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Uncertainty in Impact Assessment – EIA in Denmark

Abstract

Uncertainty may be viewed as an inescapable part of the exercise of ex ante assessment of impacts of plans, programmes or projects – we do per definition not know the exact impacts before they unfold. Also, there is an increasing focus on integration of impacts such as climate change in impact assessment; impacts that are characterised by uncertainty, and for which uncertainties in general are much discussed. There have been scattered calls from authors suggesting that there is not enough focus on uncertainty in assessment reports. This lack of transparency about the uncertainties is viewed as problematic, as this is important information for decision makers and public actors. Taking point of departure in these issues, this paper seeks to add to the discussions by presenting the results of a study on the handling of uncertainty in Environmental Impact Assessment (EIA) reports in Denmark. The study is based on analysis of 100 EIA reports. The results will shed light on the extent to which uncertainties is addressed in EIA in Denmark and discuss how the practice can be categorised.

Introduction

Uncertainty has been raised as an issue for impact assessment in many instances through the last decades. It has been pointed out that uncertainty is a challenge that needed to be handled in impact assessment. Lee and Walsh (1992, p. 135) argue that *“ensuring that uncertainty is satisfactorily handled in each stage in the assessment process”* would be a main challenge of developing Strategic Environmental Assessment (SEA), and various authors have discussed methodologies and typologies for doing this (e.g. Thissen and Agusdinata 2008; Walker et al. 2003). At the same time authors have questioned whether impact assessment in practice is succeeding in handling uncertainty satisfactorily. Notably, Tennøy, Kværner and Gjerstad (2006) concluded that in a Norwegian context there was a *“lack of both communication of such uncertainty and transparency in the prediction processes”*, which could result in inexpedient decisions and democratic problems.

At the same time, in recent years there has been an increasing focus on integration of impacts such as climate change in impact assessment. This is for example underlined by the publication in 2012 of the IAIA’s Climate Change in Impact Assessment Best Practice Principles (Byer et al. 2012). One of the points that is made about climate change is that *“there is significant uncertainty about the precise nature (degree, timing, etc.) of these changes”* (Byer et al. 2012, p. 3) and that impact assessment should address such uncertainty. Thus an increased focus on complex impacts such as climate change reinforces the focus on uncertainty. Despite this, a study on SEA in Denmark by Larsen, Kørnø and Driscoll (2013, p. 149) concluded that *“SEA practice does not seem to recognise, take into account and communicate problems arising from climate change uncertainty”*. This is based on a study of 151 SEA reports of which only 5 reports address climate change uncertainty, while 87 of them address climate change (Larsen, Kørnø and Driscoll 2013).

On the basis of these issues, this paper seeks to answer three overall questions:

1. How often is climate change uncertainty addressed in EIA in Denmark? And how does this compare to the practice in SEA?
2. How often is uncertainty in general addressed in EIA in Denmark? And how does this compare to how uncertainty specifically connected to climate change is addressed?
3. What are the general main categories of uncertainty found in the EIA reports?

Through these questions, the paper seeks to add to the discussions on handling uncertainty in impact assessment.

Methodology

The paper is based on a document study, where a sample of 100 cases of EIA reports have been gathered and analysed. An overview of the cases is provided in table 1.

Table 1 Overview of EIA cases and publication lapses

Year	1995-2000	2001-2006	2007-2012
Number of cases	4	37	59

As can be seen in table 1, most of the reports are published after 2001, even though earlier reports have actively been sought out. The reason for this may be the way the cases were collected, since they were found through searching the internet, and reports from before 2001 are not often digitalised. In Denmark there are no databases that gather EIA reports, thus the method of searching the internet was chosen.

Another important feature of the reports is the types of projects which they cover. The reports analysed corresponds to different project types as follows (the number in parenthesis is the number of reports in each category):

- Energy (27, 16 on wind turbines)
- Roads (20)
- Agriculture/fishery (17)
- Industry (8)
- Energy infrastructure (6)
- Leisure (6)
- Nature/forestry (5, 1 on forestry)
- Waste/wastewater (5)
- Raw materials (4)
- Retail (2)
- Water supply (2)
- Other (4)

Each EIA report has been searched for the keywords *climate*, *CO2* and *greenhouse gas*. For each occurrence it has been registered whether it addresses uncertainty in relation to climate change, in order to answer question 1. In order to answer question 2, a further analysis has been carried out, where the reports have been searched for the keywords uncertainty, doubt and unknown. It has been registered whether uncertainty is addressed, what the uncertainty is related to and how. Using all the information collected it was possible to answer question 3 by establishing a set of general categories of uncertainty. It should be noted that the study says nothing about the quality or depth of the way uncertainty is addressed.

Results

Looking first at the results for question 1, the study shows that 10% of the reports address uncertainty or limitations in relations to climate change. This is in spite of the fact that 71% of the reports address climate change. Most of the reports address uncertainty in calculations of CO₂ emissions from the project. One report mentions uncertainties in climate change impacts on marine biology, and one report mentions uncertainty about climate change impacts on the hydrological system. Thus, climate change uncertainties are not handled in very many reports. Also, the focus is mainly on uncertainties in relation to what impact the project will have on climate change, and less on uncertainties regarding what impact climate changes will have on the project, the baseline environment and the assessments. Compared with the SEA practice outlined by Larsen, Kjørnø and Driscoll (2013), the pattern seems to be the same, that very few reports address climate change uncertainties. Even though relatively speaking more EIA reports address climate change uncertainty, there is no sign of a systematic inclusion of the issue in EIA practice either.

Turning to question 2, looking at uncertainty in a broader sense than that related to climate change, the picture is different. Here, 85% of the reports addressed uncertainty on some level. 24 of these reports have a specific section in the report dedicated to discussing the uncertainties or limitations of the EIA. When comparing this to the practice around climate change uncertainty, it seems that there is a systematic practice of addressing uncertainty in some areas, but climate change is not one of these.

The issues of uncertainty in the reports vary, some examples are:

- Uncertainty in calculations of noise impacts
- Uncertainty about the exact placement of wind turbines
- Uncertainty about the impact of high voltage cables and electromagnetic radiation on human health
- Uncertainty about the protection status of the otter in Denmark

From these examples and more found in the reports, the next section presents a discussion of question 3 about general categories of uncertainty that are and can be addressed in EIA.

Discussion: Categories of uncertainty in EIA

From the analysis so far, a preliminary set of categories of uncertainty in EIA has been developed. The categories are based on what sources of uncertainty the EIA reports have addressed and indicate that the following are relevant:

1. Uncertainty about the final design of the project or the choice of technology. Also uncertainty about the precise methods and timelines for construction work. For example uncertainty about the specific placements of wind turbines or their size. Or uncertainty about which types of vehicles and routes will be used for transporting building materials.
2. Uncertainty about data used as the basis for calculations, predictions and assessment. For example uncertainty about the registration of species in an area or the traffic data used as a basis for traffic models.

3. Uncertainty of calculations and models. For example uncertainty about the output of traffic models calculating future traffic amounts and modal splits.
4. Uncertainty of what the secondary consequences of the predicted impacts are. For example uncertainty about what consequences a predicted increase in particulate pollution or electromagnetic radiation from power cables will have on human health in the surrounding population.
5. Uncertainty about society's classification of or goals for areas and species as protected, endangered, valuable etc. For example if a species that is legally protected will no longer be so at the start or during the lifetime of a project.
6. Uncertainty about the status of related projects and developments. For example whether or not a large harbour development project will take place in the same area as the project under assessment.

Notably, each one of these categories or sources of uncertainty seem to relate to one of two parts of the assessment process; the prediction of impacts and the assessment of significance. Thus categories 1-3 all encompass uncertainty that would influence what has been termed the identification and prediction of impacts (Glasson, Therivel and Chadwick 2005). This part of the process of EIA according to Glasson, Therivel and Chadwick (2005, p. 5) encompasses identifying all "*potentially significant environmental impacts*" as well as the "*magnitude and other dimensions of identified change in the environment with a project/action, by comparison with the situation without the project/action*". Categories 4-6 on the other hand mainly encompass uncertainty that would influence the evaluation and assessment of significance of the impacts. This is described by Glasson, Therivel and Chadwick (2005, p. 5) as assessing "*the relative significance of the predicted impacts to allow a focus on the main adverse impacts*" and follows after the identification and prediction of impacts. Thus uncertainty has been identified as influencing two separate stages or tasks in the EIA process.

Conclusion

In conclusion climate change uncertainty is rarely addressed in EIA in Denmark, as it is only included in 10% of the reports analysed. This confirms the results found also for the practice of SEA in Denmark. Also, the main issue of climate change uncertainty addressed is the uncertainty of calculations of CO₂ emissions resulting from the project. This corresponds to category 3 in the proposed framework. Looking at how uncertainty in general is addressed in EIA in Denmark, the preliminary analysis suggests a different picture since 85% of the analysed reports address uncertainty. This is contrary to some of the results found by authors in a Norwegian context, where Tennøy, Kværner and Gjerstad (2006) have pointed out problems with the lack of focus on uncertainty in EIA. The question is what this difference in results stems from, for example the different contexts in Denmark and Norway or a development in EIA practice since the first study in 2006. The analysis of uncertainty in EIA has led to proposing a preliminary set of categories of sources of uncertainty in EIA. This framework is as stated preliminary and will have to be developed and tested further.

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