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An Analysis Of The Ecological Footprint

Using Actor-Network Theory And Case Study Research

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Abstract

The aim of this thesis is to investigate the factors hindering and enabling the use of the environmental composite indicator, the Ecological Footprint, in Denmark. In this project, Actor-network theory and case study research will be applied to the empirical material, consisting of five semi-structured interviews and written documents. The case study approach works as a general research strategy, providing a framework and a set of guidelines for the research process. Actor-network theory provides an extensive framework, created to describe contemporary entities in intertwined relation between the social and the natural, such as environmental issues. The distinct ontological and methodological scope of both of the approaches will be explored in the study of environmental issues which have generally been ignored within Sociology. The results suggests a number of factors enabling and hindering use of the Ecological Footprint in settings in Denmark. Finally, the results describes the outcome of the application of each of the approaches in the study of the Ecological Footprint.

Summary

The aim of this thesis is to investigate hindering and enabling factors for use of the environmental composite indicator, the Ecological Footprint, in Denmark. This aim stems from a EU-project, 'Policy influence of indicators', where the overall aim is to "improve indicator influence, by helping to better understand factors that enable and hinder the usefulness of indicators in policymaking". The ontological and methodological scope of Actor-Network theory and case study research will be explored by applying them to the study of scientific projections of the environment. The study shows that the case study approach works as a research strategy, providing a framework and a set of guidelines for the research process. The case study analysis of the Ecological Footprint provides a number of concrete factors hindering and enabling use of the Ecological Footprint. Actor-Network theory provides an extensive framework, created to describe contemporary entities in intertwined relation between the social and the natural, such as environmental issues. In the study of the Ecological Footprint, Actor-Network theory provides interpretations based on its contextual framework, to describe use of the EF.

Keywords

Actor-network theory, Case study research, Ecological Footprint.

Acronyms

ANT : Actor-Network Theory

CO_2 : Carbon Dioxide

CS : Case Study

EF : Ecological Footprint

EI : Environmental Issues

EU : European Union

EUS : Environmental Utilization Space

GFN : Global Footprint Network

LPR : Living Planet Report

MIC : Miljøpunkt Indre by og Christianshavn

NERI : National Environmental Research Institute

NGO : Non-Governmental Organization

POINT : Policy Influence of Indicators

RP : Research Participant

WWF : World Wildlife Fund

Content

1. Introduction

Over the last decades human activity has been increasingly interpreted in terms of threats towards the environment and impacts for future generations. The environment has become an integrated part of political issues and has been termed the biggest challenge of the 21st century. Environmental issues concern the relation between society, ideas, nature and the physical world and thus challenge classical sociological perspectives. Sociology has generally avoided or ignored questions related to the environment. This might be a result of a general move away from future perspectives and a suspicion of naturalistic explanations of social facts (Lever-Tracy 2008, 452).

Traditionally, social science method include tools to approach and extract empirical data in social settings. Over the last decades, methods as well as theories, have developed to create understandings of issues and events within contemporary intertwined relations. The outcome is methodological research designs presenting ontological perspectives. This thesis explores the understanding and potential of two approaches representing each of this trends, namely case study (CS) research (Gerorge & Bennet 2005, Yin 2009, Simon 1969) and Actor-network theory (ANT) (Latour 1987, Callon 1986, Law 2004). The aim of this thesis is to investigate how scientific projections of the environment can be studied sociologically, by applying the two approaches in practise.

The CS research was developed to meet a demand, ignored for decades, criticized by many, openly celebrated by few, but used across social science disciplines to seek insight and understanding of events and phenomenon, processes and contexts (Yin 2009). CS research refers to various approaches, but can generally be described as a holistic, in-depth investigation. CS research is relevant when understanding the phenomenon that is being explored in the context and it is often used to bring out details from the actors viewpoint. It is

often referred to as a method, but it is defined by most contemporary writers as an empirical approach or a research strategy, which can include both quantitative and qualitative methods.

ANT can be said to be a crude alternative to classical social theory. As a modern theory it strives to understand and create knowledge about contemporary entities and processes in a world where technology, knowledge, businesses and society are increasingly intertwined (Latour 1987). It is notoriously known for breaking down the divide between Nature and Society, treating humans and objects as equal by putting them in the same contextual framework. The theory leads to methodological implications, not only for our understanding of what we are studying, but also the way we understand what it is to study something.

The empirical focus of this paper, stems from a broader EU-financed research project 'Policy influence of indicators' (POINT), which builds on the notion that indicators are being ignored or misused within policymaking. The overall aim of the POINT-project is to look at indicators and their "influence chains", to "improve indicator influence, by helping to better understand factors that enable and hinder the usefulness of indicators in policymaking" (point.pbworks.com)[1]. This paper will focus on one specific composite environmental indicator, the Ecological Footprint (EF), as part of the objectives of WP5 focusing on influence chains of composite indicators (point.pbworks.com).

Environmental issues in a broader context will be explored to provide a background for the use of the EF, in Chapter 1.1. The method and development of the EF is described in Chapter 1.2. The research question is presented in Chapter 1.3.

1.1 Environmental issues in a broader context

NOAH[2], established in 1969, is regarded as one of the most proeminent environmental organisations in Denmark. Throughout the years, NOAH has worked towards communicating EI among Danes and shape the political environmental debate (www.noah.dk). In 1988 they became part of the worlds largest grassroots environmental network, Friends of the Earth.

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[1] See appendix 1 for project description.
[2] NOAH was originally called NOA as a short for 'Naturvidenskabelig Onsdagsaftner', but after being wrongly introduced as NOAH with a 'h' at seminar, they changed their name to NOAH (www.noah.dk).

Today NOAH is accompanied in their mission, by organisations like World Wildlife Fond (WWF), The Danish Society for Nature Conservation (which is the largest nature conservation and environmental organisation in Denmark today) and Klima X.

The Danish ministry of the Environment was established in 1972, by the name Ministry of Pollution Combating. At the time, environmental questions were typically discussed at a national level and were primarily related to industry. A more coherent environmental agenda in a global context was yet to be established (www.mim.dk). The Social Democrats were part of pushing forward the establishment of the ministry. Today all political parties support developments towards a 'better environment', but with different levels of involvement and participation.

EI hit the global political agenda in the 1980's. In 1993 the United Nations (UN) establish the World Commison on Environmental and Development (WCED), known as the Brundtland Commison. The commission is known for, among other things, defining sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." (1987) The Climate Convention was developed and later signed by 154 countries at UN's climate convention in Rio in 1992. The main objective of the treaty was to stabilize the emission of greenhouse gasses. The Commison established the Intergovernmental Panel on Climate Change (IPCC) in 1988, with the aim of providing scientific insight and knowledge of the environment and its development. Their first report was published in 1991, and received world wide attention. The main task of IPCC today is generally perceived as maintaining an international scientific consensus, rather than creating and distributing new scientific calculations.

The Conference of the Parties (COP), held annually since 1995, assesses progress of dealing with EI and combating climatic changes. The interviews for this paper were all held in the first half of 2009, 6 months before the 15th COP meeting, held in Copenhagen. It was agreed that negotiations for a future treaty were to be finalised at the meeting, intended to succeed the existing Kyoto-protocol expiring in 2012. The conference, however, did not turn out as many had hoped and no agreement was reached.
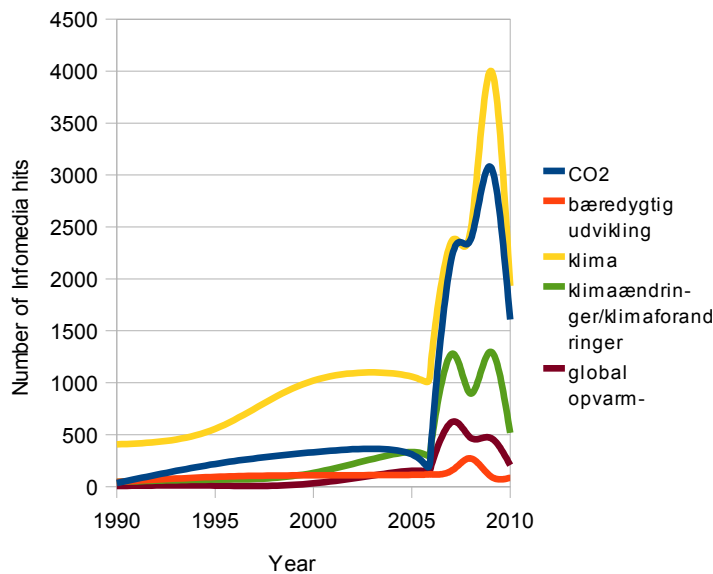
Figure 1: *Number of hits in Infomedia for each of the keywords.*

Through the media it is possible to establish how EI have been projected into the public sphere. The graph in figure 1, shows the frequency with which different concepts related to EI have being mentioned over time in Denmark[1]. It is possible to see that the concepts CO_2, climate (klima), climate change (klimaændringer/klimaforandringer) and sustainable development (bæredygtig udvikling) are mentioned more frequently over the past 5 years. Also we see a clear increase of use of all concepts in 2008 and 2009, probaby due to the upcoming COP15 in Copenhagen.

EI has increasingly become an integrated part of the scientific research. Denmark has become a world leader in wind turbine technology, fields of biology and geography are increasingly oriented towards environmental questions and also social science has started looking into how 'the environment' has become an integrated part of society. Sociology has over the last years started looking into issues concerning the environment, for example within the area of Sociology of climate change.

1.2 Ecological footprint

The EF was developed in the late 1990's by Matias Wackernagel (1996). In 2003 he founded and is today the executive director of the Global Footprint Network (GFN). GFN is an association of researchers and activists, promoting a sustainable future and trying to influence decision makers by accelerating the use of the EF (www.footprintnetwork.org, June 2010).

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[1] The graph builds on numbers collected through Infomedia (www.infomedia.dk, 2010), a database of articles from danish news media. The graph represents the three largest newspaper in Denmark, namely Berlingske Tiderne, Jyllands posten and Politiken. The words was chosen 'randomly' as examples of typical concepts used in the environmental debate.

GFN collaborates with partner organizations and companies, where it provides a method and dataset to calculate environmental constraints.

The EF is a data-driven metric providing a multidimensional measure of "how much land and water area a human population requires to produce the resources it consumes and to absorb its wastes, using prevailing technology", to show "how close we are to the goal of sustainable living." (www.footprintnetwork.org, June 2010) The common unit is Global hectare refering to "the average productivity of all the biologically productive land and sea area" (www.footprintnetwork.org, June 2010).

The EF consists of a number of different indicators which can be divided in 6 different groups: cropland, grazing land, forest, fishing ground, carbon and guilt-up land. Resources within these groups are primarily calculated based on datasets published by the International Energy Agency, Food and Agriculture Organization of the United Nations, the Intergovernmental Panel on Climate Change, the UN Statistics Division (www.footprintnetwork.org). The datasets are calculated based on a method, developed by Wackernagel. GFN sells national and regional datasets, apart from the EF method, in the form of a software for calculating the EF. Both dataset and the method is continuously being updated[1].

1.3 Research question

The CS approach and ANT will be applied to study use of the EF, to explore their approaches potential and understandings when approaching the environment, sociologically. The two approaches will be explored in practice by investigating the EF and how it is used within different settings[2] in Denmark. More specifically, based on the POINT-project, the aim is to *investigate how CS and ANT can be applied to investigate and identify factors hindering and enabling the use of the EF indicator in Denmark.*

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[1] See appendix 2 for more information and details on the EF method.
[2] Setting are here being used as a theoretical neutral word, as a broader concept referring to the meaning of 'context' in CS research and 'network' in ANT.

A research question will be specified and defined based on the understandings, ontological scope and empirical approach of both ANT and CS research, later in chapter 5.1 and 5.3, respectively.

The study builds on the understanding that the EF is a scientific projection of the physical environment, designed to be used within societal settings, existing as part of social understandings of environmental issues (EI). EI will henceforth be used as a general reference to a collective field of environmental problems like climatic change, sustainability etc. The EF will be explored within Denmark, and unless otherwise stated 'the EF' refers to EF in Denmark, termed 'økologiske fodspor' or 'økologisk fodaftryk'.

1.4 Outline of paper

Chapter 2 focuses on the choice of method and the data collection process. CS research as a method and research approach is presented in Chapter 3. The conceptual framework and empirical scope of ANT is presented in Chapter 4. The research questions, which will guide the analyses of the EF are formulated in Chapter 5. The five settings will be presented and analysed using CS research and ANT, in Chapter 6. Chapter 7 presents conclusions and final remarks of this thesis.

2. Practical methodological approach

This thesis' empirical material consists of transcribed interviews and written documents. Semi-structured interviews were carried out with five research participants (RP). The RP represent settings where the EF has been used, this are presented in chapter 2.1. The selection process is described in Chapter 2.1. The process of conducting the five semi-structured interviews are elaborated in Chapter 2.3. Finally Chapter 2.4 discusses the process of transcribing and translating the interviews.

2.1 Presentation of research participants and their setting

Use of the EF will be explored in the following settings:

- World Wildlife Fund (WWF), based on the Living Planet report (LPR) and interview with Signe.

- The schoolbook 'Bæredygtig udvikling – det økologiske fodatryk' and interview with its author Susanne.

- The ecological farm collective Svanholm and a student project.

- Miljøpunkt Indre by og Christianshavn (MIC), their blog and interview with Jens.

- A research project requested by the ministry, and interview with Johan.

I contacted the WWF Denmark, mentioned the EF, and was immediately put in contact with Signe. I met her in April 28, 2009[1]. The EF is an integrated part of the LPR, which is WWF's "periodic update on the state of the world's ecosystems" (www.panda.org, June 2009). The LPR tracks the footprint of the world and has been released every second year since 1998. It is primarily written by GFN, but consulted by WWF who is responsible for publishing the report.

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[1] Transcribed and translated interview can be found in appendix 8.

I came across the gymnasium schoolbook 'Bæredygtig udvikling – det økologiske fodatryk' (2006, sustainable development – the Ecological Footprint)[1], where Susanne was listed as the author. I met her in May 12, 2009[2]. As a physicist she has been working on EI since the 70's, both as a researcher and over the past years of her career, as a teacher. The book looks at how the EF is made, the method behind, its limitations and weaknesses. Susanne heard about the EF through the 'World Summit' conference in Johannesburg in 2002, where Wackernagel held a presentation about the EF and sustainable development, related to education.

I visited the ecological farm community, Svanholm, located northwest of Copenhagen. I came in contact with them after seeing their student project, 'Ecological footprint for Svanholm et øko-samfund'[3], posted at several universities in the Copenhagen area. The project was directed towards students about to write their Master or Bachelor project. I met Bo, the responsible for visitors at the farm, in May 15, 2009.

I found several entries referring to the EF on the blog of MIC. (Henceforth I will be using the name Miljøpunkt when referring to the whole Miljøpunkt organization, and MIC when referring to Miljøpunkt Indre by og Christianshavn). The blog was written by Jens, an architect who has been involved in various projects related to EI and is currently the leader of MIC. I met him for an interview, in their newly opened centre in the middle of Copenhagen, in April 18, 2009[4]. MIC is described as "your local Agenda 21 in the heart of Copenhagen" (www.a21.dk). The center is financially supported by the municipality, and was created to work in close relation with local actors, with the aim to "help realize the goals of Agenda 21" (www.a21.dk).

The National Environmental Research Institute (NERI), responsible for the POINT-project in Denmark, suggested I contact Johan, who they claimed had been part of a research group working on the EF. I met him in May 19, 2009[5], where he elaborated on a project about the indicator 'Environmental utilization space' (EUS), which he and his research group were working on in the beginning of the 1990's. The EUS, similarly to the EF, measures the amount of natural resources which can be used per year, without prohibiting future generations

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[1] Electronic version of the book can be found here: http://www.fys.dk/nfa/01/heftet/baeredygtig.pdf.
[2] Transcribed and translated interview can be found in appendix 9.
[3] Original student project can be found in appendix 12.
[4] Transcribed and translated interview can be found in appendix 10.
[5] Transcribed and translated interview can be found in appendix 11.

accessing the same amount and quality of resources. The report was made on request from the Danish Ministry of the Environment, and was intended to be used as a starting point for political work within EI and sustainability.

2.2 Finding, choosing and creating the empirical material

Besides the settings listed above, a number of settings were initially identified where the EF was used or referred to. However, after consultation, most of them did not show in-depth knowledge of the EF and/or could not elaborate on why they were referring to this indicator in specific. This settings have been omitted from this study (for example Det Økologiske Råd and Eco consult). In other settings they did have elaborate knowledge and an interview was conducted which was later omitted. This was the case for interviews carried out at GFN in Oakland, in the summer of 2009. The interview was omitted as the study later came to focus on use of the EF in Denmark. Another interview, carried out at European Environmental Agency was omitted based on providing little insight in use of the EF, combined with the researcher in question, not having worked with the EF.

I decided to concentrate on interviews with RP's representing settings which could show at least one written document describing the EF. I did this based on the belief that the interviews and documents together could provide diverse insight into the setting where the EF is used and practiced.

2.3 Semi-structured interviews

According to Sage Encyclopedia of "Social Science Research Methods" there are three types of interview forms: structured, semi-structured and unstructured interviews (2004). Structured interviews follow a set of predefined questions, semi-structured follow a set of topics and/or issues s/he wants, and unstructured interviews where the interviewer is free to ask questions on whatever topic or issue. Semi-structured interview was applied as the topic and issues were pre defined. During the interview I tried to follow up on whatever issues the RP included and found to be interesting and relevant.

An interview-guide was prepared for all the interviews, including a list of areas I assumed would be relevant[1]. In some cases the interview-guide included questions which turned out to be less relevant, but was useful as a starting point, and as a check-list for covered areas.

The RP's knowledge of the EF, was often based on personal and professional interest for environmental related issues. The RP's were generally more than willing to talk, and often had a lot to say. As a result, the biggest challenge became finding a balance between letting the RP talk and controlling the interview towards a topic I though relevant. In this process I found it helpful to make short sum-ups of what I understood was important from what the RP had said, letting the RP add comments, confirming or rephrasing it. Also, asking questions about basic knowledge or present specific understandings, often lead to useful specifications, as well as smoother shifts in the conversation.

2.4 Transcribing and translating

The interviews were taped, transcribed and translated to English. This was a time-consuming process, literally changing voices into written material, then into another language and finally into 'empirical data'.

Based on ANT, the process of transcription is a process of transformation, (re)creation and change, involving 'inscription devices' such as a tape recorder and a computer, interpretations and an active shaping of a reality. There is no specific way of interpreting or understanding the action of transcribing and translation within the CS approach. Authors have specified how to deal with the process of transcription, but leave no, or little interest in how translation or transcription shapes the data.

As the focus in this study is the RP's understandings, details like silence, timing, speed emphasis and volume will be ignored in the transcriptions[2]. Instead of interpreting the transcribed and translated interviews as the actual conversation, it is treated as an overview of

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[1] Interviewguides can be found in appendix 3-7.
[2] Practically this means that a sentence expressed verbally like this: " Ehh… Men, men det er ikke sådan at… sådan.. man kan sige at fodaftryk som sådan ikke at det er ubrugelig." is being transcribed like this: "Men det er ikke sådan... man kan sige at fodaftrykket som sådan ikke er ubrugelig." Which again is being translated to: 'But it is not like... you could say that the footprint as such is not useless."

the interview process and the issues discussed. Consequently, I will not use citations in the analysis. This is done in favor of telling a coherent story aimed at presenting the understandings, opinions and storyline being presented during the interview.

3. Case study research

The CS research method has been defined in a variety of ways, with differing functions, purposes and goals. Its development, definitions and empirical scope will be described in this chapter. Chapter 3.1 presents a brief history of the CS research. Chapter 3.2 works to define CS research, and in chapter 3.3 George and Bennett's interpretation of the case study will be elaborated. Finally a critique of CS research in Chapter 3.4.

3.1 History of case study research

The CS can be traced back to the early 1900's and its systematic development flourished mostly throughout the 1920s and 1930s. It has been argued that this was as a result of a lack of applied research methods at a time where US business owners started subsidizing research to encourage development of new solutions to their own problems. Chicago school researchers, the leading developer and users of qualitative method at the time, described the CS as limited to qualitative research, emphasizing context and history, striving to see the actor perspective.

The CS was strongly associated with the field of Sociology, but as several problems were raised by researchers in other fields, and a scientific movement was emphasising quantitative research methods, a decline in the use of the CS ensued (Tellis 1997). By 1970, the use of CS research had declined across all disciplines, which can be seen as a result of less focus on localities and applied research and increased interest in grand theories (Bromley 1986).

In the 1960's researchers within Sociology were becoming aware of the limitations of only using quantitative research (Tellis 1997). The concept of 'grounded theory' was developed, followed by some well regarded studies, which resulted in a renewed interest for the CS (Tellis 1997).

3.2 Defining case study research

"Understanding a case in its context, is understanding relations of parts, facilitation an understanding of the whole" (Stoecker 1991, 98).

The CS research has been defined in a variety of ways, - related to specific topics (Babbie 2007) or based on a specific methodological approach (Hagan 2006). Stoecker defines the aim of the CS to "explain holistically the dynamics of a certain historical period of a particular social unit" (Stoecker 1991, 94). He suggested that the CS is not a method but a research design or a design feature determining "the boundaries of information gathering" (Stoecker 1991, 94). This view is shared by Yin (2009), defining CS as a comprehensive research strategy providing a systematic way of reporting on events and phenomenon within its real-life context. As such, the CS is today often referred to as CS research. Simon has repeatedly been cited for stating that: "The specific method of the case study depends upon the mother wit, common sense and imagination of the person doing the case study. The investigator makes up his procedure as he goes along" (Simon 1969, 206). Simon continues by arguing that the CS researcher has to report objectively, while constantly reassess and make judgments of relevancy, and at last, "work long and hard", to avoid problems of validity (Simon 1969, 206).

3.3 George and Bennett's case study

In George and Bennett's book 'Case studies and theory development' (2005) the authors explore how CS research can be used to test an hypothesis and develop theories by examining causal mechanisms and address causal complexity. Causal mechanisms are placed on an ontological level to explore "the operation of causal mechanisms in individual cases in detail" (George and Bennet 2005, 21). George and Bennett argue that the CS achieves high conceptual validity through detailed examination of contextual factors, and its procedures of in-depth examinations (2005, 19).

George and Bennett criticize the deductive nomological (D-N) model, for not distinguishing between causal regularities and other mechanisms. They avoid the 'exception-less regularities', represented in the D-N model, by sticking to probabilistic terms (George and Bennet 2005, 132). Furthermore, the same authors distinguish between predictive relations and causal

explanations, seeing causal mechanisms as prior to causal effects, where defining them as equally important components of explanatory causal theory (2005, 132). This becomes clear, when they define causal effect as "the expected value of the change in outcome if we could run a perfect experiment in which only one independent variable changes." (George and Bennet 2005, 138)

Causal mechanisms are "ultimately unobservable physical, social, or psychological processes through which agents with causal capacities operate, but only in specific contexts or conditions, to transfer energy, information, or matter to other entities." (George and Bennet 2005, 137). Material and social environment makes it possible to act, but it also constraints and socializes human agents, which are seen as unique by being reflective and having the ability to cause intentional change (George and Bennet 2005, 129). Mechanisms are seen as operating only under certain conditions. Consequently, explanations and theories are defined as "hypothesized models of how underlying mechanisms work." (George and Bennet 2005, 136)

The job of the researcher is to arrange the facts and analyse causality. The aim is not to determine laws, but to seek explanations through mechanisms and processes, providing a contingent and continuous chain of interrelated or causal links (George and Bennet 2005).

3.4 Critique of case study research

> "Case study research remains an unsophisticated method, if it can even be called   a 'method'." (Stoecker 1991, 88)

CS research has been equated with various data collecting methods and criticized for a lack of procedural descriptions. It has been argued that the CS allows for no scientific distance making it difficult to maintain objectivity. As a result it has been claimed that it suffers from an excess of bias and generally lacks rigor. Critiques of qualitative science claim that it cannot avoid researcher bias, stating its inability to answer applied questions and provide valid explanations and generalizations.

As a response it has been claimed that the CS fills gaps pointed out by critiques of quantitative science. Stoecker argues for its usefulness to test and compare the multiple implications of theories or different cases (Stoecker 1991, 98). The question of internal validity is suggested to be solved by adding triangulation or continual data collection. George and Bennett tries to avoid the problem of validity by narrowing the focus of interest.

Several writers have argued that CS research can employ the best of both quantitative and qualitative methods, and thus Gerring claims that "[t]he case study survives in a curious methodological limbo,"adding that "[it] is the very fuzziness of case studies that grant them a strong advantage in research at exploratory stages." (2004, 350) Both critics and advocates alike have argued for caution when using the CS for anything other than exploratory purposes.

4. Actor-network theory

Through the understanding of ANT, the EF is a complex entity being created in actor-relations, forming networks. I will here look closer at ANT's development, theoretical understandings and concepts, its empirical approach and most common critiques. The development of ANT is described in Chapter 4.1. The concept of actor and network are defined in Chapter 4.2, and Chapter 4.3 deals with translation and multiple reality. Immutable mobiles, black boxes and inscription devices are defined in Chapter 4.4. ANT as a method is described in Chapter 4.5, followed by Chapter 4.6 presenting critique of ANT.

4.1 The development of Actor-network theory

ANT builds on the work within science and technology studies (STS). STS looks at how scientific research and technological innovations are being affected by political, social and cultural values, and vice versa. Bruno Latour, together with Michel Callon, started the development of ANT in the 1980's. They detected the separation and stabilization of Nature and Society, subject and object, things and humans not only in technoscience, but also in science and society in general. They wanted to explore a way to talk about these distinctions without taking them for granted[1], arguing that:

> *"there is no thinkable social life without the participation – in all the meaning of the word – of non-humans, and especially machines and artifacts" (Callon & Latour 1992, 359).*

ANT was not originally developed to be an alternative social theory. It stems instead from the idea of developing a method that could deploy the actors own world building activities. Latour

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[1] Latour shows how this is relevant in discussing attempts to grind corn using wind mills, asking how wind can be borrowed and used (1987). Arguing that the wind can be translated and made interested in grounding the corn. This is not only a discussion and study made by scientists figuring out how the wind works and how to make it useful, rather a continuously complicated negotiation to keep up the alliances between wind, the mill, the grinder, the corn etc. (Latour 1987:129)

wanted to call it 'sociology of translation' or 'sociology of innovation', referring to sociology not as the 'science of the social' but rather as a tracing of associations (Latour 2005, 7).

4.2 Actor and network

> *"The theory of the actor-network assumes that there is no overall structure, that there is always a multiplicity of actor-networks each trying to impose its own structure on potentially unreliable entities and thereby borrow their forces and treat them as its own." (Law 1986, 70-71)*

ANT builds on the concepts of 'actor', 'network' and 'translation'. An entity becomes an actor, by acting or by being given agency in network relations. This means that anything can be an actor, if it can be seen as the source of effects[1]. This is essential in ANT, as it is in the actor concept, that both humans and non-humans are defined. As actors are being defined and exist in networks, they can said to be 'network effects' (Law & Hassard 1999, 5). ANT talks of 'mediations' as the actor has no a priori essence or substance, but is being defined, named, given a purpose and a meaning in different mediations, that is, different constructions of actors in networks. Hence an actor never comes alone, but always carries "modes and modulations of other objects with them." (Mol 1999, 81)[2] As Law puts it:

> *"Nothing is simply social. Everything is also material, happening in practice (…) nothing exist in and of itself. Instead, things exist and take the form that they do by participating in an emergent web of materially heterogeneous relations." (Law 2009, 68)*

Networks are sustained by continuous making and re-making, repeatedly being 'performed' by actors. As a result there in no singular reality, no right or wrong 'out-there', only 'shorter' or 'broader' networks, where broader networks contains larger number of actors, which have been created and defined by means of translation.

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[1] ANT also defines the concept of actant, which refers to the way that actors perform and define their role. As such, the concept relates to the actor-concept.

[2] An example of this is how "(Mol 1999, 81)" is enrolled as an actor, representing scientific understandings and reasoning in the form of knowledge, to create this master thesis as a scientific network.

4.3 Translation and multiple reality

"By translation we understand all the negotiations, intrigues, calculations, acts of persuasion and violence, thanks to which an actor or force takes, or causes to be conferred on itself, authority to speak on behalf of other actor or force."(Callon & Latour 1981, 279)

Translation "involves creating convergences and homologies by relating things that were previously different" (Callon 1980, 211). Translation is a remaking of an entity, unifying and merging an actor's aims, into the aim of the network (Latour 2005). This is done in a triangular operation involving "a translator, something that is translated, and a medium in which that translation is inscribed" (Callon 1991, 143).

Networks can be connected via a translator, a spokesperson putting forward the entity s/he/it constitutes, working as an 'obligatory point of passage' (OPP)[1] where entities can be translated. Translation makes the entity and network consent to diversion by methods like seduction, violence and bargaining. A successful translation is complete when the translated has been inscribed, leading to physical and social displacement of the entity, building actor-worlds and establish somewhat stable relationships between them (Callon 1986, 25-27). Most translations will, however not succeed, as entities will meet resistance, blocked by contradictory actors and understandings (Callon 1986, 25). The success depends on the actor-world's capacity to enroll and define entities which might challenge its definition, and the actor's ability to fit the aim of the network.

When successful, translation leads to an entities displacement, making it multiple as it is acting simultaneously in various translated forms, in different networks. As each of these networks consists of associated actors which have been translated and created in the network, these networks represent different (actor-)worlds and realities. "Realities are not explained by practices and beliefs but are instead produced in them. They are produced, and have a life, in relations." (Law 2004, 59)

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[1] "'Our interests are the same', 'do what I want', 'you cannot succeed without going through me'. Whenever an actor speaks of 'us', it is translating other actors into a single will, of which s/he becomes spirit and spokesman. S/he begins to act for several, no longer for one. S/he becomes stronger. S/he grows." (Callon & Latour, 1981, 279).

Reality is traditionally perceived as consisting of fixed and stable entities and/or as a single entity which can be observed and detected 'out-there' in a (somewhat) natural world. With ANT's reasoning networks construct their own reality, with the consequent of reality being multiple. This ontological understanding has consequences for ANT's methodological approach, as shall be seen later in Chapter 4.5.

4.4 Immutable mobiles, black boxes and inscription devices

When looking at knowledge creation, the concept of 'inscription devices', 'immutable mobiles' and 'black boxes' are central within ANT. In 'Science in Action' (1987) Latour qualifies scientific knowledge as immutable mobiles. Immutable because it is typically organized in tables or graphs, and written text, not possible to change. But mobile as it is able to move freely and circulate in networks and actor-worlds. Immutable and combinable mobiles are consequently "objects which have the properties of being *mobile* but also *immutable*, *presentable*, *readable* and *combinable* with one another" (Latour 1986, 26, italic in original).

An 'inscription device' (ID) or machine is basically what "transform pieces of matter into written documents" (Latour and Woolgar 1986, 51). This makes it possible to deal with 'matter' on a piece of paper, which is critical to the production of scientific knowledge. This draws the attention to how scientific knowledge production is more than a process of representing reality, and questions how an ID becomes standardised and regulated. Lastly, it emphasises that the production of scientific knowledge is a form of literary production.

When knowledge has become what we see as stable and fixed, it is 'black boxed' in Latour's terminology. The term derives from cybernetics where it was used when a commando or piece of machinery was too complex, thus drawing a box over it to be able to look at only input and output (Latour 1987, 3). In ANT it is a concept used for describing knowledge or theories that are seen as known and factual and thus used to build new theories, or to study and understand something.

4.5 Actor-network theory is/as a method

"[Using ANT is] a way for the social scientists to access sites, a method and not a theory, a way to travel from one spot to the next, from one field site to the next, not an interpretation of what actors do simply glossed in a different more palatable and more universalist language." (Latour 1999, 20-21)

Law states that a multitude of sins have been committed in the name of ANT, by making it tidier and neater than it actually is and prefers to talk about 'after-ANT', as a profoundly empirical methodological toolkit (2009, 66). Law argues that, contrary to traditional views of social science methods as tools to capture, read and decode a somewhat stable pre-defined reality, methods are traditionally 'squeezed over' (a) reality, which is shaped, created and enhanced through method (2004). Law argues that method is a co-producer of reality, as "methods, their rules, and even more methods' practices, not only describe but also help to produce the reality that they understand." (Law 2004, 5 and 116)

"[M]ethod is not, and could never be innocent or purely technical. (…) [M]ethod does not 'report' on something that is already there. Instead, in one way or another, it makes things more or less different. The issue becomes how to make things different, and what to make." (Law 2004, 143)

Law stresses that "the task is to imagine methods when they no longer seek the definite, the repeatable the more or less stable." (Law 2004, 6) Based on this, ANT as a method strives to follow actors network building activities, focusing on how networks consists of more or less stable and closely related actors, to capture multiplicity, complexity and observe how realities disturb and overlap.

4.6 Critique of Actor-network theory

"While the reflexivist players have escaped the fate of the foolhardy by jumping into a hole in the road from which there is no escape, the adherents of the actor network turn out to have crossed the road well before the traffic was in sight, leaving only their ventriloquist's voices echoing between the curbs. Listen and understand, but do not follow too closely." (Collins & Yearly 1992, 323-324)

The critique against ANT has been substantial, even by Latour himself stating that "several of

us (…) [are] somewhat terrified by the monster that we have begot" (1999, 24). Trying not to do as Victor Frankenstein did by "abandoning the creature to its own fate, but continue all the way in developing its strange potential." (Latour 1999, 24) Latour also stated that, "[t]here are four things that do not work with actor-network theory; the word 'actor', the word 'network', the word 'theory' and the hyphen!" (1999). Though, withdrawing the statement 6 years later saying. "I criticized all the elements of this horrendous expression, including the hyphen, I will now defend all of them, including the hyphen" (Latour 2005, footnotes, p. 9). Stating that it "is so awkward, so confusing, so meaningless that it deserves to be kept, adding that the acronym ANT is a "perfect fit for a blind, myopic, workaholic, trail-sniffing and collective traveler." (2005, footnotes, p. 9)

> *We are also dissatisfied with our own network theory, but (…) we do not see this as a reason to put our head in the sand and pretend the sociology is 'business as usual'.(…) The domain is young. The topic of science and society have barely been touched." (Callon & Bruno 1992, 344)*

ANT is said to be a material-semiotic method, but based on its reasoning it can also be said to represent a form of extreme idealism. The idea of nature and the social being constructed in multiple realities, is not only a rather abstract idea, but also results in everything essentially being mental products and a question of beliefs and understandings. Based on this reasoning, one could argue that there are no such thing as for example climate problems, if we only do not belive it is so.

We can recognize this understanding of reality from well-known writers like Baudrillard, studying the 'hyper real' in a postmodern era. He argues that we can no longer differentiate between the imaginary and the real, where nothing can be said to be original, as we live in a world of simulations. But also from social constructivism, where for example Berger and Luckman states that "[s]ociety is a human product. Society is an objective reality. Man is a social product." (1966, 61) In both perspectives the divide between the social and nature is intact. ANT brakes down this divide, but as a consequence it becomes difficult to distinguish a divide between material, ideologies and ideas. This results in a not only 'messy' world, but also a world where morality, laws, nature and scientific findings seem to be no more than mere

opinions and beliefs. This is also one of the arguments against ANT, that it can do no more than describe practices and reactions, while making it impossible to criticize.

To make ANT 'work', one is forced to accept the principals that the theory/method are built upon, otherwise the whole theory fall apart. By accepting it, one is left with a theory and a method that strives to explore and describe entities, such as the EF, as part of contemporary settings of intertwined traits.

5. Research question and empirical scope

Two research questions have been formulated based on the scope of the CS and ANT, and the aim of providing insight into how the EF is being used in the different settings.

5.1 Case study research

"A case study may be understood as the intensive study of a single case where the purpose of that study is at least in part- to shed light on a larger class of cases (a population)."(Gerring 2007, 20)

This study will be an exploratory, "atheoretical/configurative idiographic" (George and Bennett 2005, 75) case study. This implies that the study will not contain theory but instead shed light where current available research is scarce, by providing descriptions of conditions where the EF is being used.

In sum, the research question is:

What factors are hindering the EF from being used within a context, and what factors are enabling and supporting the use of the EF?

Interviews and written documents will be used to investigate the five contexts in which the EF is used. Enabling and hindering factors will be identified and analysed within these cases.

5.2 Actor-network theory

"Follow the actor" preaches Law and in this case the EF will be stalked in the name of ANT (2004). In the analysis, ANT will identify the EF actor as created in different networks, where the analysis will strive to define:

By who, why and how is the EF being used, created and defined?

The purpose of the pronoun 'who' is to create an understanding of what networks the EF is enrolled in and with which actors it is associated. 'Why' seeks to determine the aims and purposes which the EF is part of creating and working to obtain, while 'how' questions the definition of the EF actor in the network. The answers to these questions will make it possible to understand what aims and purposes the EF is part of constructing, how and why the EF is translated, what influence the EF has within the network, and what entities the EF is part of creating through the network.

5.3 Choice of approaches

CS research and ANT represents different perspectives and trends in the field of Sociology. CS was built to solve practical problems. It seeks insight in empirical settings by focusing on the practical side of a research process, emphasising the actual data collection and strategy of conduction an investigation. ANT was initially built to overcome theoretical distinctions, between nature and the social. ANT was developed as a conceptual framework, built to theoretically understand and analyse processes of relation.

Both focus on contemporary settings, but this is done in very different fashions. CS research focus on real-life empirical settings, to seek insight in events and phenomenons as they are happening. ANT, on the other hand, focuses on the creation of relation, and the entities involved in this process. There is nothing out-there, rather the study itself is part of creating reality, and the study object.

This thesis explores the use of the EF, as projections of the environment. To do this I was forced to question how this can be done sociologically. This study strives to create insight and knowledge of how EI can be approached sociologically, by applying two approaches from different understandings, times and trends. The purpose is not to compare them, rather create insight in what the two approaches can contribute with in the study of EI.

6. Analysis

The use of the EF will be investigated in the five settings. WWF, Signe and the LPR will be presented in chapter 6.1. Chapter 6.2 looks at the Susanne and the schoolbook, and chapter 6.3 presents the eco-community Svanholm. Chapter 6.4 presents MIC, Jens and the blog, and Johan and the research group is presented in Chapter 6.5. Each chapter will present general information about the setting, insight in the background of the RP and use of the EF. Each of the settings will be analysed separately, using CS and ANT. Chapter 6.6 provides a summary of the CS and ANT analysis.

6.1 World Wildlife Fund, Signe and the Living Planet Report

WWF was established some 45 years ago to 'protect the future of the nature'. Over the years it has become a well-known organization, operating at an international scale. "WWF's ultimate goal is to build a future where people live in harmony with nature." (www.wwf.org, 2010). WWF strive to achieve this goal by spreading information about the environment among the public, and attending national and international climate negotiations to provide pressure on policymakers and large organizations to take action for change. WWF's homepage states that "the earth's population in one year, consume one fifth more than the earth can regenerate, which can lead to disruption in the Earth's ecosystems" (www.wwf.org, 2010). This measurement and reasoning derives from the LPR. The LPR builds on the EF and is produced in a collaboration between WWF and GFN. GFN makes partnership with organizations sharing their goal "strengthening the Footprint and enhancing its value as a catalyst for sustainability" (www.footprintnetwork.org, 2010). WWF are one of GFN's 90 partner organizations.

Signe[1] works with measurement and calculation of the EF, at WWF Denmark. She started working on EI as a student at Roskilde University Centre in Denmark, where she graduated in 2004. Signe is familiar with GFN, refers to Wackernagel by his first name Mathias, and has extensive knowledge of the EF and the method behind. WWF is working towards raising

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[1] For transcribed and translated interview (April 28, 2009) see appendix 8.

awareness and make some politicians and companies, and the general public aware of the problems we are facing, explains Signe. The EF is an intuitive concept, making it easy to communicate, which is crucial when one as an organization wants to communicate environmental conditions, she adds. With this indicator we can create intuitive mental images, making people associate their actions with a footprint being created on earth.

> *"The Ecological Footprint – representing human demand on nature – and the Living Planet Index – measuring nature's overall health – serve as clear and robust guideposts to what needs to be done." (Living Planet Report 2008, 3)*

Despite the LPR stating that the EF 'serve as clear and robust guideposts to what needs to be done', Signe argues that the EF has become rather well-known, but has failed to become useful in making practical change. WWF would have wanted the politicians to use the EF or a similar indicator, to keep track of not only our footprint here in Denmark, but also in the rest of the world. That would have been an indication of their work having made a difference. According to Signe they have not yet accomplished this.

By August 2009, Signe no longer works at WWF. Due to 'changing structures', no one at WWF was at the time working with the EF and it was uncertain whether anyone would do so in the future. By the end of 2010, however, WWF has again hired a person to keep working on the EF.

6.1.1 Case study analysis

When talking to Signe it becomes clear that she is very much aware of the critique against the EF and knows how to defend WWF's use of the EF. This becomes apparent when she for example mentions that the EF is not very detailed, but at the same time argues that this is a strength, as the EF provides a holistic view.

Signe supports and describes the EF as a measurement tool, and also argues for its communicative abilities, making it a helpful tool in reaching WWF's main goals. Though unfamiliar to why WWF started using the EF in the first place, Signe mentions a number of reasons for using this specific indicator. It is essential, when looking at the environmental exploitation at a national level, that we include the enormous footprint's we leave other places

on the planet. The EF does this, making it possible to get a broad picture of consumption world wide. The EF measurements are based on renewable resources, which Signe describes as crucial for maintaining life on earth.

WWF's main goal as an organization is to communicate environmental conditions. In order to do this it is crucial to have intuitive concepts that are easy to communicate. The EF is an example of such a concept. The EF allows us to create intuitive mental images which people can remember and which will make them understand that their actions are creating footprints on Earth.

According to Signe, WWF Denmark is not working as extensively with the EF anymore. This is explained 'as a question of priority'. New datasets have to be purchased as the existing ones are outdated. There have been made methodologically changes meaning that the method also needs to be updated. However, updated versions of the dataset and method are expensive. Also, the EF can be used when communicating environmental conditions, but the understanding of the environmental conditions has been fairly well established among the public and politicians.

These hindering factors, are not based on how the EF is built or work, rather are explained by contextual factors, in the form of economy and how the EF is being received and understood. The EF is not presented as essential to WWF obtaining its aim, rather as important in the process of establishing the purpose of WWF by spreading the message of 'critical environmental conditions', and communicate WWF's main objectives. As such, the essential factors for making the EF useful within WWF depends on what the EF represents and that this is represented in an intuitive fashion.

In summary, the enabling factors for use of the EF at WWF includes the EF providing a holistic view of EI, and that it accounts for renewable resources. Furthermore it is regarded easy to communicate and an intuitive concept which is easy to understand. Both factors are defined as crucial for communicating EI. Hindering factors primarily concerns external factors. Signe mentions the dataset and EF method being expensive.

6.1.2 Actor-networks theory analysis

The LPR[1] is created in collaboration between the GFN- and WWF-network. The EF-actor becomes translated and enrolled within the WWF-network through the LPR. The LPR is an immutable mobile, which can circulate in a variety of networks, working as a spokesperson both for the EF-actor, and the aim and purpose of the WWF-network. GFN, on the other hand, are similarly working towards reaching their aim, by spreading the EF through the WWF-network.

The report defines the EF as "representing human demand on nature", instead of the 'planet', similarly to GFN. The Living Planet Index, which shows population trends in species, is defined as "measuring nature's overall health". By making these definitions, 'nature' is used both to describe actual hectare of land (the EF), and as reference to animal species (Living Planet Index). Despite the diverse definitions, using the same concept in both definitions emphasises how the two indicators are to be regarded as associated, and also shows how the EF is translated to fit the aim and purpose of the WWF-network.

> *Humanity's footprint first exceeded the Earth's total bio capacity in the 1980s; this overshoot has been increasing since then. In 2005, demand was 30 percent greater than supply. (Living Planet Report 2008, 14)*

The EF is used as an inscription device, which can translate 'bio capacity' into numbers and percentages. Bio capacity becomes a numerical value, but also a concept specifically describing natural resources useful to humans. The method of measurement is defined as stable and fixed, making comparisons over time possible. As such the EF works both as a measurement, but also as an abstract concept.

Signe states that the EF is intuitive and easy to communicate, which is essential for the WWF-network. As such, the EF is presented as an OPP, making it possible to translate specific understandings and ideas, into other networks and their actor-world. We know from ANT that an actors ability to be translated, depends on its ability to adhere and fit into different relations

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[1] This paper refers to the LPR 2008. Electronic version can be found here :
http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/living_planet_report_timeline/lpr_2008/

and definitions. When the EF is defined as easy to communicate, the EF is defined as flexible in the sense that it is being possible to redefine and recreate the EF to fit new networks.

Signe expresses loyalty towards the EF, by supporting its legitimacy and usefulness within the WWF-network. This can be based on scientific reasoning, but can also be seen as a result of Signe as an actor being defined in relation to the EF-actor, within the WWF-network. The EF can here be seen as an OPP for her as an actor being created as useful in obtaining the goal of the WWF-network. With this understanding, arguing for the EF could be seen as a way for Signe to argue and defend the legitimacy of her work and her association within the WWF-network.

In summary, the EF is defined as a measuring tool and inscription device, translating resources and the nature into numbers and intuitive images. The EF is translated through the LPR, showing that the nature is threatened and thus supporting the legitimacy of WWF's aim of protecting the nature.

6.2 Education, Susanne and the schoolbook

Susanne[1] wrote the schoolbook 'Bæredygtig udvikling – det økologiske fodaftryk'[2] (2006, Sustainable development – the Ecological Footprint) together with two teacher colleagues, with backgrounds from biology and chemistry. The schoolbook, which is intended for basic levels at gymnasium, looks at how the EF and the method behind it are built, and describes its limitations and its weaknesses. Susanne chose the EF as the main topic of the book as she had learned about it at the 'World Summit' conference, where Wackernagel held a presentation focusing on education. The book was written as part of a series, which was to be used within interdisciplinary projects, combining natural and social science.

The schoolbook focuses on the EF and starts out by elaborating on contemporary discussions and problems regarding EI and the scientific uncertainty surrounding these questions. In the schoolbook it is stated that it is impossible to determine what exactly is sustainable and what is not (2006, 4). The EF is presented as 'a good, visual concept', which can provide 'an estimate'

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[1] For transcribed and translated interview (May 12, 2009) see appendix 9.
[2] Electronic version of the book can be found here: http://www.fys.dk/nfa/01/heftet/baeredygtig.pdf.

of what can be regarded as sustainable (2006, 5). Moreover, it is stated that the EF was originally introduced as an 'attempt' to create a measurement of sustainability (2006, 7).

Susanne has a background as a researcher in physics at Denmark Technical university. In collaboration with the danish Organization for Information on Nuclear Power, Susanne was part of working on the first alternative energy-plan for Denmark. This also became the topic of her Ph.d. She later started working as a teacher, where EI has been one of the motivating factors and main issues in her teaching.

EI was a very sensitive issue, states Susanne when talking about the early years as a researcher. There were a general gap between natural scientists and economists. Researchers from the natural sciences claimed that the current development could potentially lead to large threats to the environment. Economist, on the other hand, claimed that new inventions and technological development would combat any potential future problems. As a teacher Susanne experienced fellow colleagues sabotaging her school projects concerning sustainability and the environment. They thought it was meaningless to teach students about EI, which they claimed to be misperceived 'non-sense', explains Susanne.

Susanne regards her main job as a teacher to help the students learn, but for a large part also affecting their understandings and opinions. She states that her students got interested and involved in EI at the time, but is uncertain whether this has had an impact on their future decisions and actions. Susanne expresses hopes for having influenced some of her students to vote for someone advocating for environmental regulation.

6.2.1 Case study analysis

The reason for Susanne choosing the EF for the schoolbook is presented as somewhat coincidental, but can be regarded as a result of GFN and Wachernagel's work towards spreading the EF and making it known as an accessible option when teaching EI. This can thus be regarded as an enabling factor for use of the EF. Susanne's aim, when introducing the EF was to communicate EI. In this process she found the EF helpful, as she regards it as, easy to communicate, and helpful when teaching the students to think critically about indicators and models.

Susanne is not arguing for the EF as a 'correct' measuring tool, rather as an example of how EI can be measured and understood. She stresses that it is essential to have tools that can show whether we are getting closer to a sustainable development, or not. As such, she regards the EF as part of a process towards finding better measuring tools, and regards the fact that it is being criticized as a natural part of this process. It is difficult to develop models and indicators, and there will always be critique to these models, argues Susanne, stating that the EF has a number of weaknesses in the way it is measured and calculated. As an example Susanne mentions the way it calculates energy. Energy is difficult to calculate in hectare, when dealing with oil an coal. The EF deals with fossil fuels by measuring how much forest is needed to absorb the CO_2 let out by burning these fuels. But in fact, this says little about the impact of CO_2 emissions on the earth environment. She mentions this as an example of what the EF is being criticized for. For Susanne, being part of an educational setting, this is however not a weakness which can be regarded a hindering factor. Susanne's aim is not to advocate only the strengths of the EF, rather use the EF as an example of how to think and interpret indicators. The EF has weaknesses, but as this weaknesses are rather easy to explain, it must be regarded an enabling as factor for using the EF, for educational purposes.

The only hindering factor Susanne mentions is not related to the EF, how it is build or what it represent, but rather EI in general. This factors concerns her fellow teachers sabotaging her work, as they were against the idea of there being threats towards the environment. This critique was not aimed directly at the EF, but it here becomes clear that the EF gains validity and is regarded as meaningful only as long as the idea of there being threats against the environment is regarded valid and true.

In summary, the enabling factors for using the EF within the schoolbook and educational setting concerns the EF being easy to communicate. Furthermore the EF is regarded helpful when teaching the students to think critically about indicators and models. Susanne states that there are weaknesses in the way the EF is measured and calculated, but as these can be explained and understood it is not a hindering factor for using the EF.

6.2.2 Actor-network theory analysis

When Wachernagel and GFN takes part in venues about the environment, they are presenting the EF-actor to possible spokespersons and points-of-passage into new networks, contributing to the negotiation of translating the EF. Susanne became a OPP into the Danish high-school. Through the schoolbook 'Bæredygtig udvikling – det økologiske fodaftryk'[1] (2006, Sustainable development – the Ecological Footprint), the EF is translated in a education-network with the purpose of translating general knowledge and specifically, creating an understanding of EI.

By associating the EF to the well-known, broader term sustainability, the EF is created as an actor in a broader network of EI, which in the schoolbook is presented as a network containing a number of uncertain and undefined actors. By defining the EF as an attempt to calculate sustainability, it is also made specific that it is not a sollution or an indicator whose results is to be regarded as the 'truth'. By doing so the EF is first and foremost created as useful in demonstrating how to critically think and interpret the knowledge which the indicator represents, by revealing the construction of the EF. As such, Susanne does not act as a spokesperson for translating the EF. Rather the EF is being used as an actor to introduce the network of EI, and how to question actors of 'scientific fact', making up the network of EI.

We know from ANT that actor's will typically meet resistance during attempts of translation. Regarding Susannes controversies with fellow teachers, it becomes clear that the EF-actor is constructed within a network with the understanding and belief that there are 'threats' towards the environment. Based on the protests we must assume that the understanding, where the EF is associated and which Susanne promotes and strives to translate as a spokesperson, could jeopardize the legitimacy of her fellow teacher's knowledge and beliefs. This resulted in their protests.

In summary, the EF is translated through a schoolbook. The EF was used as it was regarded easy to understand and as an actor to communicate indicators weaknesses and strengths. Wackernagel worked as a spokesperson for the EF, making Susanne interested in the EF. By writing the book the EF becomes an immutable mobile, which can circulate in a number of educational networks.

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[1] Electronic version can be found here: http://www.fys.dk/nfa/01/heftet/baeredygtig.pdf

6.3 Svanholm and the student project

Svanholm (visited in May 13, 2009) is a community established in 1978, located 60 km outside Copenhagen. Today there are 130 inhabitants living at Svanholm, in separate apartments or houses located on and around the estate. Together they run an ecological farm and a number of smaller businesses. Their "basis is formed by common ideals concerning ecology, income sharing, communal living, and finally, self government." (www.svanholm.dk, 2010).

I contacted Svanholm, after finding a student project posted at several universities in Copenhagen, under the name 'Ecological footprint for Svanholm'[1]. The document presents Svanholm as an ecological community who wants an EF analysis of its community and businesses, and a strategy for decreasing this measure. Moreover, the project description also asks for a 'lifecycle analysis' calculating when it would be optimal to change cars and appliances. Finally the student project should include a description of "the model and analysis models in general terms", to make it possible for other eco-communities to make the same types of calculations based on the same model. The project not only reflects specific hopes for what the EF can do for Svanholm and other eco-communities, but also what a Bachelor or Master student can do in one project.

When arriving at Svanholm I met Bo who works as a 'tour guide' at Svanholm. He has extensive knowledge of Svanholm, its inhabitants and their way of living. However, he does not know much about the EF and why this indicator in specific has been regarded as useful to Svanholm. Bo introduces me to a number of people in the community, in search for someone who might know more about the EF. An administrator at Svanholm recalls that the project was first suggested by a member that no longer lives at Svanholm.

Throughout my visit I learned that people at Svanholm put a lot of work and dedication into their community, which they are proud of and see as part of their identity. Also, it became clear that one of the central issues at Svanholm is sustainability, in the sense of being self-sufficient by preserving the land that they live on, and of. They are concerned about their environmental impact they are making and are interested in the possibility of developing, including investing money into projects that can contribute to lowering their CO_2 emission and/or decrease their EF.

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[1] Original student project can be found in appendix 12.

By 2010, no one has yet replied to the challenge of calculating and writing about Svanholms EF.

6.3.1 Case study analysis

The 'lifecycle analysis' and the EF is in the student project described as a rather clear and transparent 'models', which can be explained in general terms for later replication. Furthermore defined as a detailed method which can measure specific local environmental factors. Both can be regarded as factors enabling use of the EF.

The EF is understood as a model, which can be replicated in similar areas, once the method is developed. Also the data which the EF measures, is understood as a measurement which can be read, and/or counted, in an empirical world. The administrator explained that the project was intended to show Svanholm's environmental impact, point out areas where they could improve and continuously monitor their development and progress. She explains that the project was intended as a form of self-reflection, and potentially be used to 'promote' Svanholm as a highly sustainable, eco-friendly community.

The EF is defined as a measurement tool in the project description, but the measurement tool is defined based on the understanding of what the EF can show and contribute within the community. As such, the EF has become the focus of some ideas and wishes, related to an overall plan of the Svanholm community. But as no one reacted to the student project, the EF of Svanholm has (yet) not been calculated. Why this is, we can not know for sure. But one reason might be that the description of the EF, does not correspond to the descriptions and definitions of the EF used in other settings. Also the EF is generally being used and associated with national and global measures, working on a larger scale.

In summary, use of the EF is being enabled at Svanholm based on being defined as a clear and transparent model, which can measure local environmental factors and be explained in general terms for later replication. The EF is moreover, being enabled based on the community wanting to improve and continuously monitor their development and progress, which potentially can be used to promote Svanholm as an environmentally friendly way of living.

6.3.2 Actor-network theory analysis

The EF is defined and created in the Svanholm network through ideas and hopes for what it can do and contribute with, in the form of self-reflection, identity-building and improvement of current attempts at an environmentally friendly way of living. To make this possible they see an academic student as a possible OPP, making it possible to create and define the EF-actor as part of their network. The aim of the project is thus not 'only' to translate the EF-actor into the Svanholm-network, but also translating and creating the EF-actor according to the definition already created within the Svanholm-network.

The EF is defined as a model that can calculated resources, energy and use of materials on a small scale. This is rather different from how the EF is typically used, to calculate natural resources on a global and national scale.

The Svanholm EF-actor is still just an idea of what the EF could be and do for the ecological farm community. Students might find it difficult to combine and enroll a Master or Bachelor thesis defined within a university network, with Svanholms project. In a Master or Bachelor thesis, Svanholm would have to be the study object and the EF would be both the theory and the method for how to study Svanholm (apart from the life-cycle analysis). This could be feasible, but also risky as the EF is not clearly defined as a scientific theory or a well-known, generally accepted scientific method. As such the student, apart form meeting challenges in translating the EF, might also have problems when translating and enrolling this project into a university-network, and meet the requirements for translation within this actor-world.

In summary, the EF is defined as an actor and an inscription device which can calculate and measure local consumption of not only natural resources, but also use of heating, kitchen supplies etc. The EF is for now primarily an idea of what the EF model can do for the Svanholm-network.

6.4 Miljøpunkt, Jens and the blog

Miljøpunkt works towards implementing the Agenda 21 plan of sustainable development for the 21st century, signed by 181 countries at United Nations Conference on Environment and

Development, in Rio de Janeiro in 1992. In 2007 politicians decided that locally oriented environmental centres should cover all parts of Copenhagen. By 2009 a total of 8 independent Miljøpunkt centres were established. They are financially supported and organized under the municipality.

The EF is mentioned on a blog at Miljøpunkt Indre by og Christianshavn's (MIC) homepage. Especially four articles from 2008, talk about the EF. The first two are written on March 4, the others are dated May 17. and October 29 (2010). It is not clear who has written the blog, but upon request I learn that Jens[1] the leader of MIC, is the author of the blog. At the time I met Jens, MIC had just opened in the centre of Copenhagen. Apart from Jens, there were one accountant and a few employees working on the start up of establishing the centre.

Jens has a Ph.D. in Architecture and has several years of experience as an Architectural researcher. During his student years he was part of a group working on Architecture and ecology, and defines his studies as a study of cultural ecology. Today he lives in a house outside Copenhagen, owns his own windmill and is passionately engaged in EI. He defines MIC's most important task as creating room for opportunities to make changes and do something for the environment. He is stressing the necessity of creating a connection between 'environmental problems' and 'what we can do about it', to reach this aim.

Jens states that one of the goals of the centre is to work towards an overall scenario of a different Copenhagen. Instead of making small changes from how things are now, we have to create small changes in a larger perspective. We have placed ourselves in a very difficult situation, where we are captured in our consumption patterns, argues Jens. This is partly due to a commercial industry constantly telling us we need a to consume to be happy. The politicians do not dare say that we need to make drastic changes and even people who have realized how messed up it is, are still traveling the world 5 times a year. We are not very consequent in what we do, even when it comes to issues where we can actually make changes, argues Jens.

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[1] For transcribed and translated interview (May 18, 2009) see appendix 10.

6.4.1 Case study analysis

When communicating through the blog, Jens explains that he attempts to avoid frightening people, but tries to present arguments based on scientific data. This is also how the EF is made useful. Both in our conversation and on the blog, the EF is presented as scientific data, used to support arguments and opinions about the need to act and make changes. Jens argues that, a general model, such as the EF, offers a better way of looking at environmental problems, as it provides an overview of the situation, rather than only focusing on, for example CO_2. Furthermore, stating that knowledge which can be made understandable for most people is very helpful when communicating EI. The EF is presented as an example of such knowledge.

Most people working with EI, focus on communicating these issues and are also interested in how to do this in the most effective way, argues Jens. This tendency, however, has also lead to over-simplifications, states Jens, giving the example that the way the EF calculates CO_2, by forest areal, is a mix of abstraction level. On one hand, the EF is very concrete, by for example stating that we consume resources equivalent to 3 and a half planets. On the other hand, it is abstract by calculating CO_2 based on hypothetically planting of x hectares of forest. As CO_2 accounts for a large part of the over-consumption of the earths resources, the EF basically provides an illustration of how much forest we need to plant to solve the environmental problems of today. But this planting of forest will of course not happen, states Jens.

Jens argues that the '*fun and catchy*' has had a tendency to replace an in-depth understanding of the context. One example is 'climate' which is stealing most of the attention in the public debate today. As a consequence a large number of organizations try to relate to climatic issues to get attention. This is also the case for MIC. The municipality forced Miljøpunkt to change their original name 'Agenda 21', which is associated with sustainable development, to Miljøpunkt which gives the impression that the environment is our main concern, explains Jens. At the same time, he regards this as a necessary process, where we learn that EI are related to everything, before we can start working on more specific issues.

Jens expresses great plans and hopes for MIC, which is still to be tested and tried out in 'real life'. It is somewhat difficult to separate Jens opinions and understandings, from the aims and purposes of MIC. This might be a result of MIC still being in its start-up fase, and its main objectives and aims are still to be clearly defined. When talking to Jens however, it becomes

clear that the EF as such, offers little help in their everyday work. This can be seen as a result of MIC primarily working on practical issues and processes of change, rather than communicating knowledge and EI generally. As a consequence the EF is not incorporated in any concrete projects in collaboration with local actors and citizens. As such, the EF fails to be included and made useful related to Miljøpunkts practical objectives.

Enabling factors for use of the EF on the MIC blog, is its representation of scientific data, which creates an overview and is perceived as easy to understand for most people. One the other hand, the EF is a simplification, which mixes various abstraction levels. All in all, the EF is enabled related to communication, but fails when it comes to the practical application and making actual change.

In summary, use of the EF is enabled at MIC based on being built on scientific data. Moreover, it is enabled based on providing an overview and is useful in supporting arguments and opinions about the need to act and make changes. The EF is regarded as easy to understand for most people, which is helpful when communicating EI. Hindering factors includes the EF's mix of abstraction level, and its inability to be made useful in practical applications.

6.4.2 Actor-network theory analysis

MIC's main object is to create new actors and networks, and teach people to translate and define their own actions, as actors within a network of EI. The EF is not being used on a daily basis in the MIC-network and is as such not defined as useful for translating environmental problems, into action. The EF is defined and created in the MIC-network through the blog, where it is used to support the aim of the MIC-network. This is done in a number of ways.

The first article, presents a video of Wackernagel talking about the environment and the EF. The article summarizes some of the points mentioned in the video, stressing the industrialized countries unsustainable consumption patterns, consuming the earths global resources without worrying about whether ecosystems can keep up with it or not. Wackernagel works here as a spokesperson for the EF. The video is presented on the MIC homepage and as such MIC also works as a spokesperson for the EF and Wackernagel's work.

The second article states that: "Global Footprint Network works with a simple, but telling measurement of the earths sustainability, the ecological footprint." The article focuses on what

the EF shows and the problems of large consumption of resources. It states that it is scary to think about the potential consequences of next generation of cars and airplanes relying on biofuels. It is argued that this will demand enormous cultivation areals, which literally means "taking food out of the mouth of the worlds poorest people"[1]. The article concludes that we need to prioritize our use to sustain basic needs if we want there to be a "fruitful, beautiful, green planet for further generations". The EF-actor is here defined and created, related both to the world poorest people, the future state of the planet, and future generations. As such the EF is made useful by warning people, creating a connection between the EF and 'poor people', while legitimizing the need for urgent changes.

The next article on the blog refers to WWF and the LPR. The first article presents a graph, originating from the LPR, showing the EF of different countries. The second article tells more specifically about what WWF and the LPR are showing, mentioning that Denmark is the fourth biggest consumer of resources in the world. It quotes a WWF representative arguing that Denmark coming in forth is "embarrassing"[2], and concludes that it is an "alarming picture" of the current situation.

When presenting the EF in these articles, both Wackernagel, GFN, WWF, actors from WWF and LPR are enrolled. These actors are closely related with similar actor-worlds and aims, but when translated in the MIC blog they are enrolled as individual networks. In this way they are not only working as actors supporting the legitimacy of the EF-network and the existence of serious environmental problems, but also, these actors support the aim of the MIC network. The blog is written by Jens at a time where MIC is still being planed and developed. As such the statements and arguments presented on the blog can be seen as actors supporting and legitimizing the establishment of MIC, and its work with EI.

The EF is mentioned briefly in some later entries of the blog. In these cases, the EF is black boxed, mentioned without any further explanation of what it is or what it stands for. The EF is here being used to strengthen or explain problems of various actions. One example, concerning the use of biofuel, and it is concluded that the Danes consume as if they had 3 planets of resources at their dispence, and by carrying on consuming in the same speed as now, it will

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[1] http://a21.dk/blog/2008/03/04/europe-2007-gross-domestic-product-and-ecological-footprint/
[2] http://a21.dk/blog/2008/10/29/dansk-forbrug-af-naturressourcer-blandt-verdens-hoejeste/

continuously expand our 'global ecological footprint'[1]. The EF is here defined as an actor in its own right, which needs no further introduction or explanation.

In summary, the EF is enrolled in the MIC-network through the blog, where it is used as a scientific actor, supporting the legitimacy of the MIC-network and the need for change. The EF is translated by using both Wackernagel and a WWF representative as a spokesperson. After introducing the EF in four entries, the EF is later black boxed.

6.5 Research, Johan and the report

In 1995 the government published the report "Natur- og Miljøpolitisk Redegørelse", which presents the indicator, Environmental utilization space (EUS). At the time, the discussion of sustainable development and EI was still being established both in Denmark, and abroad. The report was produced by the Danish Ministry of the Environment, who later asked the National Environmental Research Institute (NERI) to further develop the EUS as an attempt to frame sustainability in a way which could be used politically. Johan[2], became responsible for the research team working on the report. The overall aim of the project, which was carried out in the beginning of the 1990's, was to find a way to work with sustainability within the ministry.

EUS is defined as the amount of natural resources which can be used per year, without prohibiting future generations accessing the same amount and quality. The references to the Brundtland commissions definition of sustainable development is clear, where the perspective on current consumption is understood in a longterm and global perspective. The report published by our research group investigates how to adjust human consumption within a certain measurement, explains Johan.

The findings in the report turned out to be too uncertain, despite the efforts to overcome this problem, explains Johan. For example, based on our calculations, we concluded that it is very feasible to produce enough food for the world population, provided you have the social and economical resources. But, argues Johan, as you do not have the social and economical resources, what is the truth? Can you, or can you not produce enough food? It is very difficult

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[1] http://a21.dk/blog/2008/04/16/sultne-motorer/
[2] For transcribed and translated interview (May 19, 2009) see appendix 11

to make scientifically sound methods to calculate consumption and sustainability. It is simply too uncertain - in every way, states Johan. The report was finished in 1994, and was later ignored by the ministry.

The EF is not used in the research project and we must assume that Johans arguments are based on experience from working with the EUS indicator. Johan is not talking about the EF or EUS specifically, but about 'this types of indicators' and methods to calculate consumption and sustainable development. A similar tendency can be detected in the story of how leaders at NERI were against the project, not because of the EUS as such, but because of the calculations and methods which the EUS represent. In this case, 'this types of indicators', are regarded as too uncertain and unfitted for a political setting.

People do not understand the dimensions of the problem and as a result they are not willing to accept the necessary changes, argues Johan. He is convinced we are facing a severe price increase of energy within the next 10-15 years, which eventually will force us to make some change in our consumption of energy. I normally say when I go travelling in the summer, its all about using my CO_2-quotas while I can, says Johan with a smile.

6.5.1 Case study analysis

When Johan and his research group at NERI started working on the EUS, the EF was already known, but both NERI and the Ministry were not inclined to start working on the EF without really knowing what it represented. Also, they were uncertain whether hectares was a good way to measure use of resources. Another hindering factor which Johan mentions is that the EF was already associated with the political statements being used by NGO's. Being associated with NGO's is not favorable in a political setting, argues Johan. When they started the research, several leaders at NERI argued that it was 'completely crazy' to start working with these types of analysis. Johan explains the argument by stating that indicators, and especially composite indicators will always contain a great deal of uncertainty, meaning that scientifically they can always be made invalid. Moreover, these indicators do not include other factors of sustainability, such as economical and social aspects.

These factors are essential in a political context where you have a combined agenda, argues Johan. You both have to consider the area you are looking at, the political realities and the

effects of your decisions in other areas. Otherwise, you might end up having scientific data showing that a certain reduction of CO_2-emissions is absolutely necessary, which on the other hand is completely impossible to do politically.

In summary, Johan mentions no enabling factors for using the EF. The EF were hindered from a political setting based on the way it is calculated and its uncertain measures. Furthermore, the EF was already embedded with understandings from being associated within NGO's, as well as ignoring economical and social factors which is essential to consider when acting in a political setting.

6.5.2 Actor-network theory analysis

The report made by Johan and his research team was created as an immutable mobile, intended to circulate in the political-network as a scientific-actor showing specific problem areas and sollutions. In a political-network there is a number of different actors which need to be taken into account, as well as a political framework to which the statements and claims being presented, have to adhere, argues Johan. Within these networks composite indicators like the EUS and the EF are too uncertain and the reduction of production and consumption which these indicators suggests are simply politically unacceptable, claims Johan. Johan treats the EF as equivalent to the EUS, which is based on the understanding that it will have similar properties as an actor, within the scientific and political networks.

The EF was at the time translated and practiced within NGO's. According to Johan this prohibited the EF from being used within the ministry and other political networks, as this ment it was already associated with the political meanings and understandings of NGO's. We recognize this logic from ANT, stating that actors do not come alone but carry with them modes and modulations when being translated from one network to another.

Actors often fail in the attempts of translation into new networks, as this results in disturbances and change, contradictions and conflicts, in the network. At the time, when the report was published, we know there were no clearly defined and established environmental network within the ministry. It is only in the past 10 years that environmental actors have become translated within the political network, and that the political network is being constructed with aims and purposes related to environmental actors. This means that there were no established

network in which the report could circulate and form new actor-relations. We do not know how the report was attempted to be translated (spokespersons, obligatory-passage-points etc.), but based on Johans statements we can assume that no one at NERI could have worked actively as spokespersons for the EUS. All in all, the report failed to form new actor-relations, changing and adding present understandings and beliefs in the political-network.

In summary, the EF is not translated, nor being used in the network. This is a result of the EF being defined as too uncertain and vague, both in the scientific and political network. Related to the political network, the EF also carried with it modes and modulations form being associated within NGO's, which are perceived as problematic in a political network.

6.6 Summary of analysis

Use of the EF have been investigated at WWF, a schoolbook, Svanholm, MIC, and related to Johan and his prior research group. The settings have been analysed with the two approaches ANT and CS research based on their individual research questions. The outcome of the two analysis will be presented in the following chapters.

6.6.1 Summary of the case study analysis

WWF's main aim is 'to protect the future of the nature'. Signe works with the EF, and has extensive knowledge about the method. She defines the EF as a scientific method to uncover human demand on the world's ecosystem. The LPR is produced in a collaboration between GFN and WWF, and builds on the EF. Factors enabling the use of the EF includes the EF's ability to measure renewable resources globally and the fact that it is intuitive and easy to communicate. As such, the EF is made useful by supporting and enabling the overall aim of WWF. Hindering factors includes the fact that the dataset which the EF builds on and the method has to be updated regularly, and this is regarded as 'very expensive'. Also, it fails to be part of the process of creating change and as the critical environmental conditions is regarded as well-established, the EF is loosing its relevance within WWF.

Susanne wrote a gymnasium schoolbook about the EF. She has been working on EI since the 70's, both as a researcher and a school teacher. The aim of the schoolbook was to influence

and teach Gymnasium students about EI. The EF is defined as an example of how to calculate sustainability and development, and used to teach students how to understand, use and think critically about indicators and EI. Enabling factors include how GFN and Wackernagel promote the EF, making it available and known as a teaching subject. Also, Susanne regards the EF as easy to communicate and helpful when teaching students to think critically about EI. This might also be explained based on the understanding that there are a number of weaknesses in the way the EF is measured and calculated. Susanne mentions no hindering factors related to use of the EF within a teaching context, apart from her experiences of fellow teachers objecting against her teaching the students about EI.

The ecological farm collective Svanholm, has integrated the EF in a student project they have posted on universities in Copenhagen. Their aim is to keep a community lifestyle focusing on ecology, self-sufficiency and sustainability. The EF is defined as a method which can measure and calculate use of resources in detail. It is intended to be used for building identity, measure and see progress, as well as creating the basis for a model to calculate and measure ressource use at other eco-communities. There are as such a number of enabling factors using the EF with Svanholm, but one external factor is hindering the EF from being used within Svanholm, namely that no one has responded to the project. The EF for Svanholm has not yet been measured and calculated.

Miljøpunkt is working towards a sustainable development in Copenhagen. Jens is the leader of MIC and has been involved in EI for years. He defines the EF as one way to scientifically measure the state of the environment. The EF is mentioned on MIC's blog, where it is used to scientifically support claims of a need for change. As such it is also part of legitimizing the need for MIC. Another enabling factor includes the overview which the EF provides, rather than only focusing on for example CO_2. Also, it can be made understandable to most people. The EF is only mentioned on the blog and not used within MIC on a daily basis. As such it fails to be made useful related to practical project. Jens also points out the EF's mix of abstraction levels, in the way it is calculated.

The research project which Johan was a part of, focused on the EUS indicator, and how to adjust human consumption within a certain measurement. This was intended to be used as a basis for political discussions within the ministry. The EF is defined as an indicator calculating

consumption in hectare, and is one indicator of several, measuring resources. There is not mentioned any enabling factors for using the EF, neither in a research context, nor a political. The EF is already embedded with political understandings from NGO's making difficult to use politically. It is too narrow, for the combined agenda in a political setting, and contains a great deal of uncertainty.

Generally the RP's presents various reasons for using the EF. All of them mention increased environmental understanding and awareness, as part of the reason for using it. This suggests that EI as a subject of interest and importance within the context can be regarded as an important factor for the EF to be regarded as relevant and useful. In all cases, except related to the research group, the EF becomes useful as part of legitimizing and supporting existing ideas and understandings of EI. In all cases, the EF does not seem to affect understandings of indicators and EI.

Apart from Svanholm, who primarily wants to use the EF within their own setting, the RP and the setting they represent, are working to create influence outside their own context. When the EF is enabled in these settings, it is partly based on being regarded as easy to communicate.

Susanne, Signe and Jens stand out as especially passionate about EI and communicating these issues to a broader public, which is defined as a large part of their professional life. They are also responsible for defining the EF as useful within the setting they represent, and as such might be regarded as enabling factors for use of the EF.

6.6.2 Summary of the Actor-network theory analysis
As expected based on ANT's understanding, the EF-actor is multiple, defined to fit the specific network in which it is associated. The overview shows the network where the EF is defined, their overall aim and purpose, how the EF is defined and how the EF is made useful within the network.

Network	Overall aim and purpose of network	Definition of the EF	EF's use/aim within the network
'Verdensnaturfond', WWF Denmark.	Protect the future of the nature.	An intuitive concept, which is easy to communicate	Support and strengthen understandings of EI in the network. Create images in peoples head.
Living Planet Report.	Provide a periodic update on the state of the nature and world's ecosystems.	Scientific method to uncover human demand on the world's ecosystem.	Show the state of the nature, its development and what needs to be done.
Schoolteacher and former researcher working with environmental issues.	Influence and teach Gymnasium students general knowledge.	The EF is an environmental measurement tool, which can be communicated and problematize.	Teach students to use and think critically about indicators and be aware of EI.
Gymnasium schoolbook.	Influence and teach students about the EF, sustainability and EI in general.	Example of a method to calculate sustainability and development. A good visual concept.	Educate students of how resources can be calculated, why this is necessary and how to think critically indicators and EI.
The ecological farm community, Svanholm.	Create a community and a lifestyle, focusing on ecology, self-sufficiency and sustainability.	A method which can measure and calculate specific use resources, incl. electricity, space, materials, etc.	Identity marker. Measure and see progress. Replicate the method at other communities.
Svanholms student project.	Make a replicable method/formula to calculate current use of resources and detect new sustainable sollutions.	A method which can measure and calculate use of resources, incl. electricity, space, materials etc. A formula which can be reused at similar areas.	Create a 'formular' to calculate and measure ressource use at Svanholm and other eco-communities. This has however not been done yet.
Miljøpunkt inner city and Christianshavn, through the center leader.	Working towards sustainability and attention to EI.	One way to scientifically measure the state of the environment.	Not used.
Blog about environmental and climate issues.	Inform and update on issues regarding 'climate and sustainability, Copenhagen and the global reality'	Scientific method to uncovers human demand on the world's ecosystem (referees to LPR).	Scientifically support claims of need for change and the 'alarming' state of the planet.
Researcher at National environmental research institute.	Develop an indicator, measuring resources, to be used politically by the ministry.	An environmental measurement tool, which is too 'vague', unscientific and uncertain. Not suitable for political use.	As a methodological starting point to create a new indicator. The alternative indicator was created but never used.

The EF is a network consisting of measurements of material. These materials are defined as natural resources, based on being defined as materials which humans can use, consume and otherwise remake into useful entities. When the EF is investigated in this study, we are thus not first and foremost investigating natural resources, but an actor representing scientific projections of human activity.

The EF is part of creating networks. However this study shows that the EF is not essential to the network or in its process of obtaining its aim and purpose. Translating EI are part of the aim within all the networks presented, and it is within this process that the EF-actor is defined and made useful. Apart from the research-network, the EF is used as a concept, which is part of creating and supporting certain understandings making up the actor-world in the network. Within both WWF, Svanholm and the schoolbook, the EF is defined as a method and a tool to measure and calculate resources. Also here, the reason and purpose for using the EF-method, is based on the EF-actors ability to be translated into the actor-world of a network, supporting its aim and purpose.

In all the cases there are distinct understandings which the EF adheres to, rather than transforms or changes. As such, the EF does not seem to transform the network or its aim, rather is being used to reinforce existing beliefs and understandings. This is even the case in the research-network where there are predefined understandings of indicators, 'like the EF', to be uncertain and vague. This understanding is only being reinforced.

Johan defines the EF as too vague and uncertain to be translated and used in a political network. Also, it was hindered from being used in a political network, because it had been associated within NGO networks and their understandings. This claim is based on the understanding that the EF carries with it defined understandings and definitions from the NGO, which could become problematic within a political network due to conflicting definitions and association to already established viewpoints. Svanholm wanted the EF to be translated in their network. That this did not happen is not due to definitions of the EF or its modes and modulations, rather the lack of an OPP, in the form of a student-actor, which could translate the EF-actor within the Svanholm-network.

Signe (WWF), Susanne (schoolbook) and Jens (MIC), have worked as spokespersons for the EF, both to translate the EF into the network to which they are associated, but also in the process of translating EI within other networks. An initial interest and focus on EI's were established within WWF and in relation to the schoolbook, but the EF was translated and defined as a result of GFN spokespersons working to translate the EF. Both MIC, Svanholm and also the research network shows no direct relation to GFN. None of the networks are associated with each other, which might explain why there practically can not be detected any disturbances or overlaps of the EF definitions, despite there being variations in both definition and practice.

7. Final remarks and conclusions

The Ecological Footprint (EF) and the findings from the analysis is presented in Chapter 7.1. The case study (CS) approach is discussed in Chapter 7.2 and the application of Actor-network theory (ANT) is discussed in Chapter 7.3. The results are related to the POINT-project in Chapter 7.4.

7.1 The Ecological Footprint

During this study I realized that EI is not first and foremost about the environment, nature or the earth, but about human activities and its consequences for human activities in the future. This also applies to climate change, global warming, sustainable development and also the EF. The EF does not measure 'natural resources' or land areal, rather provides a measure of a given land areas average productivity. Productivity of resources useful to humans, that is. As such, 'the earth', according to the EF is a producer which is measured and evaluated based on the level of usefulness of the resources humans can extract from it.

The EF was first created by Wackernagel, but is today created, defined and developed by GFN. GFN consists of some 20 workers, sitting at desks, looking into computer screens in an office building outside San Fransisco. When the EF is investigated in this study, it is not first

and foremost the 'GFN-EF' which is being studied, rather this study investigates how the EF 'concept' is made useful and relevant in various danish settings. This study shows that the EF is being enabling in settings where EI are already defined as relevant and important, and communication is an essential aim of the setting. It seem to be a common understanding that communication of EI has to happen based on knowledge, and it is in this process that the EF is, or potentially is, defined as useful.

7.1.1 Exploring Ecological Footprint using Case study research

At WWF the EF is enabled based on providing a holistic view, and being an intuitive concept which is easy to understand and communicate. The only mentioned hindering factor is external, concerning the price of the EF dataset and method. On MIC's blog the EF is used based on being scientific and providing an overview which is perceived as easy to understand. The EF fails, however, when it comes to the practical application and making change. Susanne wrote about the EF after hearing Wackernagel presenting it, and regards the EF as easy to communicate in an educational setting. The only hindering factor mentioned is fellow teachers working against the idea of EI in general. At Svanholm a number of enabling factors for using the EF is mentioned, including its ability as a measuring tool, which can be costume-made and replicated in similar areas. Johan mentions no enabling factors for use of the EF related to research and scientific settings. Hindering factors include the way the EF is calculated and its uncertain measures. Furthermore, the EF was already associated with the NGO cause and so compromised an unbiased political agenda. Finally, the EF ignores economical and social factors which is essential to consider when acting in a political setting.

7.1.2 Exploring Ecological Footprint using Actor-network theory

At WWF the EF is used as a measuring tool and inscription device, making it possible to translate resources and the nature into numbers and intuitive images. The EF is translated through the LPR, which supports the legitimacy of WWF by establishing that the nature is threatened by human action. In the MIC-network the EF is enrolled through a blog, where it is used as a scientific actor, supporting the legitimacy of the MIC-network and the need for change. The EF is used in Susanne's schoolbook as an example of how indicator-actors has both weaknesses and strengths. The EF is not translated, nor being used in the research

network which Johan was part of. This is a result of the EF being defined as too uncertain and vague, both in the scientific network, but also related to a political network. Based on being used within NGO's the EF is defined as carrying with it modes and modulations which might be problematic in a political network. In the Svanholm network the EF is defined based on the ideas and hopes for what the EF can do and contribute with.

7.2 Case study research

CS research is based on the understanding of the existence of an empirical world which we can explore and understand through a set of strategies. Parts can be separated from its context, making it possible to see layers, single settings and seek causal explanations. The CS focuses on entities in its context, which practically means that the research question and relevancy can direct the scope. The CS approach provides little directions on how to interpret empirical data, and work primarily as a research strategy, where the researcher is left to do and include what s/he wants.

When investigating the EF using the CS approach, the context in which the EF is embedded becomes essential to the understanding of the EF. The context is here investigated through interviews and written documents about the EF. But practically, when searching for hindering and enabling factors, these are primarily defined based on interviews and the RP's understanding, motivations and insight in the context. The definition and use of the EF, is in this case primarily detected through the written materials. This however might be specific for this study.

The CS approach allows an active search towards the aspects one wants to investigate. The study of the EF lead to an overview and insight into how it is being used, as well as a number of factors hindering and enabling use of the EF. The outcome of the CS, however, essentially depends on the researcher, both to formulate a fruitful question, collect a rich data material and create an analysis, telling a convincing and coherent story. This is of course true for all types of research, but seem to be more explicit when using the CS.

The CS provides a set of guidelines for the research process and a reminder of potential pitfalls and issues to consider. It does not exclude theories or the use of methods to collect data,

nor does it dictates whether theory or data is needed or essential. Most sociological studies include a set of theories and methods, which are specific for the field. In these studies it seem that the CS would only create one extra layer of guidelines, when approaching the empirical field. In studies where the researcher tries to make a first move into a new field, question or problem in a real-life setting, and time is scarce, the CS seems to be a helpful tool, as a framework to guide the study process. As such the CS could also be useful related to the POINT-project, as a framework to create insight, knowledge and overview of the field and area of indicators.

7.3 Actor-network theory

The understanding of ANT is intriguing for a number of reasons. The idea of putting humans and non-humans in the same contextual framework seems like a promising approach when looking at EI. That everything is engaged in networks where new entities have to be molded and accepted to become part and that agency in relations defines an entity, is somewhat intuitive and logical in this setting.

It became clear quite early that ANT's understanding and reasoning is defined in a distinct way, detached from prior research and understandings, making it practically impossible to combine it with other theoretical understandings. Furthermore, when using ANT practically, I also found it hard to combine it with *any* prior ideas and understandings. ANT's focus on translation, seemed to apply just as much to the process of translating the world I knew, as to the understanding and perception of the ANT-universe. I continuously had to force myself to see the world through its conceptual framework.

ANT main focus is translation. I understand the process of translation, as a process of shaping and creating an entity. But in practice, this translation is not first and foremost directed at reshaping of material, but a process involving humans interpreting, understanding and finding ways to deal with its surroundings and the material world. As such the ANT-study is itself a process of translation, which eventually excludes all materials, except the paper which the study is printed on. ANT claims to include both the social and the material world, but in practice it seems to focus on the material world made part of social processes, and social

processes made scientific, through language. I am left wondering if ANT's empirical scope is in fact directed at, and limited to the study of the actual process of material being translated to language.

ANT as a method focuses on the actor and the processes of translation. ANT focus is the process of how an actor come to be, and the process of which the material and social is intertwined. This seem to fit well when dealing with EI. When studying the use of the EF, however, it becomes clear that it is not just the process of the EF becoming which is interesting, but also the context wherein the EF is defined and created. ANT might be interesting when investigating how matter become social and vice versa. However looking at EI in practice related to broader societal settings, ANT provides limited insight.

ANT consist of a rather extensive framework, which I find difficult to see thrive outside the university. One might argue that this should not be a criteria for determining the validity of an approach, theory or method. But I find it difficult to see how ANT's rather particular world can be related to any subject or problem funded outside the university, where the researcher strives to make the research applicable and useful. The reason is simply that it is unclear what the conceptual framework of ANT is intended to contribute with, and what we gain from its descriptions. This also makes it difficult to determine what ANT can contribute with regarding the POINT-project and studies of EI in general.

7.4 POINT-project

The aim of the POINT-project, was to look at indicators and their "influence chains", to "improve indicator influence, by helping to better understand factors that enable and hinder the usefulness of indicators in policymaking" (point.pbworks.com)[1]. This formulation rests on the assumption that the influence of an indicator can be improved, and that an indicator has a certain usefulness, which can be hindered and enabled.

This study shows that it is not the make up of the EF, but rather its ability to fit and adhere to the aims and understandings in the setting, which determines whether it is being hindered or

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[1] See appendix 1 for project description

enabled. The EF fail when it comes to being part of making change, as was detected in both the MIC and the WWF setting. This is the case both when the EF becomes part of a setting, but also when a setting works towards making change. This study can not explain why this is, but this knowledge might have implications related to policy-making in a political setting, which essentially is about making change.

This study also shows that the EF is being used in different ways, based on different definitions and understandings. We know that the EF is associated to NGO's, which already has been defined as problemtic in a political setting. Moreover researchers and leaders at NERI has defined the EF as uncertain and too vague. If the EF was to be used in a political setting, these definitions would have to be ignored. From WWF we know it requires methodological updates and new datasets, to continuously work with the EF. This is costly and requires some sort of collaboration with GFN. Collaborating with GFN, also means working towards their aim of accelerating the use of the EF, which would not correspond to the processes and aims of a ministry. As such, one might argue that the EF would prove useful within policy-making, but there are a large number of external factors, which makes the EF difficult, if not impossible, to use within a political setting.

Instead of asking how to improve the influence of environmental indicators, one could rather ask what influence one want an indicator to have and start looking at how these influences can be created. The European Environmental Agency (EEA) works under the EU and consists of 204 employees working to make EEA "a major information source for those involved in developing, adopting, implementing and evaluating environmental policy" (www.eea/europa.eu). They develop a number of indicators and composite indicators, most of which are requested from within the EU-commission. According to EEA, these indicators are not being ignored or misused. It would be interesting to look closer at what indicators the EU commission requests, based on what questions or problems these indicators are being requested, and for what purpose. This might be a fruitful starting point to investigate which indicators are requested, for what purpose they are requested and what processes they are part of, within the EU policy making process.

8. References

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8.1 Internet resources

- 'Bæredygtig udvikling – det økologiske fodaftryk' (2006), electronic version : http://www.fys.dk/nfa/01/heftet/baeredygtig.pdf

- Global Footprintnetwork (GFN) : www.Footprintnetwork.org

- Informedia : www.Infomedia.dk

- Living Planet report 2008, electronic version : http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/living_planet_report_timeline/lpr_2008/

- Miljøpunkt homepage : www.a21.dk

- Ministry of the environment : www.mim.dk

- NOAH : www.noah.dk

- POINT-project, homepage : http://point.pbworks.com

- Svanholm's homepage : www.Svanholm.dk

- World wildlife Fund : www.wwf.dk, and www.panda.org