermore, the exchange of (possibly commercially sensitive) information along the value chain can be arranged by a obligatory information provision system, information rights and agreements under private law. It is even conceivable that the process of communication, suggested in the White Paper, between producers and users will cut costs (safeguarding against risks thanks to improved knowledge of substances) (cf. Bunke et al., 2002).
- Nor does the time factor (duration of registration and licensing relative to the innovation and product lifecycle), which, under the "clouds" scenario, is supposed to account for up to 90% of production losses, appear very plausible. For this reason alone the estimated job losses under the "clouds" scenario appear unrealistic. Such costs are only to be incurred in the future as vested rights must be protected until full implementation of REACH and will probably disappear almost completely (due to learning and adaptation effects occurring between regulating authorities and the companies to be regulated). In this connection doubts were generally expressed about the logic of isolating time delays as a cost factor from other factors and thus neglecting interdependencies.
- With reference to his own study of the automobile industry, one of the experts pointed out that ADL's assumption of planning uncertainties caused by regulation did not in fact correspond with his own findings. On the contrary, certainty about the direction of regulation was a decisive factor, with companies ultimately preferring a predictable regulatory path to incalculable retroactive claims and liabilities.
- Only in the case of substances requiring authorisation for their use in the future (and raising questions of substitutes) can time delays play a significant role for sectors of industry with short innovation cycles (as in the electronics industry). It must be borne in mind, however, that within the EU potential time delays would affect all producers equally, so no competitive distortions should occur. The only important point to ensure in the respect

is that the length of the approval process be made roughly the same for all the competitors. However, in industries marked by strong global competition, competitive distortions could not be ruled out.

- While the dangers of production facilities relocating abroad and of import competition are accorded particular weight in the German study, they were thought by several experts to be exaggerated. Thus, it was noted that the automobile industry, for instance, was characterised by strong competition on quality and technology and by close pan-European integration of suppliers and producers. It was not, therefore, very plausible to argue that chemicals policy changes would in future influence competition primarily via the price parameter or that existing value chains would be interfered with to the extent predicted by ADL. Strategic behaviour on the part of the user (i.e. taking advice locally but then exploiting cost differentials between European and non-European countries) was, they said, conceivable for commonly used chemicals but hardly likely for “special chemicals”. Furthermore, the selling of services (to accompany substance applications), rather than just chemical products, is becoming increasingly important.
- The chemicals industry is not explicitly examined in the ADL study. The conference noted that this omission meant that there was an implicit assumption that price and cost pressures could be transferred directly to other sectors of the economy, without considering the feedback effects to be expected on the chemicals industry. This assumption was deemed unrealistic.
- Finally, conference participants pointed to the incorrect assumption that importers would be forced only by REACH to provide notification of new substances in imported preparations and report on existing substances in imported chemicals. But such reporting was, in fact, already common practice. So the study had, it was argued, failed to make clear why compulsory registration for chemical substances in imported preparations should lead to production losses in Germany.

On 3) Need for a reference scenario

In assessing economic measures, use is often made of the scenario technique, in which two scenarios are quantitatively described and compared: a reference

scenario presenting developments that would occur without the relevant measures taking effect and a policy scenario showing the differences to the reference scenario as a result of these measures.
In the discussion it became clear that the ADL Study relates all the quantified effects solely to the implementation of the REACH concept. The design of this study makes it impossible to assess how far these effects would occur even *without* REACH. Such a “business as usual” assessment would be needed, reflecting inter alia the fact that

- the markets under examination face (in part global) competitive pressures irrespective of the policy framework laid down by the White Paper;
- the existing inventory of chemical substances is undergoing continuous market-driven change (around a third of the substances currently being used will probably be substituted within ten years irrespective of REACH);
- numerous so-called “low volume – low value” substances (20% of the market) would in any case disappear from the European Market (rationalisation effects).

The ADL Study therefore deals with the causalities at work not – as is essential – by applying the “with and without” principle, but merely from a crude “before and after” perspective. Consequently, the effects identified as occurring *additionally* and *only* as a result of the White Paper remain arbitrary.

On 4) Need for a dynamic perspective

An analytical approach that takes into account the dynamics of economic processes and developments can substantially increase the meaningfulness of scenario estimates and models. Such an approach appears useful particularly in the field of chemical substances and preparations, where market trends change rapidly and many different feedback effects on the economy and society result from the regulation of material flows.
With regard to an understanding of complex and, in part, regulation-induced innovation effects, the conference participants took the view that only a dynamic perspective would produce meaningful outcomes. The dynamism and innovation of industry that is likely to unfold over the envisaged transitional period would have to be integrated in an appropriate impact analysis. In fact, during this period of adjustment, one could expect to see a stronger trend

towards substances with less hazardous properties and the emergence of substance-substituting processes and services (e.g. increasing provision of user support services). This means that further opportunities will exist for saving direct (e.g. cutting risk management costs, avoiding claims of recourse) and indirect costs (e.g. for companies in the form of image damage, for the general public in the form of reduced health costs).
It must also be assumed that framework conditions set by government that touch upon the issues of the White Paper, or at least specific points, will be changed. The experts emphasised the strong potential for cost-containing synergies (e.g. from bringing together the currently separate discourses on Integrated Product Policy and the Chemicals White Paper; e.g. product panels on risk minimisation).
In contrast to the present ADL Study with its *entirely static* approach, the task is therefore to integrate into the analysis the dynamic development process expected from the EU chemicals policy and go beyond the static ceteris paribus line of argument.

3. Methodological approaches and the information base for determining the potential production and employment effects of chemicals policy

In a second stage, the discussion moved on to the question of what methodological approaches to the determination of policy-induced production and employment effects are available and which ones are suitable for studies in the field of chemicals policy. Associated with this point was the issue of information gathering and data aggregation.
The experts started by considering a rough survey of the literature on empirical studies into the relationship between environmental regulation or a regulatory package (like the EU White Paper) and measurements of the economic strength of a company, a sector, a country or an international bloc (cf. list of literature).
This discussion established the following main points:

- The scientific literature is dominated by work done in the USA (regulatory impact assessment, cost-benefit analysis etc.).
- The areas most discussed in the literature are climate change, energy policy and transport policy. These are the main topics in relation to impact analyses at the national or international level.
- In the field of chemicals regulation (but also waste management) the studies tend to operate at a strongly disaggregated level. Extrapolations and models

are relatively rare due to the complexity of interactions and causalities. Most provide qualitative assessments.

- There are major empirical difficulties in isolating the influence of the regulatory measures under examination from other factors. This is all the more so as studies become more prospective, the analytical level is very “high” (e.g. national economy rather than individual value chains), the domain to be regulated is subject to strong dynamic pressures from market innovation, and there is particularly strong international interpenetration.
- A number of studies at micro and macro level were carried out ex post. Macroeconomic studies tend to be prospective.
- Ex ante cost estimates of environmental regulations are sometimes calculated too high due to valuation errors and unexpected innovation activities (cf. the meta-analysis by Harrington et al., 1999).
- It is easier to operationalise and model the costs resulting from environmental policy measures than the benefits.

Overview: methods for identifying potential negative competition and employment effects as a result of environmental regulation

Levels of analysis	Starting points for determining production and employment effects	Sources of data	Methods	Examples
Operation / company	• Costs • Time • Turnover • Net profits • Location decisions • Value chains	• Enquiries of public authorities or companies • Individual case studies • Company data	• Checking hypotheses (e.g. matched sample method); • Techniques of qualitative social research	Sprenger (1979), Knödgen (1982); Hitchens et al. (2000);
Industry / Sector	• As above but more strongly aggregated • Greater emphasis on locational factors • Factor productivity (level, growth rate) • Impact on foreign trade and investment behaviour, also at the product level	• Official statistics (environmental protection expenditure) • Estimates • In addition to results at the micro level e.g. elasticities at sector level from model outcomes • International trade statistics	• Regression analyses; • Calculation of indices (RCA); • Techniques of qualitative social research; • Qualitative estimates (e.g. using matrixes with different market and cost factors)	Morgenstern et al. (2000); Sorsa (1994); Gray and Shadbegian (1995); Blazejczak (1993); Jenkins (1998)
National/ international 1. "(Partial) extrapolation" from micro-economic studies to the macro-economic level	• As above, but more strongly aggregated (frequently trade flows) • Set of indicators for "competitiveness" • Individual techniques (energy)	• As above, additionally • Experience figures, analogies, expert estimates	• Assessments using various supporting sources; • Techniques of qualitative social research	Kalt (1988) ADL (2002) IMD (1996)
National / international 2. Econometric (input-output) models	Comparison of macro-economic magnitudes (where possible differentiated) with and without regulatory measures, without stating absolute level	• Econometric estimates of optimal precision based on past values	• Scenario technique • Modelling (bottom-up tendency)	Hillebrand et al. (2000); Meyer et al. (1999)
National / international 3. General applied equilibrium models	Comparison of macro-economic magnitudes (possibly in differentiated form) with and without regulatory measures, without stating absolute level	• Postulations or external estimates in the literature	• Modelling (top-down tendency)	Jorgenson and Wilcoxen (1990); Conrad and Schmidt, 1995)

In the discussion that followed, the experts took a closer look at the essential suitability of the methods described in the literature for use in the case of “EU chemicals policy”. In the main, the participants believed that a method, like the one chosen by ADL, that starts with companies and value chains (bottom-up) was basically the best approach to the substance policy issues under review. They contrasted this with a direct access approach via macro-economic models, which they considered inadequate to the analytical tasks. For even those macro-economic models that claim to be bottom-up (such as Meyer et al., 1999) lacked the specificity needed for chemicals policy analysis and could not, for instance, take adequate account of certain technical details or rules on adjustment periods. And yet, notwithstanding all the potential virtues of a bottom-up perspective for addressing the problems, this approach had serious problems when it comes to projecting findings onto the industry level and then onto the economy as a whole. The experts were able to discuss this difficulty very specifically with reference to the concrete example of the information base used for the ADL Study and the extrapolation and aggregation methods chosen for that study.

On this aspect, conference participants made the following points about the data base:

- The fact that the study dispenses with any *explicit modelling of the chemicals industry*, as the key link in the value chain, was considered a methodological inadequacy. The assumption that price and cost stimuli can be directly transferred without further mediation to the chemicals industry, thus ignoring feedback mechanisms, could, it was argued, hardly be regarded as realistic.
- Extrapolations based on micro-economic data from interview surveys on are only meaningful if *samples or case studies are statistically representative*. This applies particularly in the case of EU chemicals policy because of the, in part, highly differentiated sensitivities and impacts that are to be expected here. After all, within the entire sphere of manufacturing and commerce individual sectors will be affected to very different degrees by chemicals policy measures. This presents some serious challenges to the ADL Study, since the case studies it uses can hardly be seen as representative. In particular, the companies and industries chosen are largely the ones that seem to be particularly fearful of negative consequences. The experts regretted that the ADL study did not take closer account of sectors that, for instance, trade in consumer products (like furniture, cosmetics).

- A scientifically meaningful information base must be derived from a *statistically significant number and selection of interviewees*. The ADL data for the analysis of value chains is gathered, however, from a relatively small circle of respondents (cf. Annex 3 and 5 of the Study); some of the data for the individual stages of the value chain are based merely on information supplied by one company. Component suppliers often remain outside the scope of the enquiry (e.g. the automobile industry). The data for the industry-level analyses come from just one, two or three persons, and in many cases these individuals even supply the information on several industries.
- Moreover, the *quality of the responses*, in terms of the relevant expertise of the interviewees, is another important factor for the interpretation of data. Yet the ADL Study raised doubts as to the validity of the interview results not only by the narrowness of its survey base in relation to the economy as a whole, but also by the fact that the industry representatives interviewed were obviously poorly informed and in some cases misinformed (e.g. question of transparency versus confidentiality). The interviewees' assessments do not therefore always rest on sound knowledge but, to a considerable extent, on emotional fears.
- When using the results of interviews for an economic impact analysis, there is a *danger of strategic interview behaviour* on the part of the respondents which should not be overlooked. On this count, the experts said that the interview findings of the ADL Study should be treated with caution, especially since it had a one-sided selection of interviewees. With the interviews concentrating on representatives of companies and trade associations, strategic interview behaviour and a resulting ideological bias could not be ruled out. Staff and external stakeholders (e.g. from government authorities, other experts) played no role in the interviews.

Closely associated with the data base is the question of aggregation in a bottom-up method or disaggregation in a top-down method. Having discussed the strengths of the bottom-up approach taken by the ADL Study, the discussion moved on to the question of how far such bottom-up approaches can be accurately extrapolated. This discussion raised several issues in relation to the ADL approach.

The ADL Study was criticised for looking only at one point in the value chain and thus ignoring feedbacks (e.g. synergies between producers and users). On

the basis of this already narrow perspective, it then undertakes a multiple extrapolation (for one industry, for manufacturing as a whole, for the economy). In this way, a small domain of highly detailed data is extrapolated by means of a relatively crude method. The experts concluded that a set of base data which (apart from the distortions referred to above) is useful for a few specific domains had been clearly made less meaningful by being translated into crude and largely unquestioned mean values.

As for the problem of operationalising the data for the computational model, the experts identified the following weaknesses:

- The *industry factor*, which ADL takes as its basis and considers decisive, shows a model-inherent tendency to exaggerate. This is essentially because the three components contained in this factor (intensity of competition, ease of relocating production, need for market proximity) are simply combined by addition despite being closely intertwined.
- A *linear relation* between individual components of the industry factor and the production losses to be estimated certainly cannot be assumed, as the example of “non-linear” innovation strategies suggests.
- The industry factor is based on *ordinal-scaled interview survey results*. Yet for the sake of comparability and quantifiability, these are then placed in a *cardinal context* and thus assume de facto the character of an elasticity (relative quantity change due to a relative price change). The methodological difficulties thrown up here (comparability, representative sample of interviews) are not understood by ADL.
- The innovation and product life cycles do not depend on the conditions for market launch and of competition. The *linear modelling* using the so-called “*cannibalisation factor*” is not convincing, since a potential lengthening of innovation cycles would also influence the strategic conditions for innovation of non-European competitors, if one realistically assumes that European companies will continue in the future to exert major influence on market structures.
- *Time is not modelled*. It is assumed, for example, that production changes in step 1 (protection of vested rights) and step 2 are completely unrelated, in other words create no learning effects etc.. Nor is there any attempt to allow for a discounting of future production losses.
- The structure of the model contains other, unproblematised *linear stipulations* (e.g. constant testing marginal costs) and operates with *average values* that

require further discussion, such as the values given for profit margins and market prices of chemical substances.

- With regard to the *extrapolation* of the results from manufacturing industry to the whole Germany economy, the study assumes *proportional changes at the level of purchased materials and services*. Yet the change in relative prices of various material inputs calls this assumption into question and must be examined more carefully.
- The *percentage conversion of production and job losses* is a dubious step since input-output interlinkages and sectoral differences in labour intensity are not taken into account.

To estimate the impact of certain characteristic combinations of various manipulated variables, the study condenses previously defined data and parameters into three scenarios. The conference made the following main criticisms of this way of using scenarios:

- No *reference scenario* is given (cf. Section 2).
- It remains unclear how far the patterns of variables selected for the individual scenarios reflect the actual design of EU chemicals policy and what *spectrum of possible policy design* is covered. Uncertainty about the specific requirements yet to be set by the European Commission is concealed by suggestively depicting scenarios.
- The figures given for costs include not only the data taken from ADL's own survey but also *data from a number of other studies*. The method of transferring these data sets into the three scenarios with their respective hypothetical processes remains unclear.

On the whole the discussion made it clear that a bottom-up method of the type chosen by ADL is not an suitable methodology for arriving at *absolute magnitudes via macro-economic aggregates*. The data contained in the ADL Study for losses in gross value added and for job losses resulting from the implementation of REACH cannot be validated and cannot therefore constitute a sound basis for the macro-economic evaluation of EU chemicals policy. Even the *relative comparison of scenarios* suffers from distortions inherent in the model (data base, aggregation, standardisation) and can say little about the significance of individual parameters and their respective characteristics.

With regard to the *scales of magnitude* estimated by the study for production and job losses, the experts also pointed out that, according to previous studies by leading business research institutes, government regulation, as opposed to market factors, had not in fact been a decisive reason for companies to relocate or close down production facilities in Germany.

In conclusion, it was found that the ADL Study pointed to a major *research gap* which had to be closed before we can develop the substantive, methodological and data-related knowledge required for a meaningful empirical impact analysis from which sound macro-economic conclusions can be drawn.

4. Steps towards methodological refinement and alternative methods

Having established that more research is still needed to develop economic impact analyses for the new EU chemicals policy, the conference turned its attention to the question of how such an analysis can be improved and refined and what methods (e.g. used in other countries or in other policy fields) are available. The experts discussed some of the different requirements to be met by the designing a study that can produce meaningful results.

Widening the micro-economic perspective

One suggestion was that, instead of attempting a global impact assessment, an *in-depth examination* should be made of those *economic spheres and lines of business* that are strongly affected, negatively or positively, by EU chemicals policy. An analysis of this kind could, it was said, build on some important elements in the ADL Study. This approach would have the advantage of offering a foundation for detailed practical recommendations for the framing of EU chemicals policy. Unlike a global assessment, in which the specific causal mechanisms tend to be blurred by forming average values and drawing analogies, a widening of the case studies approach might be better able to calculate the different impacts felt along complex value chains. Concretely, we have to ask whether the value chains can be “rolled up” from the back (demand side), i.e. in particular what role is be played by retailers of consumer products (e.g. proactive role of the mail order company Otto).

Bridging the meso- and macro-economic levels

Finally, at various points the discussion focused on to the question of what methods are available for bringing insights at the micro-economic level (individual companies, value chains) more strongly into a meso-economic or even macro-economic context. Several experts considered the *input-output analysis* to be essentially the right approach and an improvement on the method used in the ADL Study. For developing predictive studies based on changed product structures ("sustainable consumption"), and to a certain extent using a similar analytic design, the experience with extending the input-output analysis had, they noted, been positive. This type of approach would allow us to estimate both positive and negative production and employment effects. In order to simulate changes chemicals policy frameworks, estimates would have to be made of the production functions, differentiated, if possible, by sector (via vector divisions). The greatest difficulty, and the most time and expense, would, it was added, probably lie in the area of data collection (especially for the modelling of substance structures). This aspect would prove more difficulty, the more one tried to alleviate for the specific shortcomings of the input-output analysis. A general disadvantage of input-output calculations was, the conference noted, above all their inadequacy in modelling of dynamic effects (various elasticities), and this had to be taken into consideration. Chemicals policy in particular gave rise to the additional problem of finding how to integrate the different innovation cycles, the various governmental frameworks on the global scale and the diverse conditions set by chemical policy (integrated product policy, labelling etc.).

Hence, if a study seeks to go beyond input-output calculations and produce more sophisticated results, *further methodological components* must be introduced into the analysis. For example, the experts referred here to approaches such as stakeholder dialogue, participative foresight, Delphi surveys, explorative interview methods (stated preferences) and technical outlook. Individual findings would then have to be integrated within a consistent framework. Three of four possible development paths might be brought together as *bundled scenarios* and then compared with a "business-as-usual" scenario. This approach would, it was said, only succeed on the basis of solid experience in using the scenario technique and great methodological expertise. It was added that the imputed policy measures had to be very clearly identified in the scenarios. Such a study was difficult and could hardly be expected to generate reliable results within a few months.

As an alternative to the input-output approach, one might make use of *general applied equilibrium models*. Although these are usually better at simulating the diverse substitutive and interactive relationships, the experts pointed out that the complex structure of the macro-economic model often demanded problematic and empirically rather implausible postulations (e.g. voluntary unemployment) and simplistic assumptions. The economic research here has already made considerable progress in modelling energy policy options (e.g. also on the question of integrating bottom-up and top-down approaches), far more than in other policy fields. The experts were doubtful whether this type of model offered a particularly promising option in the near future for estimating chemicals policy repercussions.

Examples of and criteria for an alternative study design to overcome the limitations of model analyses

Notwithstanding the possible improvements already discussed, the experts stressed that the choice of a particular method or model always meant entering into a certain compromise. Experience showed that it was naive to believe that alternative assessments would be accepted by all sides and would not face new criticism. However, the conference finished by considering some *ideas* as to how the *positive effects of the EU-White Paper,* overlooked in the ADL Study, could be given appropriate weight and what methods were available to do this. One possibility was seen in the attempt to integrate *retrospective studies* on particular benefits and innovation effects already induced (inter alia) by government action to set frameworks:

- The World Business Council for Sustainable Development has, for instance, collected case studies on the positive influence of state regulation on innovative behaviour (with regard to the substitution of, for instance, CFCs, cadmium, VOC, chloric gas).
- Occasional attempts have been made to monetarise the benefits of chemicals regulation. These often express benefits in terms of costs avoided for the treatment of occupations diseases, injuries and fatalities. Such studies are already being pursued by the EU Commission. However, serious methodological problems remain unresolved when it comes to evaluating benefits and attributing them to specific policy actions.

- With the help of patent data, it is possible to establish approximate values for the innovative behaviour of companies. However, this approach cannot take into account the quality of innovations.

As a further possibility, it was suggested that studies focused on those companies that are in the forefront of substance flow management and environmentally enlightened company management (*benchmarking*). Such studies could help to challenge preconceived opinions about the negative impact of chemicals policy on companies.
An important *prerequisite for successful implementation of future studies* was identified as the *improved flow of information* between government regulatory authorities, the companies concerned and other stakeholders. One expert reported that in his experience there were currently major difficulties in explaining the REACH concept at the level of actors (especially in the case of downstream users). Thus, studies should be designed to avoid the problem of the tendency for the (indispensable) interview survey of actors to record an automatic aversion (fear of higher costs etc.) to policy changes due to ignorance about the causalities involved.
A better information base would, it was argued, open up opportunities for future studies to identify individual innovation potentials along the substance chain. In the case of new substances, materials innovation are already well understood because the scope for application is known, but in the quantitatively far more significant field of existing chemicals the present gaps in the data will only be filled with the successful implementation of the REACH concept as information deficits are overcome. The conference hoped that improvements in the information base would provide an important impetus for research into innovation processes, not simply in a quantitative sense but rather as a qualitative underpinning.

5. Selected literature

Arthur D. Little (2002): Wirtschaftliche Auswirkungen der EU-chemicals policy, Untersuchung im Auftrag des Bundesverbandes der Deutschen Industrie, www.bdi-online.de.

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Annex:

1. Programme for the UBA Conference of Experts on the "Economic Impact of EU Chemicals Policy"

Part 1:
Hypotheses and starting points for an economic impact analysis

- Initial statements
- Plenary discussion

Lunch break

Part 2:
Strengths and weaknesses of selected methodological approaches to economic impact analysis

- Initial statements
- Plenary discussion

Coffee break

Part 3:
Criteria for an informative and operational impact analysis

- Final discussion

2. List of partifipants in the conference[1]

Name	Institution
Andreas Ahrens	Ökopol Institut für Ökologie und Politik GmbH
Stefan Besser	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit
Dr. Andreas Burger	Umweltbundesamt
Thorsten Frohwein	Umweltforschungszentrum Leipzig-Halle GmbH
Dr. Michel Faust	BITZ (Bremer Innovations- und Technologie-Zentrum)
Andreas Gies	Umweltbundesamt
Lydia Illge	Deutsches Institut für Wirtschaftsforschung
Lars Koch	Finanzwissenschaftliches Forschungsinstitut an der Universität zu Köln
Dr. Walter Komar	Institut für Wirtschaftsforschung Halle
Dr. Kora Kristof	Wuppertal Institut für Umwelt, Klima und Energie
Christian Meinecke	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit
Jan Nill	Institut für ökologische Wirtschaftsforschung
Ralf Nordbeck	Umweltforschungszentrum Leipzig-Halle GmbH
Dr. Janina Scheelhase	Prognos AG
Tilmann Rave	Ifo-Institut für Wirtschaftsforschung
Dr. Christian Rammer	Zentrum für Europäische Wirtschaftsforschung
Dr. Beatrice Schwarz-Schulz	Umweltbundesamt
Prof. Rolf-Ulrich Sprenger	Ifo-Institut für Wirtschaftsforschung
Dr. Klaus G. Steinhäuser	Umweltbundesamt
Dr. Rainer Walz	Institut für Systemtechnik- und Innovationsforschung
Dr. Johann Wackerbauer	Ifo-Institut für Wirtschaftsforschung

[1] In addition, written comments by Dr. Dirk Bunke of the Öko-Institut were brought up in the discussion.