

**Survey of the possibilities of collecting questionnaire-based data on
environmental protection expenditure for the manufacturing industry**

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1 Preface

1.1 Purpose

At the request of Eurostat, Unit F3, the present project was conducted by Statistics Denmark's Division for the Environment and Energy. The purpose of the project was to study the possibilities of collecting data on environmental protection expenditure for the manufacturing industry.

Data in great demand

There is an increasing demand for this type of data. The data are typically requested by the general public and by the central and local governments, but also by the manufacturing industry and its organisations. The demand is due to, e.g. the need for being able to assess the impact on (new) political initiatives in the environmental domain. The most recent example of this occurred in connection with the proposal for amendments of EU's Structural Regulation¹, aiming to make integrated technologies (i.e. pollution *prevention* investments) and total current expenditure for environmental protection compulsory. Data on investments of the manufacturing industry in purification measures (the so-called 'end-of-line' investments) were previously made compulsory.

The best information involving the lowest burden

Statistics Denmark wants to examine the possibilities of collecting data for producing the statistics in demand. To ensure the compilation of top-quality statistics and also to reduce the time spent by each enterprise on filling in the questionnaires, it is Statistics Denmark's intention to design questionnaires, which are as far as possible based on an understanding of the existing primary statistical data that today are already available to the enterprises.

1.2 Background

The issue

In the opinion of Statistics Denmark there are considerable problems associated with collecting these data. Furthermore, operationalisation of the definitions is difficult, and the distinction between environmental investments and other investments is theoretically not well-founded.

Problems involved in data collection

There are partly conceptual and definitional problems. For example, problems relating to the demarcation line between *environmental* investments and other investments and problems relating to the concepts of purification or treatment of pollutant, respectively prevention of "pollution production".

There are partly the methodological problems linked to estimating the environmental part of (large) integrated investments. The theoretical complications in this domain result in an operational method of low usefulness.

There may partly be some considerable problems (and resources) associated with adapting the financial operating and accounting systems to capturing and tabulating data relating to environmental protection expenditure of the enterprise.

There is partly the issue of response burden. The above problems imply that the completion of questionnaires relating to environmental expenditure of the enterprise is regarded by the industrial enterprises as a disproportionately time-

¹ Council Regulation No 58/97 on Structural Business Statistics

consuming process. This problem arises not at least because doubts can be raised as to the degree of reproduction, the statistical uncertainty and the usefulness of the data.

Analysis of the possibilities for improvement

Against this background, Statistics Denmark wanted to conduct a project based on qualitative interviews involving a number of enterprises, with a view to assessing the scope and nature of the problems. This assessment is intended, if possible, to result in improvements of the questionnaires that are to reduce the response burden and the sources of error, and thereby improve the data quality.

1.3 Procedure

Basis for analysis

Basically, statistics Denmark wants to have *an understanding of which economic data are available to the manufacturing industry* in the domain of environmental protection. And how this type of data is envisaged by the manufacturing industry.

Interviews

Consequently, Statistics Denmark has undertaken a number of interviews involving large and medium-sized Danish industrial enterprises in selected industries. 21 enterprises were covered by the interview-based survey (see annex). The survey is very small and is not representative of the entire manufacturing industry. It must be assumed that a great number of the enterprises selected are among those with the greatest motivation in relation to the problems raised. They are in other words pioneering enterprises. On the one hand, they have contributed with their experience and have perhaps also been able to act as a signpost for the future development within the area of statistics on environmental economics.

1.3.1 Content of the interviews

Clarification and understanding

Statistics Denmark wants to *examine how environmental investments and environmental expenditure are envisaged by the manufacturing industry*. We also want *an examination of which questions and concepts are best suited, and give the right associations in relation to obtaining the data requested*.

Statistics Denmark wants to *clarify how the existing data can be used for constructing useful estimates of environmental expenditure for the manufacturing industry*. We want to *start a dialogue about the possibility of providing/creating the environmental variables requested*. Investments in purification measures, investments in pollution prevention and current environmental expenditure.

"Survey of data sources"

The objective of the interviews is to acquire an understanding of:

- which data are already available to the industrial industries,
- the form of these data,
- how they are recorded,
- availability,
- documentation,
- degree of reproduction, etc.

What are the possibilities of collecting these data in a systematic manner? What are the possibilities of "producing" the statistical variables requested on the basis of the information available? What information is missing? How does Statistics Denmark formulate the questions to avoid misunderstandings?

Another objective of the survey is to identify the problems that are considered by the enterprises to hamper the collection of reliable and homogeneous data. And in

our discussions "sow the seeds" for this type of statistics by, e.g. calling attention to the self-interest of the enterprises in producing the statistics.

Furthermore, it is also a major task to give instructions as to any future initiatives in order to meet the problems identified and thereby contribute to improving the data quality in the long term.

Finally, it is intended that the project is to outline the most useful statistical methods of importance, which should be incorporated in the future work.

1.3.2 Experience

International experience This type of statistics has been compiled or is compiled regularly by several EU member states. This has enabled us to study the questionnaires used in these member states and thus acquire the experience gained. The questionnaire used by Statistics Sweden (SCB) has been used as model for the questionnaire, which has formed the basis for the Danish interviews.

Danish experience Moreover, 2 pilot surveys have been conducted in Denmark over the last ten years. The experience gained from these surveys will be outlined below.

2 Experience from previous surveys conducted in Denmark

2.1 Pilot survey in 1994

Statistics Denmark A pilot survey² was conducted by Statistics Denmark in 1994. The purpose of the survey was to explore the possibilities of collecting reliable data via a questionnaire-based survey.

The same focus on questions compared with today The questionnaire aimed at: Investments (divided into pollution purification, respectively reduction) and current expenditure. However, the questionnaire included both expenditure and revenue for the above-mentioned categories and a number of questions about water and energy consumption, noise reduction, and air emissions and water emissions. The survey covered the period 1992-1993.

557 out of nearly 2,000 enterprises From a population of about 2,000 industrial enterprises (at least 20 employees and a turnover of at least DKK 20 mio.) 30 pct, corresponding to 557 enterprises, was selected for a sample survey. The sample comprised all enterprises in the population with more than 500 employees and all enterprises in the industry 'recycling of waste products' (NACE 37) – also enterprises with less than 20 employees and a turnover less than DKK 20 mio.

Voluntary survey The survey was voluntary, and 2 reminders and additional reminders by phone were necessary to reach a response rate of 55 pct. that included *useful* replies (319 questionnaires). 6 pct. declined to provide any replies, 24 pct. abstained from replying despite reminders, and 14 pct. returned their questionnaires without any replies at all. The reason given for not completing the questionnaire was that the data could not be extracted from their accounting systems.

Highest response rate among medium-sized enterprises A declining response rate was seen in line with an increasing size of the enterprise. For example, 80 pct. of the enterprises providing useful replies had between 20 to 99 employees.

Many enterprises with no environmental investments The most significant reason for the comparatively high response rate among the medium-sized enterprises was due to the circumstance that many replied that no environmental investments were made, neither in 1992 nor in 1993. 80 pct. of the useful questionnaires that were completed, corresponding to 254 enterprises, provided this reply, and this applied primarily to the medium-sized enterprises with 20 to 99 employees.

Most environmental investments are comparatively accounted for by large enterprises An average of 23 pct. of the enterprises, which had completed the questionnaire, had made environmental investments. For enterprises with over 500 employees about 50 pct. of the enterprises, which returned the questionnaire, had made environmental investments. The most important domains for investment were water, followed by the domains of air and waste.

Current environmental expenditure The pilot survey from 1994 also contained questions about current expenditure on (and revenue from) environmental protection. A distinction was made between expenditure/revenue concerning pollution prevention (cleaner technology),

² Working document no. 38 "industriens omkostninger til miljøbeskyttelse" (the manufacturing industry's expenditure on environmental protection. ISBN 87-501-0946-4

purification and other current expenditure/revenue. For each of these 3 categories questions were asked relating to staff costs (salaries), raw and auxiliary materials, energy, external costs and other costs.

Incomplete replies The general assessment of this material was that it was incomplete. Many enterprises reported that it was impossible to extract the data requested from their accounts. The data required for completing the questionnaires were simply not available to the enterprises. According to the enterprises it would therefore be an extremely cost-consuming process – directly or impossible in a meaningful manner- to work through a comprehensive material in order to provide replies.

Consequently, the survey results should be interpreted with caution. 55 pct. of the current expenditure was spent on waste disposal/treatment. The share of staff expenditure (salaries) accounted for 14 pct. and raw and auxiliary materials 13 pct. Savings on staff resources made up 47 pct. of total current revenue. 66 pct. of total current expenditure was derived from investments made in previous years.

2.2 Survey in 2000

Ministry of Finance A survey of the manufacturing industry's expenditure on environmental protection was conducted by the Ministry of Finance in 2000. The purpose of the survey was to contribute to a broad-based assessment of the financial dimension inherent in the environmental policy³.

Sample survey and response rate Questionnaires were mailed to 503 enterprises. 103 questionnaires, corresponding to 21 pct., were returned following a number of reminders and contact by phone. About 20 pct. of the enterprises questioned did not want to participate, stating that their environmental costs were small or non-existent. About 50 pct. of the enterprises did not want to participate for other reasons, and it was impossible to get into contact with 11 pct. of the enterprises.

Broad-based focus on investments and operating economy The questionnaire contained questions relating to environmentally related investments (before grants) in 1999, 1998 and over the period 1992-1997. There were 6 categories comprising: air, energy, water, waste, noise and other. Similarly, there were also questions relating to grants for environmental investments. Moreover, there were questions relating to both environmentally related current expenditure and current revenue for 1999, which were divided into salaries, operating and maintenance, purchases of external assistance and other costs.

The material also covered questions about other related subjects The questionnaire also comprised a number of questions about the manufacturing industry's environmental management, changes in consumption of resources per unit produced, strategic and competitive effects and changes in turnover as a result of the environmental work carried out by the enterprises.

Very low response rate According to the Ministry of Finance the response rate of the survey was so low and the quality so poor that the data were not used (only stated with several reservations on one single page) in the mentioned publication, dealing with the financial dimension in the environmental policy.

³ Miljøpolitikens økonomiske fordele og omkostninger, Finansministeriet, Februar 2001 (Economic advantages and costs of the environmental policy, Danish Ministry of Finance, February 2001)

2.3 Evaluation of earlier Danish surveys

An overriding problem: Low response rate

The response rate seems to be the greatest statistical problem associated with the 2 recent Danish surveys. Both surveys were voluntary. It is not surprising that a central problem then is to ensure an acceptable response rate seen from a statistical point of view. It is also highly desirable to reduce the number of dubious "zero-respondents": A large number of respondents replying "zero" *may* indicate that the respondents "take the line of least resistance", if the questionnaire is, for example, difficult or resource-consuming to complete.

3 possible explanations

There are three factors that are particularly critical:

1. The questionnaires are not thoroughly prepared.
2. The instructions are difficult to obtain or are directly incomplete.
3. The questionnaires contain questions that are beyond a narrow environmentally economic horizon.

Re 1): The graphical design of both questionnaires was very simple, especially the last survey conducted by the Ministry of Finance.

There is a risk that a simple graphical design signals that only little time and few efforts have been used for preparing the questionnaire. And a frequent result of this is that the respondents do not want to spend too much time and energy on completing the questionnaire. The experience gained in Sweden seems to indicate that it is worthwhile to use some resources on the graphical layout and design.

The 1994 questionnaire prepared by Statistics Denmark contained too many variables. The questionnaire contained over 200 cells/"questions" when looking at one of the pages in the material: 5 groups of expenditure classes (cleaner technological investment, current expenditure for purification measures, etc.), 4-5 financial categories (salaries, energy, etc.), 4 environmental domains (noise, water, air, waste) and two years (1992 and 1993). Against this background, the questionnaire appeared to be highly compact and impracticable.

Re 2): For the first survey conducted by Statistics Denmark 4 pages of introductory instructions were prepared. There were no instructions in the questionnaire itself. This implied that the respondents had to read and understand the instructions *or* leaf from questions to instructions, back and forth, which is both inexpedient solutions. The instructions also comprised compact text section without any form of graphical layout, thereby presenting the instructions as unintelligible and not well-arranged. Conversely, the Ministry of Finance achieved a relatively better result by spreading the instructions to the relevant places throughout the questionnaire.

Re 3): The questionnaires contain a heterogeneous number of questions, which should be duly directed at widely different groups of people/functions in each individual enterprise. Questions about investments and operating budgets are traditionally dealt with by the accounts departments or finance departments in the enterprises. Whereas, questions about emissions and environmental performance will be dealt with by the technical department/environmental management. When the target group is not clearly defined (or there are two simultaneous target groups), there is a general tendency for the language and concepts to become imprecise (populistic) or unintelligible (technical) for one or the other target group. In connection with, especially, formulation of the instructions it is inexpedient to have two different target groups at the same time. This may also cause logistic problems in each individual enterprise, and there is a risk that all questions will be answered by one

department/by one target group, whereby it must be assumed that the data quality will decline concurrently with an increase in the sources of error.

Statistics Denmark's questionnaire comprised detailed questions about the physical environmental improvements as well as questions about environmental investments and current expenditure. The questionnaire of the Ministry of Finance contained several questions directed at the environmental management, its importance to the enterprise both inwardly and outwardly, changes in consumption of resources per unit produced, etc. There were also questions about environmental investments and current expenditure. The mixture of heterogeneous questions – each with its own target group – presumably reduced the possibility of obtaining (good) replies to the questions relating to environmental expenditure.

2.4 Conclusion

*A carefully prepared
questionnaire increases the
response rate*

There is a certain probability that the response rate and thereby the data quality would increase substantially, provided that more efforts were made to carefully prepare the questionnaire – especially, as regards the graphical presentation and the part played by the instructions in this context. Brief instructions providing an overview and questions aiming at obtaining the most essential replies are preferable ("need-to-know" as opposed to "nice-to-know").

However, this did not remove the basic problem that in many enterprises the data requested were not available in a form, allowing the enterprises to extract the data, without involving considerable costs to the enterprises.

3 Feedback from the enterprises

In the following section, a brief description of the survey is presented, followed by feedback from the enterprises, which is the result of the interviews with the Danish industrialists. Only the *main impressions* of the numerous inputs, comments, etc. that have been made, are incorporated into the present report.

3.1 Survey design

Selection of industries was made in collaboration with the Confederation of Danish Industries

Initially, the Confederation of Danish Industries was contacted and joint efforts were made to select a number of major Danish industries in different parts of Denmark. A characteristic feature of these industries was that they were all producing environmental statistics in a visionary manner. Against this background, we decided that they were able to contribute with relevant ideas and qualified inputs for discussing the problems involved in this type of statistics and what possible solutions were available.

A number of industries were added

Further industries were selected, so that the number was considered adequate to provide a picture of the issue, without necessarily being representative. These industries were selected from a geographic point of view (so that more interviews could be conducted in the same part of Denmark in one day).

Telephone call, briefing and selection of form

All industries were contacted by phone, and a relevant sparring partner was identified. Contact was typically made to the environmental manager or (in the case of medium-sized enterprises) the factory manager. They were informed of the project and its background (that Statistics Denmark assumed to see a future European demand for statistics). The persons who participated in the project were then presented with two possible forms of interview: Prepared or unprepared interview.

- Unprepared interview, i.e. questionnaire and an information letter (and in some cases Eurostat's draft for definitions⁴) were mailed, so that they were able to prepare themselves – may try to test/complete the questionnaire prior to the interview.
- Prepared interview, i.e. the material was not presented before the interviewee until the interview was to be conducted.

Each form has its own strength. The number of prepared and unprepared interviews that were conducted, were almost equal. Several persons from the enterprise in question were present during most interviews. They were typically persons from the environmental management and accountants/controllers. There were even 4-5 persons present during some interviews, among these were persons from the production department. This resulted in fruitful and substantial discussions, and many discussions of issues, etc. were influenced by the inclusion of concrete examples from everyday life.

Focused group-interview

Moreover, a so-called focused group-interview was planned and conducted in collaboration with Green Network in the county of Vejle, where a number of environmentalists from different industries in the region participated. This enabled

⁴ Doc. ENV-EXP/TF-IDC/01/2: "Definitions and guidelines for measurement and reporting of environmental protection expenditure, revenues and related matters. Draft final version"

a different form of opportunity by conducting a dialogue between the interviewees, and then take note of the exchange of views and experience.

Current changes to the questionnaire

During the process of interviewing the enterprises from 15 January to 21 February 2002 the questionnaire was changed twice as a result of inputs and criticism put forward by the manufacturing industry.

Possible bias: Large enterprises are over-represented

The majority of enterprises included in the interview-based survey are large enterprises. Only few enterprises had under 100 employees and some had over several thousand employees. It must be anticipated that all enterprises of a certain size (over 500) will be covered by a future sample survey, if it is decided that statistics relating to this domain are to be compiled from questionnaire-based data. Against this background, it is therefore important to be particularly aware of this part of the manufacturing industry. One reason for this is that some of the most important problems in the environmental domain is associated with collection of knowledge and logistics of knowledge, and it must be anticipated as such to be more generally available from the major industrial enterprises. Attention should be paid to the possible bias that occurs when interviews of the smallest enterprises (20-50 employees) have not been conducted. The interest organisation the Confederation of Danish Industries has declared that the task of reporting the requested data on environmental investments and expenditure related to the operation, will constitute a heavy burden on all business enterprises. The reason for this is that the information is not available from the systems operated by the business enterprises. Consequently, this will call for the establishment of new registration systems. However, it will, after all, be a difficult task to calculate the environmental element inherent in an investment, due to the fact that it is an integrated part of the investment.

Even for large business enterprises, which already give high priority to the environmental issue, the reporting of such information will be difficult; see the preliminary work to the survey conducted by the Ministry of Finance. While the production director of a medium-sized business enterprise may possess the overall information on investments made by the enterprise and have an idea of which of these has an inherent environmental element, the environment group director, on the other hand, does not possess data on investments made by the different branches of the group, and direct knowledge of whether, or to which extent, the investment can be considered as environmentally related.

3.2 General delimitation (purpose vs. impact)

No primary environmental purposes in addition to legislation

It was appeared from the interviews that there was some uncertainty as to the understanding of Eurostat's recommendations that only expenditure whose *primary purpose is environmental protection*⁵ is to be included:

Definition of environmental protection activities: (8) Environmental protection is an action or activity which involves the use of equipment, labour, manufacturing techniques and practices, information networks or products where the main purpose is to collect, treat, reduce, prevent, or eliminate pollutants and pollution or any other degradation of the environment resulting from the operating activity of the company.

The same element is present in the Commission's recommendations for definitions of the domain⁶:

⁵ Doc. ENV-EXP/TF-IDC/01/2: "Definitions and guidelines for measurement and reporting of environmental protection expenditure, revenues and related matters. Draft final version", page 6. My underlining.

Environmental expenditure includes the costs of steps taken by an undertaking or on its behalf by others to prevent, reduce or repair damage to the environment which results from its operating activities. These costs include, amongst others, the disposal and avoidance of waste, the protection of soil and of surface and ground water, the protection of clean air and climate, noise reduction, and the protection of bio-diversity and landscape. Only additional identifiable costs that are primarily intended to prevent, reduce or repair damage to the environment should be included. Costs that may influence favourably the environment but whose primary purpose is to respond to other needs, for instance increase profitability, health and safety at the workplace, safe use of the company's products or production efficiency, should be excluded. Where it is not possible to isolate separately the amount of the additional costs from other costs in which it may be integrated, it can be estimated in so far as the resulting amount fulfils the condition to be primarily intended to prevent, reduce or repair damage to the environment.

*Nobody understands
"primary purpose"*

This wording has not in any way conveyed any fruitful understanding, let alone operational guidelines for selection/rejection of expenditure items and investments. Practically all business representatives who were interviewed held the view that environmental protection will never *on its own* become a target for an enterprise.

*All investments are
profitable*

The interviewees frequently indicated that "environment is a good argument" for making investments that would otherwise have been regarded as dubious. Such investments could cover investments taking 4-5 years until they are repaid – or where it was difficult to assess, e.g the impact of an improved image. In such cases it may prove decisive that obvious environmental advantages can be documented by the investment project. However, there has been a general attitude that investments are *only* made if they are recovered within a few years – the environment or not. Viewed from this perspective, the only expenditure whose *primary purpose* is environmental protection is the expenditure that the enterprises is obliged to make as a consequence of legislation or demands put forward by the public authorities. And even then the Danish regulative legislation on the environment will counterbalance environmental and economic interests due to a principle of proportionality - implemented in the legislation, between economic and environmental consideration.. Consequently, the environment will always embrace an economic element. In this perspective the environment will never become a (*sole*) *primary purpose* – not more than one among several coordinated goals.

*The environment and the
economy are not
necessarily oppsites of each
other*

It has frequently been asserted that investments are never made in environment protection equipment unless they are recovered within a few years (excluded are investments as a consequence of public demands or legal orders). However, there has, at the same, been a widespread attitude that many profitable environmental projects and environmental investments are undertaken. The environment has not been the *primary purpose* of these as long as they are profitable - the environment is rather a form of initiating factor. Several of the interviewees have pointed out that Eurostat's terminology appears to be "pre-Brundtlandish" as it seems to insinuate that there is a necessary opposite between the economy and the environment. In many of the enterprises interviewed, the experience was *not*, that such an necessary opposite relation between economy and environment existed. The *primary purpose* of investment projects, which are clearly regarded as investments projects by the enterprises, may easily be to increase turnover.

⁶ Doc. ACCT-EXP/01/4.2 Room Document: "Draft Commission Recommendation on the recognition, measurement and disclosure of environmental issues in the annual accounts and annual reports of companies", page 10. My underlining.

At the beginning "the environment" can be the purpose, but is during the process transformed into economy!

The discussion focused on an unclarified element in the present recommendations; i.e. that the purpose of an investment project need not be the same from beginning to end. The typical procedure in especially the environmental domain is that when the environmental department (from an environmental purpose) wants to carry through investments for decision, the department *has* to put forward rational economic arguments before the management of the enterprise when the project is gradually materialized. In this way the original purposes (the environment) are transformed during the decision-making procedure into a rational purpose for the operating economy.

The environmental idea proves to have economic potentials

In other words: possible improvements (environmental performance) may be identified by the environmental department during a review of the (environmental) technology of the enterprise. Subsequently, an assessment of which investments are economically sustainable is undertaken in collaboration with the management. A choice is made among the different (more or less necessary) environmental improvements – those which are most profitable will be realized.

The environment can be a central element of the decision-making process, but need not be the primary purpose

A paradox of the present recommendations seems to have been unveiled by the interviews. However, a practicable solution has been pointed out. In the jargon of "business language" this implies that if there are any environmental considerations as (central) inherent elements of the decision-making process, the investments are regarded as environmental investments. The same applies to projects that were implemented with the intention to improve the environmental performance. Conversely, projects that are implemented where the environment was not mentioned in the investment material or was not mentioned during the discussions, are not environmental investments, *although* it later proves that there is a highly favourable environmental impact.

The environment is the prime mover. The environment is rarely the actual (final) argument

This will imply that profitable investments (that may be projected regardless of the enterprises' environmental considerations) will be covered by the statistics *provided that* environmental considerations caused them to be realized and/or carried forward. This is not tantamount to "primary purposes" in Eurostat's recommendations. There is also a tension inherent in this consideration concerning "initiation" - but there is not necessarily an antagonism - between "comparison with the normal operating activity" criterion⁷:

Definition of environmental protection activities: (10) The environmental purpose criterion should be applied through comparison with the normal operating activity of the company; i.e. actions and activities beneficial to the environment which would have been taken regardless of environmental protection considerations are not considered as environmental protection activities.

This criterion aims to exclude investments, which would have been made regardless of the environmental considerations by the enterprises. However, insofar as it is, in actual fact, environmental considerations that initiate or carry forward a project, the reasons (e.g. increased earnings) for the ultimate approval of a project are of no significance according to the interviewees. The view of the enterprises has been that no (important) decisions are made without having taken the environmental element into account – and at the same time: No decisions are outside the scope of what is regarded by the enterprises as "normal operating activity" (i.e. the profitability criterion), the environment or not.

⁷ Doc. ENV-EXP/TF-IDC/01/2: "Definitions and guidelines for measurement and reporting of environmental protection expenditure, revenues and related matters. Draft final version", page 6. My underlining.

The environmental impact alone is insufficient

The present Eurostat recommendations state in addition to "primary purpose" also **purpose contrary to effect**⁸:

Definition of environmental protection activities: (9) There are a large number of actions and activities which may have a favourable effect on the environment. The environmental purpose criterion is used as a screening device to filter out the actions and activities whose expenditures should not be reported as environmental protection expenditures.

This means that investments may have an (favourable) effect on the environment without (necessarily) having an environmental purpose. It appeared from the interviews that "effect without purpose" could be used as *exclusion mechanism*. Viewed in this context, all projects embracing (significant) environmental *purposes* become environmental projects. And only the projects, which have been implemented without any environmental purposes, but where it later proves that they had an effect on the environment, will quite correctly be rejected.

Retrospective analysis: Purpose? Or merely effect?

This can be regarded as a retrospective "method" as long as an assessment of whether an investment is an environmental investment, is based on a retrospective analysis of the decision-making process – the investment is regarded as an environmental investment if the environment is emphasized as purpose and not an environmental investment if it proves to be an effect only. An investment cannot later be "nominated" as an environmental investment because it proves to have a positive effect on the environment.

Is environmental function tantamount to initiating or leading environmental purpose?

However, Eurostat's recommendations do stress the environment as a function rather than a purpose⁹:

Definition of environmental protection activities: (11) The environmental purpose criterion should be applied in connection to the function of the implemented measure so that all actions and activities (and parts thereof in the case of "integrated" solutions) should be included, where the primary function is environmental protection, regardless whether the ultimate objective for the company is to stay in business by responding to environmental legislation, to meet expectations of customers, to increase market shares or improve company image etc.

Difficult definition

In the context of the interviews, it was not that easy to clarify/explain this distinction. The point is more or less that the environment may be a primary purpose regardless of the fact that the primary purpose (ultimately speaking) is to increase profits. Nevertheless, against the background of the interviews it is my view that insofar as "function" involves intentionality and thereby explicit purposes, the above distinction between purpose gradually as opposed to the final – primary – purpose as expressed in the last-mentioned quotation is expendable: An investment whose *function* is to reduce the environmental effect will have the environment as purpose, although it is primarily *undertaken* (ultimately speaking: only) on the basis of a rationality with respect to operating economy.

⁸ Doc. ENV-EXP/TF-IDC/01/2: "Definitions and guidelines for measurement and reporting of environmental protection expenditure, revenues and related matters. Draft final version", page 6.

⁹ Doc. ENV-EXP/TF-IDC/01/2: "Definitions and guidelines for measurement and reporting of environmental protection expenditure, revenues and related matters. Draft final version", page 6. My underlining.

3.3 The environmental share of integrated technologies (Estimates and cleaner technology)

Enterprises call for instructions, but also have doubts about their value

How is the scope of environmental protection assessed by the enterprises in a large-scale solution. A great number of the interviewees indicated that assessing the environmental share of integrated technological solutions (cleaner technology) was an extremely difficult exercise. In this context, they called for concrete instructions/methods. Simultaneously, they also doubted whether it was possible to prepare such instructions. All interviewees held the view that in all circumstances such instructions would inherently be far too long and complicated.

Coordination between the accounts department and the environmental department

Several of the interviewees – especially those from the large enterprises – also expressed their concern about the problems of having to coordinate the completion of a questionnaire, containing this type of questions among a great number of persons. Consequently, it may constitute a concrete problem that accountants – having information about the enterprise's investments – are to collect assessments of environmental shares from, e.g. the environmental department or from technicians situated at different places of production. This will result in a considerable increase of the response burden.

Markings and short comments require estimates

In the questionnaire presented to the interviewees, this discussion was countered by pointing out that estimates would suffice – and by designing the questionnaire in a manner, implying that estimates were required (this results in a simultaneous reduction of the response burden). The two most important elements are:

- The enterprises mark with an X which environmental domains they think the investment is aimed at.
- There is only little space intended for the enterprises to give a description of the investments.

The idea was that the questionnaire would thereby directly illustrate the rough character of the data. This strategy seems to hit the bull's eye. The enterprises participating in the interviews felt they were encouraged to – or felt they were permitted – to give rough "thumb" estimates in cases where it was otherwise difficult to assess the environmental share of an integrated investment.

Assessment of the environmental share is best undertaken by the enterprises

Several of the interviewees stated that the marking with an X instead of, e.g. indication of a percentage, tends to encourage to undertake estimates. The main conclusion was that the interviewees feel they are qualified to indicate rough estimates of the environmental share of integrated solutions as long as the instructions with/and questionnaire encourage the enterprises to undertake estimates. It may be necessary to use estimates in the statistics, but a number of uncertainties are inherent in the estimates, which must be taken into account, when/if the final statistics are to be compiled.

The questionnaire distinguishes purification technologies and integrated technologies

In the questionnaire presented to the interviewees, each investment was to be indicated either as an investment in purification equipment or as an investment in cleaner technology. It has been suggested that the two types of investment are distinguished (both with respect to investments and operation). The purpose were to clarify the delimitation (in the present situation some enterprises mark with an X both types of investment regardless of the fact that it says "only" one X), and to render visible the circumstance that the certainty of the data is typically higher with respect to purification than in the domain of cleaner technology, where estimates of a percentage share are undertaken.

Investments for product improvement

Criticism was raised against Eurostat's guidelines that expenditure on improving the environmental performance of products was not be included. Several

enterprises held the view that this item was a great significance – and there was a clear desire to being able to disclose (the size of) these investments. Due to the circumstance that for the time being there is no efficient manner in which to capture this expenditure "from the consumers", these enterprises considered it to be of greater importance that (separate) questions relating to this domain were included in the questionnaire. These questions were presumably also to cover increased costs of operation and maintenance and increased costs of materials, etc.

3.4 Sub-systems in the profit and loss accounts (registration of current expenditure)

Large differences among the enterprises' entry systems

The most significant practical problem left was to register the costs of operation and maintenance in the environmental domain. There were great variations in the extent of this problem from enterprise to enterprise. There appears to be no relationship between neither industry nor extent. Few enterprises have designed their profit and loss accounts in a way so that few adjustments are necessary to extract the data requested. However, the majority of enterprises anticipated that new "satellite systems" had to be constructed or the existing systems had to be totally renewed. For the last-mentioned enterprises, comprehensive and resource-intensive efforts will typically be necessary.

The enterprises have come up with good ideas

The feedback from the enterprises and the discussions with, particularly the Swedish statisticians in the domain, resulted in a further development of the questionnaire. The essence of this development was that operation and maintenance costs for purification measures and for direct environmental plants would be separately distinguished. The reason for this distinction is that the data quality in this domain will probably be higher. For the same reason, expenditure on general environmental management, including certification, etc. is separately distinguished. What is left is (environmental share of) expenditure on operation and maintenance of cleaner technology and other integrated/general solutions – it must be anticipated that the least valid data (most estimations) will appear here. Consequently, it seems fruitful to isolate this category.

It is OK to distinguish between own expenditure and purchase of services

Common to the part of the questionnaire material concerning operation and maintenance is that there is a distinction between own expenditure vs. purchase of services. This distinction does not seem to cause any major problems.

4 Conclusion

Problematic and costly There are no doubts that conducting a comprehensive and adequate collection of data on environmental protection expenditure for the manufacturing industry is a problematic and cost consuming exercise. Difficulties are particularly caused by "total current expenditure", but also, to some extent, "integrated technologies", and this will imply that the enterprises will have to allocate time and resources before they are able to complete the questionnaires in an adequate and satisfactory manner.

Considerable statistical uncertainty The overall impression is that the statistical data will contain a substantial element of subjective estimates, thus implying that the statistical results will be difficult – or directly impossible to – use in the context of a theoretical economic framework.

Focus on layout and guidelines The survey – and especially the previous experience – emphasizes the importance of carefully prepared and "attractive" questionnaires. Particularly when voluntary surveys are conducted. The general attitude is that guidelines should be included in the material itself and be kept to an absolute minimum. The test questionnaire used in this survey embracing 1 page with an introduction and 2-3 text sections of guidelines for each variable were well received and seemed to be sufficient.

Focus on jargon, conceptualization and distinction of variables The predominant problem is to operationalize the concepts in the questionnaire, enabling the enterprises to report data in a reasonable easy manner (and in continuation of this the question of how design and layout, etc. of the questionnaire are underpinning this).

It has been pointed out by the survey that it is possible to reduce the response burden (and improve substantially the data quality), provided that resources are initially allocate for designing the questionnaire, so that its conceptualization and variables match the enterprises' self-knowledge. Particularly the discussion of "the primary purpose" and the distinction between the different types of operation costs seem to give rise to concrete considerations:

Primary purpose It was concluded with respect to "the primary purpose" that the statistics will have to cover all investments and operational actions which deliberately aim at improving the environment – regardless of the underlying rationale of the decision. The only thing thus sorted out from the statistics is the investments which after the decision has been made about them are "retrieved" as environmentally friendly (post-rationalization). There is no practicable, intelligible "middle course" between environmental investments as a result of coercion (demands by public authorities) and profitable investments aiming deliberately at attaining an environmental effect (environmental investments without the environment as *primary* purpose). In other words: there is no voluntary excess investment – neither an easy method for sorting out among highly profitable and less profitable environmental investments. Simultaneously, there is an unwillingness in the industries to distinguish too fiercely between profitability and environmental purpose as it may be perceived as being artificial and not related to the enterprises' everyday life.

Operation and maintenance The general impression with respect to "total current expenditure" was that if it was explicitly stated that the data were given as estimates, it would ease the task considerably. Furthermore, it would be advantageous to ask direct questions about operation and maintenance of actual environmental plants, purification technologies and waste disposal. This outright jargon becomes simultaneously instructive and demystifying. To this can be added that questions are subsequently

asked about general environmental current expenditure (environmental management, certification, etc.) and about further environmental current expenditure (e.g. operation and maintenance of the environmental share of cleaner technology). However, the use of estimates gives rise to margins of uncertainty in the statistical results.

*Environmental share of
integrated solutions*

It was concluded with regard to "integrated investments" that it was important for the questionnaire to give the impression that rough estimates of the environmental share of integrated and/ or cleaner technologies were acceptable.

5 Annex

The following persons have contributed to the project with their experience, insight, inspiration, critical questions, etc.

Organisations and public authorities

<i>CDI</i>	Helle Juhler-Kristoffersen, Confederation of Danish Industries.
<i>Statistical institutions</i>	Peter Fränngård, Statistisk Central Bureau (SCB), Sweden. Jaap van Reisen, Statistisk Bureau (SB), The Netherlands. Poul Erik Olesen, Statistics Denmark (DST) Sven Egmos, Statistics Denmark (DST) Preben Etwil, Statistics Denmark (DST)
<i>Horsens Kommune</i>	Tage Sønderby, Municipality of Horsens.
<i>Vejle amt</i>	Peter Nissen, Head of Division, Industrial Division, County of Vejle. Erik Ørskov, Green Network-Secretariat, County of Vejle. Dorthe Bramsen Clausen, Green Network-Secretariat, County of Vejle.

All enterprises below participated in the interviews

<i>Brenntag</i>	Jørgen Bæk, Production director, Brenntag Nordic
<i>Tuborg</i>	Jørgen Frederiksen, Tuborg
<i>Cerealia Unibake</i>	Lone Rossing, Cerealia Unibake
<i>LEO Animal Health</i>	Lise Hansen, LEO Animal Health
<i>Dong Naturgas</i>	Poul Kruse, Dong Naturgas
<i>Panther Plast</i>	Niels Martin Lundsgaard, Works Manager, Panther Plast Asger Rasmussen, Environment consultant, Panther Plast
<i>Danisco Sugar</i>	Erik Knudsen, Senior engineer, Danisco Sugar Søren Hjuler Vogelsang, Vice president, Danisco Sugar Per Feddersen, Business Controller, Danisco Sugar
<i>Junckers Industries</i>	Jørgen K. Jensen, Controller, Junckers Industries Charlotte Bregenholdt, Environmental Manager, Junckers Industries
<i>Danfoss</i>	Poul Dyhr-Mikkelsen, Vice president, Danfoss Keld Stærke, Business unit director, Danfoss Malene Østergaard, Environment Manager, Danfoss Hans Eskildsen, Danfoss (og formand for Green Network)
<i>Sauer Danfoss</i>	Egon Hansen, Quality & Environment director, Sauer Danfoss Tom Andersen, Economy director, Sauer Danfoss
<i>Saint-Gobain Isover</i>	Jeanette Hounsgaard, Human relation manager, Saint-Gobain Isover
<i>LEGO</i>	Aage Hillersborg, Environment director, LEGO Jesper Jensen, Environment management, LEGO
<i>Dynamate</i>	Pia Vissing Jensen, Quality and environment coordination, Dynamate
<i>Trevira Neckelman</i>	Palle Nelleborg, Environmental Director, Trevira Neckelman
<i>Novo nordisk</i>	Henrik Tribner, Controller, Novo nordisk Jens H. Jørgensen, Vice President, Novo nordisk Johnny Henriksen, Env. Specialist, Stakeholder relations, Novo nordisk
<i>SAS</i>	Martin Porsgaard, Env. coordination, SAS
<i>Bdr. Hartman</i>	Thomas Schou Winther, Koncern Miljøkoordinator, Bdr. Hartmann
<i>Coloplast</i>	Jørgen Ravn, Koncern Mil. chef., Coloplast Caroline Jessen, Env. coordinator, Coloplast

<i>Rockwool</i>	Peter Bredsten, Vicepræsident, Rockwool Poul Gunnar Larsøe, Techn. director, Rockwool Elin Lambertsen, Env. coordinator, Rockwool Svend Vitek, Prod. controller, Rockwool
<i>Aalborg Portland</i>	Preben Andersen, Env. Director, Aalborg Portland Henrik Lund Jensen, Controller, Aalborg Portland
<i>Vestas Wind Systems</i>	Hans-Ulrich Thornberg, Env. director, Vestas Wind Systems Stefan Wulf, Accountant, Vestas Wind Systems Karsten Jensen, Quality and environment, Vestas Wind Systems

Covering letter for Questionnaire

Data collection

A questionnaire-based survey of selected Danish industrial enterprises is conducted by Statistics Denmark. The purpose of the survey is to gain insight into environmental protection expenditure for the manufacturing industry.

Delimitation

NO EXPENDITURE ON THE WORKING ENVIRONMENT.

The enclosed questionnaire is exclusively aimed at the external environment. Consequently, all investments and current expenditure relating to the working environment are to be **excluded** from the statistical data.

ONLY THE PRODUCTION NOT THE PRODUCT.

Only expenditure on reducing the environmental impact on the *production* is to be included. Expenditure aiming at reducing the environmental impact on the *product*, e.g. reducing the impact on the environment by usage or scrapping of the product, is to be **excluded**.

ENVIRONMENTAL PURPOSES RATHER THAN ENVIRONMENTAL EFFECT.

With respect to investments, we only want to capture those investments whose *explicit* purpose was to improve the environmental performance. Investments made for other reasons, but which have subsequently proved to be a good solution for the environment, are to be **excluded**!

ESTIMATE THE ENVIRONMENTAL SHARE IF THERE ARE SEVERAL PURPOSES.

If an investment had several purposes, which is typically the case in conjunction with cleaner technology solutions, then the *environmental share* of the investment project is to be estimated. Only the environmental share of the investment is to be calculated!

ONLY EXPENDITURE INCURRED IN DENMARK.

The survey is restricted to the national factories and production facilities. For major corporate groups and the like, whose production is located abroad, only expenditure incurred in Denmark is to be included.

Why?

What are the costs to society to take care of the environment? The environment is on the agenda in the debating of current concerns in society. When solutions to environmental problems are to be found, areas in which it will be most effective and financially expedient to take initiatives, are frequently debated.

One of the most predominant problems in these debates are the lack of sufficient national data relating to environmental protection expenditure for the manufacturing industry.

What were, e.g. the costs on investments of the entire manufacturing industry, when CO₂ taxes were imposed on the industries in the mid-1990's? What are the costs on the manufacturing industry if taxes were to be increased? By how much will current expenditure increase if the demands on sewage treatment were tightened? Which industries account for the highest investments in, e.g. air control? Sound and reliable primary statistical data will be instrumental in answering such questions.

Contact

If you have any questions to the above-mentioned or the enclosed questionnaire, you are very welcome to contact the undersigned.

QUESTIONNAIRE: Environmental protection expenditure for the manufacturing industry in 2001

The following is at rough abstract of the Danish draft questionnaire presented to the manufacturing industry during the pilot survey.

The questionnaire changed slightly during the consultation proces. The form presented here equals the final draft. The layout is much simplified, in order to fit the Microsoft word format.

5.1.1.1 Environment Expenditure 2001

How much money does the Danish manufacturing industry spend on reducing the environmental damage caused by their production? Do they spend more or less than they did five years ago? Which industries account for the highest investments?

Such questions are difficult to answer, since there are no valid statistical data on the subject. And still the answers have great relevance if the environmental effort is to be optimized and targeted.

The following questionnaire contains questions on the manufacturing industry's expenditure on environmental protection. That is: Expenditure on schemes that aim at reducing the different types of pressure on the environment, eg. reduction of emissions to air and water, waste treatment and -deposition, noise control etc.

In the questionnaire there is a distinction between

- A) investment, and
- B) Current expenditure

In A) investment there is a fundamental split between investment in *pollution treatment* and investment in *pollution prevention* - as sketched below:

In B) there is a fundamental split between *internal expenditure* and *purchased services*

1: Pollution treatment investments

The distinguishing feature of pollution treatment investments is that they do not affect the production process itself. They consist of distinct, identifiable components supplementing the equipment used in production. Their purpose is to take care of and to treat the impact on the environment caused by the activities of the enterprise, to prevent the spread of and measure the level of pollution.

Examples in different environmental domains

5.1.1.1 Air

Different types of filters, scrubbers, cyclones, centrifuges, etc.

Coolers and condensers to treat process gases
Equipment for thermal and catalytic combustion of process gases and other measures involving combustion technology

Measures to restrict dust problems in connection with transport and storage
Measurement equipment

5.1.1.2 Water

All investments in own wastewater treatment plants
Dams and tanks for storage of wastewater
Oil separators, sedimentation basins, neutralisation basins, etc.
Taking care of and treating sludge
Costs associated with connection to municipal wastewater treatment plants
Measurement equipment

Waste

Equipment for own storage and transport, e.g. special vehicles, containers, transshipment stations, sorting equipment
Equipment for own treatment, e.g. compressors and all investments in own landfill

5.1.1.3 Other

Noise pollution: different materials and measures to reduce noise pollution, e.g. enclosure of equipment, sound-proofing, noise barriers, etc.
Soil and groundwater: soil decontamination and protection of soil and groundwater from pollutants, e.g. by building embankments, firming surfaces, covering over landfills, etc.
Landscape and biodiversity: measures to protect biotopes and natural areas, e.g. wetlands, streams, stone walls, pastures and meadows. Preservation of landscape. Examples include purchasing land and burying electrical cables
Compressors for lower energy consumption, flue gas recycling ventilation, processed air recycling

2: Pollution prevention investments

Pollution prevention investments affect the production process itself. They are often specific to the particular enterprise or industry but the following characteristics apply:

- they reduce emissions and discharges generated by the production process itself
- they make it possible to use production inputs that have less of an impact on the environment
- they involve completely new equipment and processes that have less of an impact on the environment.

These investments can be made for various reasons. If the main purpose of the investment is to reduce the environmental impact, you should report the whole amount invested. Often the equipment is fully integrated in the production process and/or cannot be identified as a distinct component. In this case, you should report the estimated share of the total investment that is due to the choice of more environmentally friendly technology (the "extra cost").

Examples in different environmental domains

5.1.1.4 Air

Closed production processes, re-circulation of process gases
Measures involving combustion technology, control systems and optimisation of operations
Measures involved in switching to less polluting raw materials and fuels, e.g. water-based products, substitutes for fossil fuels
Replacement of coolants
Encapsulation of equipment
Control of chemical use, including use of precise amounts

5.1.1.5 Water

Closed water systems, closed cooling systems, re-circulation of process water
Measures involved in switching to less polluting production inputs
Reduced discharges achieved e.g. by control equipment and programmes for reduced and more efficient water use and reduced losses of solid substances
Maximisation of water circulation
Countercurrent rinsing
Multi-stage feeding of chemicals

5.1.1.6 Waste

Increased recovery, use of recovered materials in production processes
Reduced use of raw materials, utilisation of waste
Switch to less polluting production inputs to make waste less hazardous

5.1.1.7 Other

Noise pollution: low-noise machinery
Soil and groundwater: measures involved in switching to less polluting production inputs

A. Environmental Investments in 2001

Larger investments are to be reported in A1 - one investment per row. Minor investments may be summed up, and reported in A2.

If the main purpose with the investment was to reduce the impact on the environment, please report the total amount invested in 2001. If the main purpose wasn't to reduce the impact on the environment, please report the calculated/estimated extra cost connected to the choice of a more environmentally friendly solution.

Mark the investment type with a cross, as *either* preventive *or* treatment - and mark the most important environmental domains. Give a short description of the investment (important!). Definition and examples on investment in 1: prevention versus 2: treatment is given above.

Has the company made any environmental investments in 2001.

- ☐ No -----> go to B. Total Current expenditure
☐ Yes -----> fill in table A1 and table A2 below

A1 larger environmental investments in 2001

- List the large investments. One per row.
- If the main purpose with the investment was to reduce the impact on the environment, please report the total amount invested in 2001.
- If the main purpose wasn't to reduce the impact on the environment, please report the calculated/estimated extra cost connected to the choice of a more environmentally friendly technology.

amount invested i 2002 - in 1000 DKK	Investment type. ONLY cross one type		Cross out the environmental domains, the investment primarily benefits				Give a short description of the investment, eg. term, purpose, cause...
	1: Treatment	2: Prevention	Air	Water	Waste	Other	

A2 Minor environmental investments (not reported in A1) in 2001

- Minor investments may be summed and reported in one line for each investment type.
- Give a short description of the investment.

Investment type.	Amount invested in 2001	Cross out the environmental domains, the investment primarily benefits				Give a short description of the investment, eg. term, purpose, cause...
		Air	Water	Waste	Other	
1: Treatment						
2: Prevention						

B. Total current expenditure in 2001

Here you should report all costs for environmental protection that are not investments. These may be related to existing equipment but they can also be more general. Examples include payments for transport of waste and landfill, operation of purification plants, environmental management and certification, costs for personnel with environmental responsibilities, etc.

For each type of expenditure you should state separately the costs for work by your own enterprise (in-house or internal expenditure) versus payments for purchased services. Please note that personnel costs should also be reported separately.

Capital costs (depreciation), and payments of general environmental taxes should not be reported.

Has the company made any environmentally related current expenditure in 2001.

- ☐ No -----> go to C. Evaluation
☐ Yes -----> fill in table B below

B Current expenditure in 2001
 - all amounts in 1000 DKK

	payments for purchased services. Eg. cost for wastetransport and landfill, payment to env. consultants.	Total internal expenditure. Eg. staff, material, cost of energy used in environment techn.	--- of which ÷	"of which" ÷ Personnel Costs (ONLY internal expenditure)								
1: Operation, maintenance, inspection and control			--- of which ÷	<table border="1"> <thead> <tr> <th>Air</th> <th>Water</th> <th>Waste</th> <th>Other</th> </tr> </thead> <tbody> <tr> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Air	Water	Waste	Other				
Air	Water	Waste	Other									
2: General env. administration, education, information etc.												
3: Research and development												
4: Other												

Instructions:

- 1: Operation, maintenance, inspection and control
 2: General env. administration, education, information etc.
 3: Research and development
 4: Other
 5: Personnel Costs

Costs for personnel, materials, energy used in operations and maintenance of existing plant and general environmental supervision. Inspection fees paid to public authorities should be given under purchased services.
 State here costs for general information, investigation, education and training of own personnel, environmental management and certification, etc. This includes costs for environmental departments, environmental coordinators, etc., that are not specifically related to operations and maintenance or research. Purchased services here can refer to environmental education and training, environmental certification or environmental studies conducted by external agents.
 Total costs for R&D, tests, etc., aimed at reducing the impact of the enterprises operations on the environment. Purchased services here can refer to financing of activities at other enterprises in the group.
 Report here all other current costs for environmental protection, including estimated extra cost of purchasing less polluting, more expensive production inputs and fuels. Soil decontamination included!
 The costs for the enterprises own work on environmental protection reported above include personnel costs. This question asks for a separate statement of these personnel costs, incl. social insurance payments and other peripheral costs.

C. Evaluation

How long time did you approximately use for gathering the information and filling in the tables?
 _____ hours and _____ minutes.

Would you like to receive an electronic version of the statistical document that is to be produced on the basis of these data, then please specify the appropriate e-mail address here: _____