On how to Conduct Multidisciplinary Environmental Research:
The case of Lund University

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Abstract
The process of creating a centre for multidisciplinary co-operation on environmental issues at Lund University was analysed as a case study regarding the theoretical aspects of these kind of activities within the university system. The discussions within Lund University point to potential problems regarding the theoretical framework of the concept of the environment, the methodology of multidisciplinary research and the aspect of ensuring a high scientific quality of these activities. The organisational setting of the centre can be of great importance regarding the legitimacy of the centre activities within the rest of the university.

Keywords: Environmental research, multidisciplinary research, scientific ideals, quality control.
1. Introduction

The Lund University Master's Programme in Environmental Science/Studies (LUMES) was started in the autumn of 1997 and I was part of the first batch of international students participating. This thesis is a product of the multidisciplinary atmosphere of LUMES, as we were constantly encouraged to explore new aspects of the environmental discourse. My background is not within environmental history, policy making or philosophy of science, although this could be expected considering the topic of this thesis and as much of the theoretical framework of this piece of work is found within these subjects. Instead, I have a Master of Science degree in geology. Without the professional guidance of more experienced scholars in these subjects I could not have written this thesis. During the course of working with this thesis I have learnt a lot about science in general and about the multidisciplinary field of environmental science in particular. I have had the opportunity to find out more about how other sciences view the environmental field of research and I have got a glimpse of the wealth of knowledge on the environment there is to find within all these sciences. Hopefully this has increased my competence as a participant in future multidisciplinary environmental research projects and hopefully this thesis will contribute somewhat to the discussion on this kind of research.

The purpose of this thesis is to describe, discuss and analyse the theoretical aspects of creating a centre for multidisciplinary environmental activities at Lund University. The discussion is divided into three main areas of potential problems related to multidisciplinary environmental research within the organisational structure of a large university in Sweden; i) the aspect of theoretical framework of environmental science, ii) the methodology of multidisciplinary environmental research and iii) the issue of quality control of these multidisciplinary environmental activities.

The theoretical framework of environmental science, i.e. what is implied when using the concept of the environment in research, is an important issue for discussion in relation to the new centre for university co-operation on these issues. Many disciplines conduct research related to the environment but this area is multifaceted and the definitions of the environment are consequently also very diverse.

Another aspect of these kind of activities is the choice of methodology in research and in education. Multidisciplinary co-operation will be the main strategy of the centre activities and there are theoretical aspects of different sciences co-operating in research, related to for example different scientific traditions.

The third area of multidisciplinary environmental activities within the university that will be discusses in this thesis is the issue of ensuring a high scientific quality of these activities. This aspect is very much related to the issues discussed above regarding theoretical framework and methodology. Differing ideals of science and different scientific traditions among the various parts of the university system make the quality judgement of this multidisciplinary field of research difficult to handle.

The material used in this thesis work has consisted of publications from many scientific areas, as well as unpublished material from the centre formation process at Lund University. In addition to the written material I have also attended meetings related to the centre formation process.
2. The Growth of the Modern Concept of the Environment

The modern environmental movement started worldwide in the middle of the 1960's, inspired by the debate surrounding Rachel Carson's book *Silent Spring*. It must, however, be stressed that the ideas of preservation and protection of nature were not new. In Sweden, many of these thoughts had their origin in the period surrounding the turn of the century. In the late 1800's the ideals of wild and untouched nature in remote areas co-evolved with the new patriotism that grew in the country at that time. In 1909 the first national parks were established in the sparsely populated mountainous northern parts of Sweden. It has been argued that this long tradition of appreciation of nature made the Swedish society more prone to incorporating the new ideas of the environmental movement. The discussion on protection and preservation of nature changed in the 1960's, as the modern concept of the environment was introduced. This new concept dealt with phenomena and problems related both to the natural environment, nature, and to society. For the first time the relationship between man and nature was framed as a serious problem. The strong faith in the possibilities of science and technology of improving the lives of people was hampered somewhat as the awareness of the adverse effects of scientific discoveries and technologies grew. Until the rise of the environmental movement the major threat to the planet had been the nuclear bomb but as the environmental debate continued and the knowledge about the situation grew, the environmental problems came to be seen as the major long-term serious problems. The environmental problems were portrayed as threatening the very existence of mankind, with lethal substances spreading in the ecosystems that humans depend upon. In connection to the rising awareness of poison in nature, there was also an increased debate about the looming crisis regarding resources, because of the population bomb. It became obvious that Homo sapiens was not only threatening the life and well being of other species on the planet, but that human beings were indeed threatening the lives and well being of themselves.

The Swedish word for the environment, *miljö*, received its modern meaning in connection to the rise of this new environmental movement. The concept formation process can be followed in the emergence of many new words connected to the environment. Dictionaries from the

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1 In the book Carson describes the effects of exposure resulting from the indiscriminate use of chemicals in society. She describes how pesticides and insecticides are applied everywhere in our surroundings without concern for the effects these chemicals have on the food chains in nature of which we are also a part. She makes the connection clear between the negative impact we have on other species and the negative impact this will eventually have on ourselves. Carson, R. 1962. *Silent Spring*. Houghton, Miffling, Boston.


4 The peace movement and the environmental movement had many things in common and attracted a similar mix of supporters, people reacting against an, according to them, malfunctioning society.

5 The resulting effect of a large increase in human numbers was portrayed as a resource crisis in 1969 when *The Population Bomb* was published. The authors P. and A. Ehrlich presented the population growth as a frightening scenario with a lack of food and other resources on earth. Ehrlich, P. & A. 1969. *The Population Bomb*. Ballantine. New York.
1960’s and onwards show that 181 new words where miljö is found were introduced during the period 1969-1973. The enlargement of the concept of the environment can be interpreted as a reflection of the need for a concept able to summarise the multitude of issues related to the interaction between society and nature. When analysing the meaning of the word miljö it is obvious that it has got an increasingly positive connotation in society over time. In the 1996 version of the Swedish National Encyclopaedia Dictionary this positive and emotional meaning of the word is described as a strong feature. This positive meaning of miljö can also be detected in the use of the word in commercial presentations and in politics. One example of the increasing use of the concept of the environment in the political debate is that all political parties in Sweden have an environmental policy programme. In the most recent governmental document on environmental policy, the government states that:

"Sweden shall be a leading country regarding an ecologically sustainable development and a strong force internationally on these issues".

It is worth noting the construction “ecologically sustainable development”, which is reflecting the growth of a new terminology surrounding the concept of sustainable development. The original definition by the World Commission on Environment and Development, usually referred to as the Bruntland Commission, was made in *Our Common Future* (1987). This document was used in the preparations for the 1992 UN Conference on Environment and Development (UNCED) in Rio de Janeiro. The concept of sustainable development has subsequently changed somewhat from its original rather vague wording.

“Sustainable development is a development that meets that needs of the present without compromising the ability of future generations to meet their own needs”.

It has come to include many aspects of the words sustainable and development; economic, ecological and social aspects are usually included in the discussion today.

Today there is no political controversy in a governmental statement like the one above from the Swedish government. It has even been claimed that the environmental issues have risen to the same level of political importance as democracy or equality between the sexes. The main political controversies regarding the environment are related to the choice of strategy in dealing with the problems.

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10 Sellerberg, 1994, p6 ff.
3. Scientific Research and the Environmental Debate

From the early days of the concept of the environment, i.e. from the 1960's and onwards, the public debate on environmental issues has had a special characteristic relating to the fact that from the very start scientists have played an important part in the public discussions on the environment. The author of Silent Spring, Rachel Carson, was for example an active researcher in biology. The use of, and focus on, scientific research results and scientific theories in the public discussions are special features of the public environmental discourse. Nowadays science is not only expected to explain and analyse the environmental problems, but also produce knowledge that can be used in designing solutions. One reason for the focus on scientific research regarding environmental problems is that detecting them is often impossible for human senses without the assistance of highly specialised technical equipment and expertise. Many of the environmental problems are caused by very low concentrations of chemical substances without smell or taste and the effects are often found far from the source both in time and geographically. One example is dioxins, a group of highly toxic substances even at extremely low concentrations. These chemicals are anthropogenic in origin, i.e. they are the result of industrial processes. Dioxins are bio-accumulative and these poisonous chemicals are found in the fat tissues of animals far up in the Arctic region. The problems are found thousands of kilometres from the closest source of dioxin emissions. It would be impossible to get a reasonable understanding of this problem without scientific expertise and highly advanced technology for measuring the low dioxin concentrations. Another example of an environmental problem that is highly research dependent is Climate Change. In order to understand this environmental issue we are entirely dependent on scientific research, in that changes in the mean global temperature are very slow. The only way we can get an understanding of the phenomenon of global warming is by using computer models of the atmosphere. By modelling the effects of so called greenhouse gases in the atmosphere and comparing these results with old measurements of climatic factors coupled with models of the climate, the future consequences of these emissions can be predicted. These models are highly complex constructions including many scientific fields of knowledge.

3.1 Science Influencing Politics

The scientific community provides society with experts in possession of this specialised knowledge and the scientific community can therefore exert great influence on how environmental issues and problems are framed and discussed politically. There is a clear interaction between scientists and politicians and it can be argued that there are two interfoliated credibility cycles, one based on scientific recognition and one based on political power. The two groups borrow recognition and legitimacy from each other. The influence exerted by the Intergovernmental Panel on Climate Change (IPCC) on the political negotiations on the climate convention clearly exemplifies the science-politics interface.

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12 For example carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and chlorofluoro carbons (CFC's)
13 IPCC is an organisation initiated by the UN in 1989 to deal with the issue if global warming/the greenhouse effect/climate change. The panel consists of hundreds of researchers with a large number of scientific specialities. The IPCC reports are usually presented in the form of consensus documents in which uncertainties are discussed and analysed. For a more elaborate discussion on the work of IPCC, cf. Bohlin, B. 1993. Hotet om klimatförändring. Forskningens Frontlinjer. Scandinavian University Press, Stockholm. For a further discussion on the interaction between science and politics regarding Climate Change, see Elzinga, A. 1997. From Arrhenius...
Some countries have used scientific uncertainties and disagreements within IPCC to motivate not agreeing on emission reductions of greenhouse gases. On the other hand, most countries base their reductions on scientific data and climate models presented by the IPCC scientific community and therefore the researchers quite obviously influence the political process. One area of political agreement regarding environmentally related issues in Sweden is the positive attitude towards an increase in knowledge on these issues. The political parties seem to agree that one of the most important causes of environmental problems is lack of knowledge about nature and how man is influencing these natural processes and phenomena. The political parties often frame the environmental problems as if they were a question of ignorance and lack of commitment that could probably be corrected if more information and knowledge were produced.

3.2 Positive Attitude towards Science

Scientific knowledge in general is increasingly influential in modern society, as we have created a multitude of so called “expert systems”. The most obvious expert systems are the technological ones, like mass communication systems or transports, but the social-administrative systems, for example the social security systems and the political system, are also influencing our lives in a profound way. It can even be argued that the expert systems constitute the foundation of modern society. In modern Swedish society, the importance of scientific research and higher education has developed into an issue of political consensus, as was mentioned above. One explanation of this political unity, which is said to be rather unique for Sweden, is that the Swedish social-democratic party, together with the labour union, generally has a very positive attitude to higher education. The left wing parties in many other countries traditionally view universities as elitist and conservative. In official documents, higher education and scientific research are consequently often described as crucial components in improving the lives of future generations and in securing the economic future of the country by all the political parties. Swedish politicians often use scientific results and explanations to validate claims and viewpoints in the political debate. The positive attitude towards the universities has resulted in a fairly stable situation regarding the financial resources allocated to the Swedish research community. Even as the political leadership has changed, Sweden has for a number of years been in the top ten in the world regarding how large portion of the GNP that is spent on research and education at the universities. About 3.4% of the Swedish GNP are spent on education and research at the universities. Due to the high societal concern for the environment and a faith in science to find solutions, research on
environmental issues receives considerable financial support. During the period 1992-1997 there was a net addition of financial resources allocated to the environmentally related research and it is estimated that somewhere around 500-600 million Swedish kronor is spent annually on this kind of research in Sweden today. \(^21\) It is difficult to find a more precise estimation of the amount spent on environmental research, as a great part of environmentally related research is classified as research within other areas like energy, consumption patterns or transports.

### 3.3 Demands from Society for Multidisciplinary Research

Even if the financial support to environmental research in Sweden has been high and fairly stable, irrespective of the changes in political leadership, the demands made by society in connection to this allocation of resources have changed with the political climate. Research policy documents are the formal requirements made by the government on the issues the universities are to focus research on. During most of the 1990’s there has been an emphasis put on the usefulness of research in these documents. Other words that are often mentioned in these documents are importance, effects and relevance.\(^22\) In the latest research policy document *Forskning 2000* (Research 2000) from 1998 it is, however, stated that too much stress has been put on the aspects of relevance in research during the past years, which has resulted in an inadequate application of existing findings from research.\(^23\)

Throughout the 1990’s there has also been a request for multidisciplinary research on environmental issues. In 1992 the Swedish Royal Academy of Sciences\(^24\) made an evaluation of the Swedish environmental research. The evaluation committee pointed to the need for more co-ordination between projects, synthesis of results from different environmental investigations and an improved organisation regarding the multidisciplinary aspect of the environmental research.\(^25\) In *Forskning 2000* there is yet another emphasis on the importance of promoting environmental multidisciplinary research. It is suggested that the universities should be allowed to redirect a maximum of 5% of the governmental financial resources that are now allocated to the four main areas of research; medicine, natural sciences, technology and social sciences-humanities to multidisciplinary research projects.\(^26\) This will enable the universities to support multidisciplinary research projects financially if the university boards find it appropriate to do so. One problem with the proposal in the 1998 policy document is that it is a matter of redirecting money, which will ultimately mean that other research within the university will get less funding if multidisciplinary research is favoured.

### 3.4 Complexity Demands Multidisciplinary Solutions

For a number of years there has been a strong emphasis put on the need for a multidisciplinary approach in research on environmental issues. This can be seen as a critique of the traditional research system, which appears to be judged inadequate in dealing with the complexity of environmental problems in research. It seems like there is a common view among policy makers as well as scientists that these problems are too multifaceted and wide in relation to the rather specialised and narrow field of knowledge that constitutes each discipline. Hence


\(^{22}\) Prop. 1992/93:170, p38, 55.


\(^{24}\) Kungliga vetenskapsakademien (KVA).


the need for multidisciplinary co-operation. This is an interesting aspect of the environmental field of research. The complexity of environmental issues can be analysed as twofold; first there is a complexity that relates to the interconnectedness of natural systems, and secondly it is difficult to design solutions to these problems as many societal actors are usually involved. One example of such a multifaceted environmental problem that might require a multidisciplinary approach in research is Climate Change. There is a need to include many sciences just in order to get an understanding of the actual process in the atmosphere: chemistry, physics and meteorology for example. Computer science is furthermore required to construct mathematical models to deal with the aspect of complex interrelated global processes involving many parameters and time lags etc. The second level of complexity relates to the fact that not only do we need many sciences to understand how the processes work in nature, we also need knowledge on how to deal with the uncertainties in the scenarios and how to deal with the risks. Society is requiring applied knowledge that can lead to solutions to this potentially very threatening global problem. Solutions to a problem like Climate Change involve many aspects of societal systems and processes. Economical incentives, international conventions on emissions of greenhouse gases, and changing values regarding high consumption patterns and the use of fossil fuels, are all examples of relevant aspects to include in the analysis of Climate Change. All levels of complexity, i.e. understanding processes in nature as well as understanding societal interactions, must be dealt with in order to find solutions to this problem. It has, consequently, become necessary to deal with this type of environmental problems in multidisciplinary scientific projects, like the Intergovernmental Panel on Climate Change, IPCC.27

3.5 The University System – Unsuitable for Multidisciplinary Activities

One problem with conducting multidisciplinary environmental research at university is that the structure and organisation of the knowledge production within this system is neither designed, nor very suitable, for multidisciplinary co-operation. Most universities in Sweden are organised in a system of faculties, based on areas of research and education like natural science, technology and social science. Within these faculties are departments for the specific subjects like geology, chemical engineering and political science. Many departments are divided into subsections studying special areas of the subject and some of these subsections can be further divided into groups of researchers performing the actual research. The organisational structure of Lund University is an example of how a large traditionally structured university in Sweden is organised. There is a division of research and education into 8 larger units, called areas or faculties, based on the classification of sciences and disciplines mentioned above. A board is responsible for organising the activities within each faculty. The faculties are, in turn, divided into departments. The increasing specialisation within science has led to a large number of departments and subsections within the departments.28 The separate units of research activities within the university organisation are not very flexible when it comes to multidisciplinary co-operation. One reason is that the specialisation in general leads to a more detailed analysis of the area of study and there are few incentives to expand the research outside of this area since multidisciplinary activities in research and education have been regarded as less qualifying compared to disciplinary work. In addition, there are few projects with an element of synthesis between the research results and analyses made by researchers from different disciplines. This can become a problem as environmental problems generally stretch across disciplinary boarders and, hence, are thought

27 See discussion on IPCC in footnote nr.13.
28 The aspect of increasing specialisation within science will also be discussed in chapter 6.2.
to require a multidisciplinary approach. The narrow analysis made within a disciplinary setting is therefore inadequate in responding to these problems.  

3.6 Organisational Alternatives in Dealing with Environmental Activities

Problems dealing with multidisciplinary research and educational activities within the university can be solved in several ways. Despite differences in size, traditions and characteristics most universities in Sweden are organised in a similar manner regarding the division of knowledge into disciplines. The examples discussed below are the universities of Linköping, Umeå, Gothenburg, Uppsala and Lund. Lund University is elaborated on in a greater detail, as the process of creating a centre for multidisciplinary environmental science in Lund has been analysed as a case study of the process of reorganising the university to deal with multidisciplinary environmental research and education.

The largest universities in Sweden have dealt with the problem of organising multidisciplinary environmental activities in different manners, although some recurring strategies can be detected. Organising multidisciplinary activities in centre formations within the traditional university structure is found at all the universities mentioned below and is hence a common strategy to deal with multidisciplinary areas of research and education in Sweden. Centres seem to be good organisational solutions, since they do not require an entire restructuring of the university organisation. A centre is a comparatively autonomous unit compared to the departments, with cross-faculty multidisciplinary activities within a specific area of research as the main goal and purpose.

At all of the universities mentioned above there are cross-disciplinary and cross-faculty cooperation in research projects, although the former is more frequent than the latter. About 700 environmental projects from the late 1980's and early 1990's were examined regarding multidisciplinary aspects and it was found that about 15% of the titles had authors from different scientific disciplines within the same scientific field, for example participating scientists from plant ecology, botany and eco-toxicology. Only about 1% of the projects had participants from different faculties, for example medicine, political science and engineering. Modern science is however increasingly diverse when it comes to publishing of scientific results in international journals. This increasing diversity in science can be detected in the increasing number of authors of each research article. Most articles have at least three authors and very often four scientists have contributed to a document. Statistics from Britain show a similar trend, with a clear increase in the number of co-authored articles and also an increase in the number of articles published in multidisciplinary journals.

A multidisciplinary centre generally acts as a link between traditional disciplinary research that is dealing with related, similar or the same areas of study, each with its own disciplinary methodology and theoretical framework. A centre can, furthermore, act as a communicative link between the university and society. Interested parties in search for the right competence

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29 For a further discussion on the inadequate structure of knowledge within the university to deal with multidisciplinary environmental research, see Jönsson, B. & Wickenberg, P. 1994. På goda grunder. Inspirationsbok om miljö för lärare och andra framtidsarbetare. Liber Utbildning, Stockholm, p42 ff.
and co-operation partners from within the university and from the surrounding society can communicate their ideas at the centre and establish joint projects. A centre can facilitate for companies and other societal organisation to easily find the expertise within a specific area of science. Hence, a centre can greatly improve the fulfilment of the communicative and informative task of the university. The first two tasks of the university are education and research, in accordance with 1 chapter 2§ of a law called *Högskolelagen* (1992:1434). The third task is a responsibility to communicate research findings and knowledge to society. At present, this is an area where the Swedish universities are criticised for inadequate performance. In the latest research policy document from the government it is stated that the universities are to increase their co-operation with society, through an increase in information on education and on findings in research. Policy documents on environmental research and education have promoted centres as beneficial structures for promoting the dialogue with society for a number of years.

There are however universities that have gone further than establishing centres in promoting multidisciplinary research and education. The most radical example among the larger universities in Sweden is Linköping University, where the entire organisational setting of the university is arranged to promote multidisciplinary research and education. There are only three faculties at the university, the philosophical faculty, the University of Technology and the Health university. Research activities and education is taking place at the departments just like in the traditional system. The departments at Linköping University are however not primarily organised according to the traditional scientific division of knowledge. Instead they are pragmatically divided into areas of knowledge and skills related to the practical work of the future academics in society that the university is educating. One example is the department of Applied Pedagogic/Teaching Science. This department contains sciences like didactics, information technique, speech training, geography, history, religion, social science, English, French, Swedish, German, biology, physics, technology, maths etc. These sciences represent the skills that the students will need in their work as future teachers. At Linköping University there is also a separate department for purely thematic studies, including themes like “genus”, “technology and social change” and “water in nature and in society”. In addition to the thematic structure of the departments there are also several centres at Linköping University doing research. Some of these centres also take on projects commissioned by other societal actors. Examples of centres that do projects commissioned by external parties are “the centre for development of schools” and “the centre of food technology”. Centres in connection to departments are organisation similar to centres found at the other universities, like a forum for gender issues and a centre for environmental- and outdoor-pedagogic.

Umeå University is also an example of a fairly untraditional Swedish university regarding a multidisciplinary approach in science. At Umeå University the strategy has, however, not been to structure the entire organisation of education and research thematically. They have rather chosen to create a combination of traditional and multidisciplinary units of research and education. At Umeå University there is a unit called Forum for Multidisciplinary Science. This Forum has been working since 1976 and was initiated as a response to the emerging global problems like starvation and environmental problems. Other issues demanding a multidisciplinary approach in science were also dealt with at the Forum, like gender and development issues. Not only is there this Forum for multidisciplinary science but in 1996 a new organisation was initiated at Umeå University called *Miljöhögskolan*, which means the
Environmental University. This is a joint project between Umeå University and the Swedish Agricultural University (SLU). Miljöhögskolan conducts multidisciplinary environmental research and there is a multidisciplinary approach at all levels of education.

Gothenburg University is somewhat more traditional in its organisational solutions to multidisciplinary research and education. The main part of research and education at the university of Gothenburg is taking place within the traditional faculties and their departments. In addition to the traditional organisation there is however a common board of thematic studies for all the five faculties at the university. This board is responsible for education, research and information to society related to multidisciplinary areas of study. The board is responsible for facilitating multidisciplinary and cross-sectorial co-operation within the university and between the university and society. Organisationally, the board of thematic studies is described as a “horizontal” organisation within the university, and hence a complementary structure to the “vertical” activities and responsibilities of the traditional faculties. There are many units found in the organisation of the board of thematic studies. For example there are several departments within multidisciplinary sciences like genus-science and environmental science. In addition to these departments there are also a large number of centres with multidisciplinary fields of research related to for example geographic areas like “Centre for Middle-East Studies” but also centres for areas of research like “Centre for environmental economy”. Within the organisation of the thematic board is also a unit called “Forum for Multidisciplinary Science”, a unit with the goal of promoting multidisciplinary research and education through the co-operation between different sciences and to find new structures to already existing knowledge. 

Uppsala University is the oldest university in Sweden and is organised in a traditional manner with faculties and departments as the main organisational components. The faculty boards are responsible for the scientific priorities and the quality of education at the departments. From July 1999 the faculties are organised into three scientific areas, one for the Humanities and the Social Sciences, one for Medicine and Pharmaceutics and one for Technology and Natural Sciences. In addition to the departments and faculties at Uppsala University, there are some 50 centres at the university. About 20 of these centres are multidisciplinary organisations stretching across faculty boarders. The strategy of Uppsala University, like the universities of Umeå and Gothenburg, has been to add separate structures to the existing organisation to cover this need for cross-faculty co-operation.

Lund University is organised in a similar manner as Uppsala, with rather traditional organisational structures for the main part of the educational activities and research. Like Uppsala there is however also a large number of centres that are conducting multidisciplinary activities in research and education. The centres are dealing with areas of different characteristics. Much like the rest of the universities in Sweden the centres are organised into for example geographically related areas of study, like the centre for North-America Studies, and there are centres for methodologically/technically related research like the Centre for Geographical Information Systems (GIS). A majority of the centres at Lund University conduct multidisciplinary research within an area of study that includes many approaches of research. One such example is LUCRAM (Lund University Centre for Risk Assessment and

39 Information on the organisational structure was found 1999-08-30 on the homepage of Uppsala university, http://info.uu.se/presenta.nsf/0/.
Management) that have participants from Lund Institute of Technology (LTH), faculty of Science and the faculty of Administrative, Economic and Social Sciences. The organisational idea of LUCRAM is that the PhD students are involved part time at other departments and part time at the centre. This solution of including multidisciplinary aspects into disciplinary specialised research is interesting as it gives a “double competence” to these future researchers. They will have a close connection to both the disciplinary research environments within their department and also a multidisciplinary approach from LUCRAM.\footnote{LUCRAM are supporting 5 positions for PhD students (half time) at the centre. The students are also working at the departments of engineering logistics, fire safety engineering, economics, chemical ecology and ecotoxicology and the department of ergonomics and aerosol technology \textit{(Inventering av miljörelaterad verksamhet vid Lunds universitet – utbildning, forskning och omvärldskontakter, from hereon referred to as Inventering, 1998, p.69)}} Other examples of centres with a wide scope in research are for example the Centre for Youth Research, the Handicap- and Rehabilitation Research Centre (HAREC) and the Centre for Women’s Studies.
4. The Centre Formation at Lund University

The discussion in the previous chapters has pointed to the serious concern in society regarding environmental problems. This concern, coupled with a faith in the ability of science to find solutions to the situation, makes society spend a considerable amount of money on environmental research. As was discussed in chapter 1, the complex character of many environmental problems makes a multidisciplinary approach seem reasonable, in spite of the fact that the traditional university organisation is not very suitable for such co-operation. The research community is divided into many departments and subsections within these organisational units and there is often very little contact between the different areas of research at the university. It can therefore be said that there is a need to create additional structures within the university to improve the situation for multidisciplinary co-operation on environmental issues. Lund University is an example of a large university that experienced a need to improve its' multidisciplinary environmental research and education and a centre formation has been suggested as one way of promoting this. This chapter will describe the centre formation process at Lund University and the future organisational structure, functions and activities of the centre. The suggested name of the centre is “Centre for Multidisciplinary Co-operation on Environmental Issues”, from hereon called CMCEI. This centre is used as an example of a strategy to improve multidisciplinary environmental co-operation within the university. Aspects of the centre formation process will also be used to exemplify some of the practical problems with organising this kind of co-operation within Lund University. The discussion in the chapters below will however mainly revolve around the theoretical aspects of multidisciplinary environmental activities within the university system.

4.1 History of Environmental Activities at Lund University

In 1968 a group of students inspired by the environmental debate contacted the vice Chancellor at Lund University and got the permission to arrange a course in environmental issues. The initiators soon suggested that an environmental research programme ought to be created as well. Their idea was that the main duties for such an organisation would be multidisciplinary education, specialised courses, seminars and a catalogue for environmental research projects. During the late 1969 Miljövårdsprogrammet (the Environmental Programme) was started. The programme was placed directly under the Chancellor and hence outside of the traditional faculty system. The main goal with that organisation was to be an area for environmental courses and issues for the entire University. During the following years Miljövårdsprogrammet developed according to the plans, with courses at different levels of academic competence, seminars and increasingly frequent contacts with external parties. The expansion of this programme was however somewhat hampered by the reserved attitude from some of the faculties. This cross-faculty organisation was regarded as a threat to the established faculty system since some reallocation of financial resources was made from the faculties to Miljövårdsprogrammet. After some time the activities at the programme grew and changed. A professorship was for example established and specific financial resources, similar to the ones allocated to the faculties, were given to Miljövårdsprogrammet. In connection to a restructuring of the university organisation in 1988, Miljövårdsprogrammet was transferred to the Lund University Institute of Technology, LTH, where it was established

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41 My translation.
as a department. The new department was called *Institutionen för Miljö- och Energisystem* (IMES).

During the restructuring of Lund University in 1988, the university board decided to establish a board for research and education within the area of the environment, called *Miljörådet*. This board was thought to work as a multidisciplinary organisation stretching across all faculties and with representatives from each faculty in its board, headed by the university Chancellor. The board was given the tasks of stimulating multidisciplinary co-operation in research on environmental issues, arranging multidisciplinary conferences and seminars and of co-ordinating and preparing the statements from the university on environmental issues. In an evaluation of the work of this board made after a few years, it was found that *Miljörådet* found it much more difficult to promote multidisciplinary co-operation than anticipated. One reason for these difficulties was a lack of financial resources allocated to initiate such projects.

Based on these views, a process was initiated and on the 1st of July 1992 a centre for environmental science was established at Lund University, *Miljövetenskapligt Centrum*, MVC. It was organisationally placed directly under the Chancellor, outside of the faculty system.

It was decided that the centre would actively promote high quality education within the area of the environment and also promote qualified research demanding a multidisciplinary analysis. The MVC was also to promote contacts with society, nationally as well as internationally. The MVC board consisted of representatives from each faculty, students and representatives from the group of researchers and teachers connected to the MVC activities.

The activities at the centre consisted primarily of seminars and workshops. In addition there was also a database created with information on the environmentally related research at Lund University.

The MVC did however not succeed in fulfilling the goals set up initially and in 1996 the Chancellor formally requested an evaluation of the MVC activities.43 The evaluation committee was critical of the organisational setting as well as of the activities at the MVC. The inventorying committee found that the centre did not have a task that was adequately specified. In addition, it did not have an organisation apt for its activities. The group of teachers and researchers connected to MVC was for example not used to a satisfactory extent. Among the other difficulties and inadequacies mentioned in the evaluation was also a lack of academic status of the centre activities. The cause was said to be the fact that there was no professorship in environmental science. The committee found that due to its malfunctioning organisation and lack of academic status, the MVC did not have a genuine support from the rest of the university organisation. The centre was consequently not able to attract researchers to joint multidisciplinary projects. Despite a multitude of environmental research and activities within the rest of the university organisation the MVC was not able to synchronise these activities. The main conclusion was that the inadequacies in the MVC performance were mainly caused by internal and personal conflicts among the personnel at the centre.44

Largely based on this evaluation of the MVC, the university board decided to close the centre 1996-12-31.45

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4.2 The Process of Establishing a New University Centre for Environmental Activities

A new centre formation process started in January 1997 at Lund University, when the vice Chancellor got the task of investigating the situation regarding environmentally related activities at the university. The purpose of this investigation was to create a new centre for these activities, instead of the MVC. The vice chancellor started discussions on how a new centre for environmental activities should be organised and in December 1997 the Chancellor formally set up a committee to start working with a centre formation. An inventorying of the existing environmental activities in research and education was performed to get an overview of the present situation. All the faculties participated in the survey apart from the Lund Institute of Technology (LTH), the Centre for Oral Health (the faculty of odontology) and the Arts faculty. The latter two faculties themselves stated that they do not have any environmentally related activities and therefore their absence from the process is understandable. LTH, on the other hand, has a large number of activities related to the environment and therefore their absence from the inventorying process is important. These aspects will be discussed more in chapter 4.5 below.

The results from the inventorying and the ideas that were presented in this process influenced the proposal regarding the CMCEI activities and organisational structure a great deal. The proposal and the inventorying will be described in greater detail in the following chapter. Another document influencing the centre formation process was a new university policy on environmental issues in education and research that was approved by the Lund University Board in the early spring of 1998. This is a general policy statement were the University Board makes a comment on the idea of a centre to promote environmental issues:

In order to increase the amount of environmentally related issues in education and research there is a need for increased efforts regarding existing activities but also more multidisciplinary contacts, research initiatives and courses. An increase in monitoring and evaluating the educational and research efforts within the environmental field is needed, in order for Lund University to develop an environmental competence of its own, avoid a duplication of work, make use of competence more efficiently and ensure a high scientific quality. An organisational unit with activities stretching across the different faculties, a Centre for environmental science, with representatives from the faculties and students will be created to stimulate these activities. In addition, the centre will also act as an initiating, co-ordinating and evaluating unit.

A committee, consisting of representatives from the different faculties, made the inventorying of the environmentally related activities at Lund University during the spring of 1998. The active researchers and teachers at the different departments were asked by their faculty representative to answer a questionnaire regarding the environmentally related research and educational activities within their organisation. There was no definition of the term "environmentally related" and it was, consequently, the active researchers that classified projects as dealing with environmental issues or not. The researchers who did classify their research as environmentally related were furthermore asked if they would be interested in participating in multidisciplinary environmental research and/or educational projects at the centre. They were also encouraged to come with ideas of activities they would like to find at the centre, and services they would like the centre to provide. Many departments answered in great detail, while others made more general statements. A multitude of ideas was however presented and some of these were included in the proposal for the organisational structure and activities of the centre. The inventorying showed that there is a large number, and a great

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46 Rektors beslut 1997-12-19.
47 Lund universitets policy för integrering av miljöfrågor i utbildning och forskning, approved by the University Board 1998-02-27. My translation.
variety, of environmentally related activities at Lund University. Including activities at all the faculties, there are about 175 courses with relevance to environmental issues and over 300 researchers that are involved in projects dealing with environmental aspects in some way. The variation found in environmental research will be elaborated on more in chapter 5.

4.3 The Centre Proposal – Organisational Structure and Activities

Education, research and communication with society are the three main duties of Lund University.48 The CMCEI must, of course, contribute to the fulfilment of these tasks. According to the proposal the general responsibilities of the centre will be to initiate, facilitate and to a certain extent financially stimulate contacts between individuals and groups belonging to different faculties, in order to promote new creative activities. A formal board with representatives from the different faculties at Lund University will be responsible for the activities of the centre and a manager will be appointed to lead the practical work. Apart from the formal board responsible for the budget and overall organisational aspects of the centre, it has been suggested that another board should be appointed. This additional board would consist of active researchers from the different faculties with knowledge about and experience from environmentally related activities within their faculty. Regarding organisational aspects of the centre it is furthermore suggested that the centre should be organisationally separate from the faculty system. It is believed that the multidisciplinary activities of the centre can develop best in such an environment.49

According to the proposal, students from all faculties at Lund University should be able to come to the centre to increase their knowledge on multidisciplinary aspects of environmental issues. There will be multidisciplinary educational activities at all levels of academic competence, from basic introductory courses to advanced research oriented courses. There have also been suggestions of designing specialised courses for companies and authorities that need multidisciplinary competence within the field of the environment. There are, at present, two multidisciplinary educational activities that might be placed within the future CMCEI if the proposal is approved and implemented. Organisationally, these activities are at present placed within area 10, i.e. outside of the traditional faculty system.50 These units are the LUMES programme, which is an international 60 credit Master’s programme in environmental science/studies, and a 5 credit introductory course in environment and development issues called Planet Blå. According to the proposal, these educational modules are thought to constitute the first activities at the centre. When it comes to the multidisciplinary aspects of the LUMES programme and Planet Blå, there is an ambition that the recruitment of students should be wide in scope regarding disciplinary background, i.e. to promote multidisciplinary groups of students. In order to be accepted at the Master’s programme LUMES the students should have at least a bachelor degree. Planet Blå, on the other hand, only requires 20 credits of other university courses. The LUMES programme leads to an additional degree for the students and is therefore not very complicated when it comes to how to value these multidisciplinary courses within another degree. It is different with the Planet Blå course, as it is an optional 5-credit course that should be possible to

48 In accordance with Högskolelagen 1992:1434, chapter 1, 2§.
49 The theoretical aspects of the view that multidisciplinary activities function best when placed outside of the faculty system will be discussed in chapter 7.
50 A board, consisting of representatives from the faculties within Lund University and headed by the Chancellor, has the formal responsibility for these educational activities.
include in all degrees at Lund University.\footnote{In a letter addressed to the faculty boards at Lund University the Chancellor is making a request for the boards to make it possible to include \textit{Planet Blå} in the part of a degree which can be made up of mixed courses. Anhållan 99-01-18, Dnr I G219 9274/1998. The question regarding the inclusion of \textit{Planet Blå} in the degrees at the different faculties was discussed (1999-02-04) at a meeting of the LUMES board, which is also responsible for \textit{Planet Blå}. The representative from LTH in the board stated that it was unlikely that the LTH board could influence this aspect of the course, since the board of each engineering section has got the formal responsibility of deciding which courses are to be included in a degree at that section. Regarding other aspects of LTH and CMCEI, see discussion in chapter 4.5 below.} It is, however, uncertain whether this will be accepted at all faculties. Regarding the multidisciplinary aspects of the course content and focus of the LUMES programme and \textit{Planet Blå}, this is though to be safeguarded through an organisation of teams of teachers. These groups are made up of researchers from different disciplines, to assure that there is a multifaceted analysis of the environmental problems regarding scientific approach, theories and methodology.\footnote{In addition to the teachers, there has been students participating in the teams planning \textit{Planet Blå} and students are also participating in running the course.}

Apart from the introductory course \textit{Planet Blå} and the Master’s programme of LUMES it has been suggested that the centre should also provide educational activities for PhD students as well as for active researchers that wish to increase their competence in multidisciplinary aspects of the environmental discourse. Some suggestions on this kind of activities were; an introductory environmental course for PhD-students, thematic courses on specific environmental issues, environmental modelling and environmental risk analysis.\footnote{Inventering, 1998, p9 ff.}

Research projects at the centre should be multidisciplinary and the basic idea is that this is best achieved through creating teams of researchers, consisting of scientists from different faculties. One of the main functions of the centre is to provide a place where researchers from different disciplines can meet and discuss this approach of environmental research. The centre should stimulate creative ideas and to a certain extent financially support these projects. The centre will probably not have any equipment and the main part of the research activities will still be performed within the traditional disciplinary departments within the faculties.

The centre should in addition to the educational and research activities also fulfil an active communicative role, both internally within the university and in contact with society. According to the proposal, the centre should provide the university organisation with information on environmentally related activities at the different departments, including the centre itself, through establishing and administrating a calendar of workshops, seminars and thematic activities with relevance to environmental activities within and outside of Lund University. It has furthermore been suggested that the centre should create databases for relevant information and also provide a homepage with links to information of interest to researchers, students and other societal actors, like funding for environmental activities.\footnote{Inventering, 1998, p12, 49-51, 59.} The external communication will be a crucial component in the centre activities. The CMCEI should work as a link for interested parties from outside the university into the otherwise quite closed research community. Companies, authorities and organisations could come to the centre with problems and/or projects. The CMCEI will facilitate for interested societal actors to find the right competence within the vast numbers of researchers at the different departments of the university. The centre could then, through its board of active researchers and their channels of information within the university, make contacts with researchers with relevant competence and an interest in multidisciplinary research. The centre could also
function as a distributor of multidisciplinary environmentally related thesis projects. Companies, authorities and organisations that are interested in getting projects done could benefit from this service, as well as the students and researchers that can come in contact with interested parties financing research in other societal sectors. The communication aspect of the centre activities will probably be one of its' most important functions.

4.4 The Review Procedure

After inventorying the activities and a merging of ideas into a proposal, the faculty boards were given the option to give their final views on the proposal. The CMCEI proposal was sent out for comments to the units at the university that were thought to be influenced by it. This meant that all faculty boards were asked to comment, as well as the board of LUMES and Planet Blå. The common procedure within each faculty regarding issues like this is for the board to discuss the proposal and either approve or recommend a rejection of the proposal. Each board can also suggest changes to the original proposal. A majority of the faculties were positive to the proposal and approved of the establishment of a new centre for multidisciplinary environmental activities at Lund University, although many had opinions about the organisational aspects, as well as other parts of the proposal. Some of these responses will be discussed in the following chapters, as there are several interesting theoretical aspects of the faculty board statements. A common feature of the responses was that all faculty boards stressed the important contribution their faculty could give to the activities at the centre. In addition, all faculties were interested in participating in the board, with the exception of the faculty board of L TH. 55 The standpoint made by LTH regarding participation in the planning process of CMCEI points to the fact that apart from the more general and theoretical aspects of this centre, which will be discussed in the following chapters of this thesis, there are also several practical problems related to the specific case of Lund University with such a formation.

4.5 Practical Problems – the Case of LTH

Lund Institute of Technology (LTH) refrained from participating in the inventorying of environmental activities at Lund University that was conducted in the initial phase of the centre formation process. This was somewhat surprising, as there is a multitude of environmentally related activities and a great deal of competence on environmental issues within the technological faculty. The board of LTH was also the only one that recommended a rejection of the proposal. The LTH board did not find itself convinced by the planning committee for the centre that the new centre for environmental issues at Lund University would work better than the former Miljövetenskapligt Centrum. In addition, the board also stated that:

"...the financial situation within the university makes such investments inappropriate at the moment". 56

The negative attitude from the part of LTH could be detrimental for the CMCEI, since the options for the centre to reach its full potential regarding multidisciplinary co-operation within Lund University is dependent on a benevolent attitude from all of the faculties. A practical problem with a negative attitude towards the centre from LTH is that this might have

55 Even the faculty of Arts, that does not have any environmentally related activities within its organisation, was stating that it would be appropriate to include one representative from that faculty too, as they are also part of the university structure. Yttrande 1998-11-27 av Konstnärliga fakultetsstyrelsen, Dnr I:A 29 195/98.
consequences for the participation of other faculties.\textsuperscript{57} One of the main ideas with the centre was to promote co-operation between scientific fields that normally do not work multidisciplinary in solving environmental problems. Natural sciences and technology are sciences that do not often have joint projects with the humanities and social sciences. This seems to be the general situation in Sweden. The government has obviously found this to be a problem and there has therefore been demands made for more co-operation on environmental issues between technology and social sciences in particular.\textsuperscript{58} The fulfilment of such demands requires a positive attitude from all parties in order to succeed.

One possible reasons for the negative attitude to the centre formation from the part of LTH is that there is already a department at that faculty dealing with multidisciplinary environmental education and research.\textsuperscript{59} Therefore, there are reasons to believe that LTH considers the establishment of CMCEI to be of minor additional benefits to its overall activities. The department at LTH dealing with similar issues as the proposed CMCEI would handle is the former Miljövårdsprogrammet, i.e. the Department for Environmental and Energy Systems, IMES.\textsuperscript{60} Within that department there are researchers from different disciplines. In addition, the teachers lecturing on the 14 IMES courses have different disciplinary backgrounds. There are courses at all levels of academic competence, there is for example one 5 credit introductory course in environmental issues at IMES that is nearly equivalent to Planet Blå, which is one of the first educational activities at the new CMCEI. The introductory course in environmental issues at IMES is possible to include in all degrees within LTH, which could be said to make the Planet Blå course rather redundant in the LTH perspective.

Apart from these practical problems with a centre formation at Lund University there are negative attitudes and scepticism regarding its organisational structures and activities in general that leads to theoretical discussions on multidisciplinary environmental activities in general within the traditional university structure. The following three chapters will elaborate on theoretical aspects of the proposed centre for multidisciplinary co-operation on environmental issues. The point of departure is some of the statements made by the faculty boards in connection to the centre formation process.

The first opinion to be discussed relates to what kind of activities the centre is going to promote and support. The board of the future centre will have to decide on criteria by which to judge what sort of activities that will be conducted within the centre, i.e. try to define the area of study. What is to be included in the concept of the environment?

In chapter 6 there will be a discussion on the problems of methodology related to multidisciplinary co-operation. How is this multidisciplinary approach to environmental issues going to be performed?

The third aspect of multidisciplinary environmental activities that is to be discussed in chapter 7 is the problem of judging the scientific quality of the activities at the centre, i.e. which criteria should be used to ensure a high quality of the work at the centre, both related to the theoretical framework and the methodology of this field of study.

\textsuperscript{57} The representative from the faculty medicine in the inventorying committee expressed concern for a situation where LTH did not participate in the centre activities. The reason was that there are many projects related to environmental issues where these two faculties co-operate already. An absence of LTH in the centre activities would consequently influence the researchers from the faculty of medicine as well.


\textsuperscript{59} Inventering, 1998, p155.

\textsuperscript{60} The development of IMES is described in larger detail in chapter 4.1.
5. The Concept of the Environment

One response to the centre proposal was a request for a “mission statement” for the centre. The planning committee or the future board of the centre was asked to clarify what types of activities the centre is to promote and support, as well as the general goals and strategies of the centre. A more specified definition of the vague wording “multidisciplinary education and research within the area of the environment” is thus required. What does, for example “the area of the environment”, entail? As priorities will have to be made once the centre has started, such issues will be debated. Even if there will only be a limited economic budget for research projects taking place at the centre, the board will still have to make priorities regarding suitable projects to be initiated and performed there. A mission statement could also function as a guideline for external parties that might want to establish co-operation projects with researchers in connection to the centre. In addition, such a statement could work as unifying criteria for the board and interested researchers, so that there is a shared view of what sort of projects that are to take place at the centre.

5.1 The Absence of Unifying Criteria

One theoretical aspect of defining a mission statement is the absence of unifying criteria for what is to be classified as environmental science and what environmental research is. There is an enormous width in the field of research that is seen as related to the environment. This fact was clearly shown in the inventorying of environmentally related activities at Lund University. The inventorying committee did not define what kind of projects or courses that were to be regarded as dealing with the environment. Instead, the active researchers and teachers at the departments made this definition as they responded to the inventorying questionnaire. This open definition led to an impressing 175 courses related to environmental issues and well above 300 researchers that are viewing themselves as dealing with environmental research. The variety of aspects on environmental issues that such large numbers must result in, provokes a discussion on the background to this multifaceted picture of environmental research.

One explanation can be related to the fact that the concept of the environment in science is a comparatively new area of research. It was not until the middle of the 1960’s that the environmental concept started to be dealt with as a field of research within the scientific community. To some extent a scientific concept is defined by tradition. If we compare this new field of research on environmental issues to a more traditional discipline like geology, we find that geology is also a wide scientific field, geologists deal with all kinds of rock materials and a multitude of chemical as well as physical and biological processes related to these materials. It is, however, possible to find descriptions of what geological materials are and we can also choose to study only the materials from a certain period of time. It is, hence, possible to define the area of study quite clear through the use of previous research results and theories that have developed during several decades. The absence of a scientific tradition to fall back on regarding a definition of the subject “the environment” itself and its theoretical framework and methodology makes environmental research a very wide field of study. The large number of projects classified as related to environmental issues within Lund University is an example

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61 It was the planning group (ledningsgrupp) of Planet Blå that stated this in their response to the proposal. Yttrande 1998-11-25.
62 From the proposal regarding the centre, p.1. My translation.
63 For a detailed description of the results from the inventorying, see Inventering, 1998, p17ff.
64 See chapter 2 for a discussion on the rise of the environmental movement.
of this breadth, research ranging from a project on modern literature where female authors express concern for the technological development to a project dealing with biotechnological means of reusing old car tyres. The wide range of environmental research projects cannot only be explained as the result of a young new discipline that has not yet developed its scientific framework. It is also as a result of an inherent complexity in the subject of study itself, the concept of the environment.

5.2 Inherent Complexity of the Concept

There are many components in the concept of the environment and below is a discussion on some of the multitude of aspects of the concept. First, the extremely complex concept of nature will be discussed. It has not been possible to make an in depth analyse of this concept, as it is extremely historically and culturally variable and involve aspects of entire worldviews. It can be argued that much of the complexity in dealing with the concept of the environment can be attributed to the connection to the concept of nature. Apart from having a meaning related to nature, the concept of the environment also includes a meaning found in the concept of heredity and environment, i.e. as a large set of diffuse factors that influence an individual in general. Finally, the science that has probably been the most influential regarding the formation of the concept of the environment, ecology, will be discussed.

Most people would probably relate the concept of the environment to nature. It is a common view that environmental problems arise because people are destroying natural systems. The cutting of rainforests, the killing of endangered species and greenhouse-gas emissions threatening the global climate are all problems that humans cause in nature. One of the components that makes the concept of the environment so complicated and multifaceted is that it has a large part of the concept of nature included. The rise of the modern understanding and definition of the environment took place during the 1960’s and onwards, as was discussed in chapter 2. The discussion and research of nature has, however, been going on much longer, the debate on the relation between humans and the surrounding environment can even be said to be ancient. The new thing about the environmental concept was that there was a connection made between nature and culture. The environmental concept has even been defined as the relationship between these two spheres, nature and culture. The environmental concept came to include both, in an interlinked fashion, which is different compared to the earlier discussions where nature and culture were seen as rather separate units. The interconnectedness of the concept of nature and the concept of the environment means that the way we view the concept of nature will, consequently, have an impact on the interpretation of the concept of the environment. The understanding of and the views of nature are historically and culturally very variable. The ethnologist Orvar Löfgren points out that our view of nature is to a large extent dependent on our cultural heritage and that this has been the case in all cultures in all times. There are many factors influencing the view of nature within a culture. It can be argued that one of the most influential factors is the utility aspect, i.e. the use

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65 The project dealing with warning signs in modern literature is performed within the department of literature and the project related to reuse of old car tyres is found at the department of biotechnology, LTH.
67 This aspect makes a thorough discussion and analysis of the concept of nature impossible in this thesis, as this is an entire thesis subject in itself.
people make of nature will determine what they think of it, value it and treat it. In a historic perspective this can be found in many cultures according to the environmental historian Sverker Sörlin (1992). A culture that is dependent on a resource base that is entirely found in a surrounding environment that is not manipulated to any greater extent by human intervention, as is the case for cultures of hunters and gatherers, the view of nature can be interpreted as instrumental to a high degree. These peoples generally view nature as both benevolent and mean and they often have a great deal of religious ideas about natural phenomena. When it comes to the agricultural cultures the view of nature is different, as agriculture can be seen as a method of separating the areas controlled by man and the areas where nature could rule undisturbed. The introduction of agriculture can therefore be interpreted as leading to a general division between nature and culture, where nature was wild and in need of taming and the agricultural landscape was viewed as the ideal of order. The historian Neil Everden (1992) claims that the distinction between man and nature resulted in a humanism that raised man above nature. The consequence is that nature became subordinated human needs and wants. The rise of industrialisation in the late 1800’s led to a view of nature where it was increasingly viewed in the form of natural resources that ought to be exploited. This view can also be found in society of today. In one of the laws on protection of nature in Sweden it is included that areas valuable for their natural resources ought to be protected from activities that could be a hindrance to the exploitation of these resources. Our modern society has a mixed view of nature. On one hand we regulate societal activities to protect nature but on the other hand we in the same time protect the exploitation of natural resources even if those activities destroy the natural values. In order to fuel our ever-increasing consumption of energy services and goods we exploit resources in nature and in the same time we express a need for wilderness and unaffected nature. As the environmental concept has developed into including mostly problems, the meaning of the concept of nature has increasingly come to be the unproblematic, untouched, pure and wild surroundings, i.e. not influenced by man in a visible way at least. The word nature has also developed into one of the most value laden words in our language, with a clear distinction between the positive connotation of the word natural and a negative meaning to the word unnatural.

The concept of the environment does not only deal with phenomena found in nature in the sense phenomena and surroundings not managed by humans. One important aspect of the environment is the enlargement of the concept to include not only phenomena in remote and wild areas, but also other factors influencing us. One important meaning of the word environment is found in the construction “heredity and environment”. The Swedish word for the environment, miljö, has this meaning of the word as well. Miljö stems from the French word milieu. Milieu has one part mi-, stemming from the Latin medius, meaning in the middle, and one part lieu which means place, stemming from the Latin word locus. Consequently, the French word milieu is the equivalence of medius locus, the place positioned

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70 Sörlin et al. 1992, p338.
71 Of course any analysis of views of nature within a cultural group as diverse as “the agricultural society” without specifying the context in more detail runs the risk of being extremely simplified. It is not the intention to discuss this particular aspect of the concept of nature in a detailed manner and, hence, these simplifications are results of this broad reasoning.
72 Everden identifies this division as taking place mainly during the Scientific Revolution in the 16th century.
74 The law regulating the use of natural resources is called Lag (1987:112) om hushållning med naturresurser mm. See particularly 2 kap. 7§ that states that an area with valuable natural resources should be protected so that the exploitation of these resources is not hindered.
in the middle. It is rather ironic that the original meaning has changed into the opposite in the modern Swedish use of the word, as it is now used to describe everything that surrounds us. The word *milieu* was introduced into the public discussion by the French history-philosopher Hippolyte Taine in the late 1800’s. He identified the three main factors influencing a person to be “la race, le milieu et le moment” (the race, the environment and the moment in time). Environment in this meaning of the word then means the entire surrounding world influencing the phenomena or person under study. Example of this way of interpreting the concept of the environment can be found in research projects at the faculty of medicine at Lund University. The area of study in these projects is carcinogenic factors in the surrounding environment, in interaction with the genetic factors. A similar meaning of the word *miljö* is found in the concept of *arbetsmiljö* (the occupational environment), i.e. a surrounding that influences a person while working. There are several projects dealing with occupational health, regarding the psychological and the physiological aspects that have been classified as dealing with the environment in the inventorying of environmentally related activities at Lund University. The research on occupational conditions is mainly conducted at the department of applied psychology and at the department of occupational and environmental medicine. It could be argued that this interpretation of the concept of the environment is more related to culture than to nature, as the discussion on the occupational environment often relate to anthropogenic factors. The inclusion of these aspects into the discussion on the environment has led to a further widening of the concept. From dealing with phenomena found in nature not influenced by human intervention the concept has come to include cultural factors and actors.

One science that has been very influential regarding the concept of the environment is ecology. The concept was first introduced by the biologist Haeckel in the late 1860’s, and hence not used in the early days of biology that had been a scientific discipline since the 1700’s. Haeckel introduced the idea of ecology as a science dealing with interconnectedness in nature, of which human beings were also a part. Ecology was originally an area of research within biology, primarily found within the areas of botany and zoology. The rise of ecology as a scientific discipline primarily took place during the 1950’s and 1960’s. It could be argued that the rise of ecology as a discipline during this period was a response to the emerging discussion on a deteriorating environmental situation and the general concern for these issues in society at that time. This view is, however, contested by Söderqvist (1986) who has done a study of the rise of ecology in Sweden. Söderqvist claims that the rise of ecology in Sweden during the 1950’s and 60’s did not have a specific connection to the environmental crisis, but that is was rather a process of enrolment of new generations of ecologists by translating the naturalist interests into the scientific disciplinary language of ecology. The influence from ecology on the environmental debate is, however, not contested by Söderqvist who points to the fact that the ecologists succeeded in defining the environmental crisis as an ecological problem. It can be argued that the theories of ecology has influenced not only biology, as

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76 Sörlin et al. 1992, p.78.
80 Söderqvist has made an analysis of the rise of ecology in Sweden from a theory of science perspective.
was initially the case, but many other sciences. Some of the modern ecological theories were put forward by the biologist Eugene Odum in the 1950's. In 1977 he had made an enlargement of the ecological ideas and boosted ecology as a new integrative discipline. His ideas have indeed contributed to the expansion of ecological concepts into the theoretical framework of other sciences. In the preface of his book *Ecology - a Bridge between Science and Society* (1996) he writes: “Ecology, in my opinion, has now matured enough to be viewed as the basic science of the total environment.” He points to the sharp increase in “interface” fields of study and mentions many examples where the ecological concept has come to be included into other sciences, such as ecological economics, ecological engineering and agro-ecology. It can even be argued that ecology has transformed, from being a scientific field within the discipline of biology, into being a perspective by which to analyse phenomena not directly linked to the natural environment and its ecosystems. Ecology has, for example, been identified as the single most influential scientific discipline in the Swedish political discussions concerning environmental issues. Already in 1972 the ecological concept started to be used in official governmental documents. This trend of using ecology in politics has continued. The inventoring of environmentally related activities at Lund University showed several examples of the use of the ecological concept as a perspective by which to analyse other phenomena, for example in a project on ecological modernisation. Within the faculty of Theology one researcher classified “a green reading of the Old Testament” as dealing with environmental research. There are also several examples of the use of the ecology concept in “interface” fields of study, to use Odum’s wording. Several PhD students at the School of Economics and Management at Lund University (the faculty of economics) are dealing with projects within the area of ecological economics.

The discussion above might give the impression that the concept of ecology is mainly found within sciences that are not involved in research on the environment in the sense research on nature and ecosystems. This is however not the case, although there has been an increase of interface areas of study where ecology is used as one of the perspectives. Most environmental research dealing with ecology at Lund University is found within the department of ecology at the faculty of Science. The research related to ecology within this department is not using ecology as a perspective, as is the case for the interface areas of study, but as the scientific theoretical framework and methodology and there is a multitude of projects including the concept of ecology.

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87 In proposition 1972:111 “Riktlinjer för fysisk planering” the ecological concept was used in the Swedish construction *ekologisk grundsyn*, i.e ecological basic values.
88 There is a research project at the department of Sociology that deals with aspects of citizen participation and influence in ecological modernisation. Inventering, 1998, p121.
89 This example also shows one of the words, green-, that have come to be used interchangeably with ecology. Other examples of prefixes used instead of ecology are eco-, nature- and environmental- (*eko-, natur-* and *miljö-*).
90 Ecological economics is also often called environmental economics and green economics, which is another example of the phenomena mentioned in the footnote above. Inventering, 1998, p116.
6. Multidisciplinary Methodology

The board of the future centre of multidisciplinary co-operation on environmental issues will be facing two main problems when making a mission statement for the centre activities. First of all it could be problematic defining what sort of issues that is to be handled at the centre, i.e. defining the theoretical framework of the centre activities. Secondly there could be problems defining what is meant by multidisciplinary co-operation, i.e. a problem with finding the appropriate methodology. The concept of the environment is complicated, due to its wide and multifaceted interpretation, as was discussed in chapter 5. Multidisciplinary co-operation between scientists from several disciplines is not without inherent complications either. Both the concepts of the environment and the concept of multidisciplinary research lack clear definitions and modern scientific traditions to follow. Multidisciplinary co-operation in research lacks a modern methodological history, as this is not how science in general has been conducted during the past decades. There is also scepticism towards the concept of multidisciplinary research and education within parts of the university organisation. A common argument is that a multidisciplinary approach leads to a superficial understanding and therefore it is regarded as unscientific knowledge. One of the faculty boards responding to the proposal of the centre stated that the word “multidisciplinary” ought to be omitted from the name of the centre, as this concept was considered vague and difficult to interpret.92 This view points to important theoretical as well as methodological aspect of environmental research and educational activities, namely the debate on appropriate methodology for multidisciplinary co-operation. As we saw in the previous chapter the disciplines have different theoretical approaches in dealing with environmental issues. In this chapter, the discussion is going to revolve primarily around the theoretical aspect of the methodology of multidisciplinary co-operation on environmental issues.

6.1 Demand from Society

In the discussion on multidisciplinary research it is important to remember that the call for more multidisciplinary co-operation does not primarily come from the research community, but from society. In the governmental research policy documents throughout the 1990's there has been a recurring demand for more multidisciplinary co-operation in environmental research. In an evaluation of the Swedish environmental research in 1992 it is for example stated that:

“The fact that the environmental issues are inter- or multidisciplinary in themselves and that no scientific discipline can give all necessary answers is an undisputed fact- nearly a truism”.93

But this truism of environmental research contains complications. First of all, the concept of multidisciplinary research is in itself rather vague. This definition is taken from a Swedish encyclopaedia from 1996:

[Multidisciplinary research] demands input from different scientific fields in order to solve the problems of research.94

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92 It was the board of the faculty of Administrative, Economic and Social Sciences that stated that the word “tvärvetenskaplig” should be omitted in the name of the centre as it is difficult to interpret (svårtolkat). Yttrande 1998-11-24, Samhällsvetenskapliga fakultetens kansli. Dnr. I A29 195/98.
Several similar sources present about the same meaning of the word; i.e. that multidisciplinary research involves co-operation between different sciences in order to solve specific problems. This idea of co-operation between scientists from different fields of research is unspecific when it comes to what is expected to happen in this process. It is difficult to classify different kinds of production of knowledge. It could, however, be said that multidisciplinary co-operation involves theoretical or methodological integration or renewal between different traditional sciences.\textsuperscript{95} Projects where there are no new general conclusions drawn from the constituting disciplinary parts are not considered as multidisciplinary in this thesis. Anthologies where proponents from different sciences make their contribution without any synthesis is, hence, not considered multidisciplinary science. Multidisciplinary research is therefore scientific projects where there is a synthesis made of each researchers results and conclusions. The theoretical aspects of the concept of multidisciplinary co-operation in research involve a general discussion on the methodology of scientific research.

\textbf{6.2 Methodological Aspects of Environmental Research}

In the discussion on environmental problems and scientific research it is quite often claimed that it is the scientific ideals of reductionism that have caused the environmental problems that we are facing today. Reductionism is made responsible for the sectored society, a gigantic system made up if many complex components that are dealt with separately despite their interconnectedness. To some of these critics holism has come to be the answer to these shortcomings. Holism is seen as a necessary scientific ideal for research and education in order to produce knowledge to deal with these interrelations.

From a philosophy of science perspective holism and reductionism can be seen as contrasting schools of science. Reductionism has been the dominating ideal of modern science in that the traditional system of disciplinary research is largely a product of the belief that our understanding increases if we study a phenomenon in greater detail.\textsuperscript{96}

The method of reductionism was developed in relation to the rise of modern science during the Scientific Revolution in the 1600's. The origin of reductionism is usually attributed to the philosopher Descartes (1596-1650). The idea of reductionism, presented by Descartes, has been highly influential when it comes to scientific ideals. The process of increasing specialisation and a reductionistic focus on detailed understanding of the world is a significant feature of university research and thereby also of higher education, as research is the basis for education at the university. The university does not provide each student with knowledge about everything. On the contrary, the university educate specialists.

The basic idea of reductionism is illustrated by Descartes' interpretation of the universe. He saw it as composed of small indivisible particles. By getting exact knowledge about how the indivisible particles worked, it was possible to get an exact understanding of how the entire universe works. By dividing the universe into its constituting parts the scientists would be able to explain everything and with such knowledge everything could be predicted and therefore also controlled.

The method of analysing a problem by dividing it up into smaller sub-problems that are studied and solved separately is a common strategy in nearly all sciences. The increasing scientific specialisation has led to the emergence of new sciences and sub-sciences as well as numerous areas of research within these sciences. In that respect nearly all scientists are reductionists since every researcher is at least a specialist within a unique doctoral thesis.

subject, even though there is often an expansion of their competence in the practical work as a researcher.

Descartes had a mechanistic and dualistic worldview, nature could be described like a clock and it was only human beings that had a soul, a free will and an intellect.  

Animals were like machines with no feelings. His mechanistic and anthropogenic worldview, placing human beings above nature and other species is probably why his scientific ideals are also heavily criticised in the environmental debate.

Descartes believed in one scientific explanatory level by which everything could be explained, predicted and controlled, one true science at an indivisible level, one least common denominator. His ideas have some characteristics in common with tendencies in modern science where quantum physics by some proponents has been raised to a similar status of an ultimate science. To these fans of quantum physics even extremely complex systems could be explained using these principles. There are however few of that kind of extreme reductionists in modern science. Most scientists are moderate reductionists in that they seek the lowest common denominator, not in an absolute sense like Descartes, but within their specific area of research. In general, scientists seek driving forces within subsystems, and most researchers are aware of the fact that their system of study is only one part in a larger context.

The contrasting scientific ideal to reductionism is holism. Holism can be interpreted as the science of entities. The word stems from the Greek word Holos meaning whole and indivisible. The main point made by proponents of holism is that the whole is more than the sum of its parts. The philosopher J.C. Smuts was the first to use the word in this manner. In 1926 he presented his ideas in Holism and Evolution in which he presented his ideas of holism using wordings like:

Holism has been presented as the ultimate synthetic, ordering, organising, regulative activity in the universe which accounts for all the structural groupings and syntheses in it, from the atom and the physico-chemical structures, through the cell and organisms, through Mind in animals, to Personality in Man. The all-pervading and ever-increasing character of synthetic unity or wholeness in these structures leads to the concept of Holism as the fundamental activity underlying and co-ordinating all others, and to the view of the universe as a holistic Universe.

When discussing holism it is crucial to separate between the ontological and the methodological discussion of the concept, especially when related to environmental research and education. Even Smuts emphasised this aspect of holism in 1926, stating that using a strict and narrow scientific view, the scientific community may consider the concept of Holism as extra-scientific, giving a metaphysical and not a scientific explanation of things. The ontological holism is a theory of science, claiming that there are indivisible units with special characteristics. Extreme proponents of holism even claim that everything is connected and that the entire reality is really indivisible. One such extreme proponent of holism is the philosopher Arne Naess. He has influenced the environmental debate with his “ecosophical” ideas.

Sörlin et al. 1992, p346.
One fundamental idea is that everything in the world is connected and forms a whole entity. His philosophical discussions revolve around the idea of wholeness, of one unit composed of everything, i.e. man, nature, all living creatures and God. According to proponents of “ecosophy” it is desirable to understand this wholeness without dividing the understanding into disciplinary fields of study. Their views are, however, based on an ethical point of view, as the wholeness is seen as something holy and valuable in itself.

Other examples of holistic ideas in the environmental debate are organic theories. According to these theories systems that are not normally viewed as organic can be interpreted as such, since their parts can only be explained by their place and functions in the whole entity. An organic view of the entire world was for example presented in the Gaia theory, where life on earth was portrayed as a self-organising system, which is nearly the equivalent to the definition of an organism. In the environmental debate such scientific definitions have led to discussions with an ethical dimension since it can be considered morally wrong to cause problems within a system that is an organism, of which humans are also a part.

The methodological meaning of the concept holism is of course related to its ontological meaning. The methodology is based upon the view that it is useless to divide an entity into its constituting parts. An analysis of these parts can never explain the whole entity, as the whole is always more than the sum of its parts. Instead, science should discuss this complexity and develop methods to deal with it. The motive is however scientific and not ethical. It is basically considered as bad science to divide a complex system up into sub-components that are analysed separately, as the important understanding of the system is related to that complexity. The founder of the concept, Smuts (1973), also emphasised the methodological or scientific properties of holism, claiming that holism is not primarily metaphysical but scientific. The main arguments by Smuts were that the pre-occupation with detailed mechanisms would no longer suit the immensely enlarged scope of present day science. In addition Smuts claimed that it had become a necessity to give a more coherent explanation of complex scientific fields like Evolution, which necessitated much more widely operative factors according to him.

Similar ideas of how to deal with complexity, are found in hermeneutic theories and methodology. The hermeneutic theory of science emphasises a scientific analysis based on factors that cannot necessarily be quantified. In addition, hermeneutics emphasise context, where the complexity is not automatically avoided by trying to isolate only a few driving forces but the scientific work lies in the analysis of that complexity.

When dealing with complex environmental problems the discussion on methodology and its theoretical background is interesting and important. It is however more important from a practical point of view to understand that the work of each researcher is never either truly reductionistic or truly holistic. Very few scientific areas of research are totally reductionistic in that they claim to explain the entire universe with only one or a few theories. In the same way no person can perform holistic research in an absolute sense, as that would mean dealing with all aspects of everything.

Leonardo da Vinci is often mentioned as the ideal scientist, with a wide spectrum of knowledge and talents. But the “Renaissance man” ideal in science was perhaps possible to reach in those days when scientific knowledge was quite limited, compared to today. It has been said that 90 per cent of all research results have been produced during the past

century. It is, therefore, practically impossible to be a “Renaissance man” of today’s science. In the same way as it is a truism that one science cannot explain all aspects of these problems it is also a truism that one person could never understand all aspects of an environmental problem.

The special feature of environmental research is that the goal is often to find knowledge that can be used to prevent, control or remediate a problem that has been identified. It can be argued that multidisciplinary research integrate two kinds of knowledge: how things work and how to deal with these things. Specialists from all areas of the scientific community are therefore needed in order to come up with creative new knowledge. Co-operation is therefore a key feature in this kind of research.

What is implied with the concept of multidisciplinary research on environmental issues is that a more thorough analysis can be made, more multifaceted conclusions can be reached and more efficient solutions suggested, by synthesising reductionistic/specialised disciplinary research. The production of knowledge within multidisciplinary environmental science can, therefore, be interpreted as both reductionistic and holistic i.e. both additive and synergistic.

6.3 Communication Problems among Scientists from Different Sciences

An argument that is often used to criticise multidisciplinary research is that such co-operation is impossible since “researchers from different sciences cannot communicate” and “scientists from different fields of research speak different languages”. These “linguistic” problems are multifaceted and include many aspects of co-operation between people with different experiences. In this discussion these communication problems can roughly be divided into three types:

i) Problems arising because of the fact that there are different definitions of the same word,

ii) Problems related to differences in language because of incommensurable theories,

iii) Problems caused by unawareness among researchers that their different scientific explanations of a phenomenon are on different explanatory levels, in combination with the problem of whether it is really possible to translate between these different levels.

These types of problems related to multidisciplinary co-operation will be discussed in further detail below.

Problems of communicating and co-operating across disciplinary boarders can arise because of differences in defining a word or a concept. This is due to the fact that sciences tend to make their concepts operational and disciplinary specific. This means that the definition of a word or a concept is very strictly defined within a science, using detailed descriptions of specific equipment and exact conditions, theoretical background etc. A word or a concept that is defined within such strict limits by each science could cause difficulties in the analysis and synthesis of research results within a multidisciplinary project. The findings of one science might not be possible to include into the discussion of another, using that word or concept, since the reasoning is based upon totally different conditions that are not scientifically accepted within the other science.

Even though there might be differences in the use of certain concepts and words, shared scientific ideals and some shared concepts are likely to facilitate the process of co-operating across disciplinary boarders nevertheless. Projects are often initiated by scientists within areas

of research that are close to the theoretical background of the co-operation partners. Projects between different technological departments or different natural sciences are for example quite common.\footnote{107} One example of this process of merging two rather closely related sciences together into a new area of research is the case of immunology, where scientists in the field of biology and medical practitioners started to work together in a common area of research. The cognitive and social mechanisms that made co-operation between scientists and physicians possible was studied by Löwy (1992) who came to the conclusion that loose boundary concepts played an important role in the co-operation between these two distinct scientific groups.\footnote{108} These loose boundary concepts made possible the development of common research strategies without obliging the scientists from the different disciplines to give up advantages with their respective group identities. Löwy points out that loose concepts in general might be very valuable in the construction of efficient inter-group alliances in science and in disciplinary growth.\footnote{109} In multidisciplinary projects between different sciences the language problems that arise because of the differences in definition of words and concept could be overcome by the usage of loose concepts that both/all parties can agree upon. It is however also important to stress that such concepts might give a false impression of shared definitions and theoretical agreement. In such a situation these loose concepts might instead be a hindrance in the communication between scientific groups.

There is another type of communication problem that can arise in multidisciplinary co-operation, the problem of incommensurable theories. Incommensurable theories are said to be so radically different when it comes to drawing conclusions from studying the same phenomena, that it is impossible for one theory even to describe the phenomena using the terminology of competing theory.\footnote{110} This concept has caused a lot of discussions since the beginning of the 1960's, when it was introduced in the book *The Structure of Scientific Revolutions* (1962). In the book the author Thomas Kuhn presented new ideas on how scientific knowledge is produced. According to him it is a mistake to believe that scientific knowledge is cumulative in that new knowledge is just added to the old. Kuhn believed that the history of science could be divided into scientific paradigms, which are units of fundamental theories that influence each science during a period of time. A new idea that takes the place of the old one through providing a better explanation to the problems of study becomes the new scientific paradigm within that science. One misinterpretation of Kuhn's ideas of incommensurable theories, that is often made, is that a researcher could not see, nor understand different competing theories or paradigms at the same time and that communication between scientists with different theoretical frameworks could therefore never work. What Kuhn said was that it is impossible to believe in two incommensurable theories at the same time, one always excludes the other. It is perfectly possible to believe in both of them, since taken separately including all theoretical reasoning and assumptions they seem logic and coherent. Compared with each other they are, however, exclusive.

One important thing to observe in the discussion on incommensurable theories is that the discussion by Kuhn is dealing with theories within the same science or discipline. This is very important in relation to multidisciplinary co-operation on environmental issues since this is most often not the case. The main type of problems that the co-operation on these issues will encounter is not a matter of intra-disciplinary disputes but rather conflicts with inter-

\begin{footnotes}
\item[107] Utbult, 1993, p15.
\item[108] Illiana Löwy is a historian of science.
\end{footnotes}
disciplinary characteristics. The problems regarding incommensurability in multidisciplinary environmental co-operation will mainly deal with problems of incompatible theories of different sciences. One example of such a dispute is dealing with explaining how human behaviour in making choices has come about. Theories of evolutionary biology and theories of Freudian psychology can be used to illustrate incommensurable theories, as they are based on totally different theoretical framework regarding how a behaviour has developed. It can even be said that these theories are based on different metaphysical ideas, i.e. that they differ in a profound way regarding how the world works. Evolutionary biologists base the analysis of choice making upon theories of natural selection whereas scientists believing in Freudian psychology base their analysis upon theories of childhood experiences. Both theoretical frameworks are well-established fields of science but mutually exclusive. It is impossible to analyse human behaviour regarding making choices using both and it is impossible to translate one into the other.

The third type of language problems in the communication between scientists from different fields of research relates to differences in explanatory level, i.e. different sciences explain the same phenomena but on different levels. For example, there are many sciences that are dealing with the computer as an object of research. A computer can be studied, described and analysed at different levels depending on the scientific interest. A cognitive scientist might be interested in the implicit meanings of the screen symbols and how the icons are interpreted by the user of the computer. A computer scientist on the other hand, might rather be interested in how these icons are programmed to function in an optimal manner within the rest of the computer processes. An electrical engineer would perhaps be interested in different parts of the hardware of the computer, i.e. in the choice of components and the materials in these components. Each of these scientists are dealing with research on computers albeit on different levels. It could be very difficult to translate between these different levels. How could the level of computer components be translated into the implicit understanding that lies in the use of an icon showing a diskette for the function of saving information in the computer? It could, however, be argued that such a translation is pointless and that this is not what multidisciplinary co-operation is all about. It is nevertheless a source of potential difficulties in co-operation if there is an unawareness of the fact that different sciences describe the phenomena at different levels. The mere awareness of differences in explanatory level could however be inadequate in dealing with a conflict on which explanatory level that a relevant analysis should be placed. This aspect will be discussed in chapter 6.7 below.

It could be argued that these varying scientific manners of attacking an environmental problem would make a synthesis of the findings within each science impossible because of differences in scientific theory and methodology. Sciences have differing theoretical background, based on traditions and special characteristics of the science. It is, for example, often stated that natural sciences and social sciences cannot co-operate since these fields of research have developed in such a different manner from each other when it comes to theoretical framework and scientific ideals. Discussions on methodological differences between natural and social sciences tend to emphasise the different attitudes towards quantitative and qualitative methods, where natural sciences tend to focus on quantitative methods whereas social sciences and the humanities have qualitative methods with a hermeneutic tradition.\footnote{Rolén, M. (ed.), 1996. \textit{Culture, Perceptions, and Environmental Problems. Interscientific Communication on Environmental Issues.} FRN, Stockholm, p33.} It should, however, be emphasised that this is indeed a simplification. There are for example interpretative and contextual analyses within natural sciences. In geology there is for example a large portion of interpretative analysis, taking into
consideration the history of the soil material, i.e. the biogeochemical processes and various human impact that the soil has been subjected to over time. Similarly, there are many social sciences and areas within the humanities that make use of quantitative methodology to a large extent in research, statistics is for example used frequently in the analysis of psychological experiments. If we would like to describe the differences between these scientific approaches in general terms, it could be argued that qualitative interpretative methodology emphasises that an interesting and meaningful analysis of a phenomenon must take into consideration the context. According to this methodology the analysis is worthless if the complexity is avoided by dividing the problem into sub-problems and analysed separately to a large extent. In addition, there are factors that cannot be quantified in a meaningful way in these scientific fields of research. How can for example historic events be quantified in a reasonable manner? Is it possible to quantify suffering or oppression in an accurate way? This is however a debatable issue surrounded by a great deal of conflicts between proponents of different ideals of science. The ambition of the discussion here is not to give a full account of this debate but merely to point to potential difficulties. It is also important to remember that scientists can learn, at least superficially, to understand other sciences.\textsuperscript{112} The attitude among the researchers participating in the project must however be tolerant and open in order for this to work.

6.4 Dealing with Complexity – the Tool of System Analysis

A creative multidisciplinary atmosphere demands an awareness of the fact that there are many explanatory levels of a certain phenomena, like an environmental problem. Each explanatory level has theories and methods well suited for that particular kind of scientific work. The problems might arise when these different levels are to be transferred or translated into one another. This might even be impossible in some cases. In most cases of multidisciplinary environmental research it is not required that there should be only one scientific explanation or analysis, but rather a synthesis of many different aspects of the problem. In this work it is crucial that the participating researchers are aware of the fact that these different levels of complexity exist. One tool of dealing with different levels of complexity in multidisciplinary research is system analysis.

System analysis is a method of identifying a phenomenon as a system of different interconnected and interrelated parts. This method is based on the belief that the understanding of a system increases by making a model of the system, and checking its behaviour by running different scenarios. The theoretical framework of system dynamics was developed in the 1960’s by Jay W. Forrester, a researcher at Massachusetts Institute of Technology with an interest in the dynamics of industrial systems.\textsuperscript{113} Later on, Forrester expanded the theories to include other systems. The theories of industrial dynamics were transformed into urban dynamics and later on to world dynamics.\textsuperscript{114} The latter theory was the theoretical and methodological basis for the report \textit{Limits to Growth} (1972), where a group of scientists analysed the future situation regarding resources on Earth.\textsuperscript{115} The relevant variables


in their model were accelerating industrialisation, rapid population growth, depletion of nonrenewable resources and an overall-deteriorating environment. This book was very influential in the public debate at the time regarding the looming resource crisis. Three years before Limits to Growth the book The Population Bomb\textsuperscript{116} was published, in which the increasing world population was described in frightening scenarios with a lack of food and other resources. The continuation of the public discussion on these issues was influenced by the ideas presented by Forrester to a large extent.

According to my experience from participating in many multidisciplinary courses at IMES, as well as attending the multidisciplinary Master’s programme LUMES, the main practical problems of multidisciplinary environmental science are not related to major differences in scientific ideals or major difficulties in translating between different explanatory levels, but rather overcoming the prejudice between different disciplines. There is seldom any substance in the critique of other sciences, since there is rarely a deep understanding of other sciences than one’s own. Prejudice between different sciences can furthermore be overcome in a positive atmosphere were there is no superior theory of science or methodology.

Within the multidisciplinary Master’s Programme LUMES system analysis was introduced as a tool to analyse complex environmental problems. A majority of the multidisciplinary group of students found it to be an extremely helpful strategy in analysing these problems, as well as in overcoming problems related to ignorance of other sciences. By focusing on the environmental problem first, instead of using one discipline as a starting point, the analysis tends to be more open-minded and expansive regarding what aspects the group includes. It is important to note that the initial steps in system analysis involve a broad analysis of the system including the interrelationships and complexity. The mental model of the system that the group makes does not necessarily include only quantifiable parameters. The next step however, involves trying to quantify the parameters and the relations between them, since this phase in the system analysis involves the construction of a mathematical model. By running the model and exploring the behaviour of the system in different scenarios an improved understanding of the complexity can be reached. System analysis can therefore be seen as a powerful pedagogic tool in analysing complex systems.

System analysis is however not the solution to all potential problems of multidisciplinary cooperation in environmental research. The differences in methodology and scientific ideals could, despite a clarification of different explanatory levels, provoke problems. There might still be disagreements on which explanatory level the best and most relevant analysis of a problem is produced. In addition it is also important to remember that not all sciences agree that a quantification of all parameters is possible. The second stage of system analysis where the mathematical model is constructed excludes sciences with a more holistic perspective based on hermeneutic traditions since it is impossible to include variables that cannot be quantified. The stage of constructing the computer model is exclusively based on a mathematical worldview, since relations are described using differential equations. This is an important weakness with the method and the overall synthesis of a problem might need additional discussions including these variables and parameters where the full complexity and non-quantifiable features are included.

6.5 Scientific Controversies

Multidisciplinary co-operation can work despite the fact that scientists from different sciences can have very different views on acceptable theoretical framework and adequate methods. These differences can however also give rise to scientific controversies. It is easy to draw the conclusion that it is the increasing specialisation of science that is the cause of this situation, that a constant process of narrowing the scope of each researcher makes communication between them impossible. It is, however, not the specialisation *per se* that causes these scientific controversies, but rather these disagreements arise when there is a debate on which science is most relevant in dealing with a problem that is analysed by several sciences. There are, for example, several sciences dealing with concentrations of aluminium in groundwater (soil chemists, biochemists, plant ecologists, eco-toxicologists and physicians, to mention a few), and these scientists can come to different conclusions regarding which aluminium concentrations are causing damage, depending on the focus of their research. Consequently, a scientific debate on the definition of acceptable levels of aluminium in water can arise. Which science should advise authorities in their decision on maximum allowable concentrations of this substance in groundwater? Scientific controversies regarding environmental issues also arise because there is often scientific uncertainty related to the environmental situation and the research. It is often the case that neither the methodology nor the object of study can give criteria regarding how to deal with this problem. There are therefore frequent discussions and scientific controversies on uncertainties and risk valuation regarding environmental problems. One such debate is taking place at the moment regarding Climate Change. Due to the extreme complexity of the processes, the time scale and number of parameters involved, the computer models used to predict the consequences of increased concentrations of greenhouse gases have to deal with huge uncertainties. There are at present several competing computer models of Climate Change and there is a political focus from some countries on the uncertainty aspects, in order for them to delay emission reductions etc.\footnote{See also chapter 3.1. for a discussion on the relation between research and politics on environmental issues.} There are few criteria to use on how to deal with uncertainty related to whether an activity is harmful to the environment or not. One solution is to find more or less vague criteria that are basically political, as they are based on concern for other societal aspects than the environment.
7. Quality Aspects of the Centre Activities

In the proposal for the organisational structure of the CMCEI at Lund University, it was suggested that the centre should be placed organisationally separate from the faculties. The idea was that the centre instead should belong to a unit called area 10.\textsuperscript{118} The faculty board of the faculty of Law was positive to this proposal. It stated that:

“Since the centre is to be available for all faculties and all areas of research at the University, the board of the faculty of Law finds it appropriate to place the Centre within area 10”.\textsuperscript{119}

Some of the other faculties responding to the proposal were however negative to the organisational aspects of the proposal.\textsuperscript{120} They found it inappropriate to place the centre outside of the faculty system. The board of the faculty of Medicine motivated this standpoint by stating:

“We are however convinced that an academic organisation with planned activities within the field of education and research must be organisationally anchored to an established faculty in order for its activities and results to gain the respect that is a prerequisite for its survival. The collegial control and continuous evaluation of its activities is the guarantee for valuable results”.\textsuperscript{121}

The board of the faculty of Administrative, Economic and Social Sciences articulated a similar motivation to their rejection of the proposal of placing the CMCEI within area 10.\textsuperscript{122} This negative reaction from parts of the university organisation provokes a theoretical discussion on the evaluation of scientific quality in general and of multidisciplinary science in particular.

7.1 How to Judge the Quality of Multidisciplinary Science

If only one scientist is to explore an area of research where several disciplinary methods and theories are required in order to give a multidisciplinary analysis of the topic of research, then there is a problem of judging what level of academic competence the researcher ought to have in order to ensure the scientific quality. This discussion is one of the main reasons to why multidisciplinary science has been regarded with so much scepticism from within the universities.\textsuperscript{123} Some opponents of this kind of research even claim that accepting multidisciplinary research is abandoning the goal of finding a true description of a phenomenon, and how can research be judged if we do not have the concept of truth as a scientific criteria? Some researchers even claim that their main duty is to contribute to a discourse that is already political and not to try and find knowledge about their field of research.\textsuperscript{124} Referring to the discussion in chapter 3.3 and 3.4, this is likely to be the situation

\textsuperscript{118} See chapter 4.2 for a more detailed discussion on the proposal for the CMCEI.
\textsuperscript{120} Opponents to the proposal on this issue were the boards of the following faculties; Science, Medicine and the faculty of Administrative, Economic and Social Sciences.
\textsuperscript{121} My translation of the response to the proposal from the board of the faculty of Medicine. Yttrande 1998-11-24. Dnr I A29 195/98.
\textsuperscript{124} Fox Keller, 1996, p32.
for many of the researchers within the area of the environment. Dependence upon the financing parties from the part of the individual researchers and the impact this might have on the scientific quality of research is however not a particular aspect of multidisciplinary environmental research and therefore rather something that ought to be discussed within all the faculties at the University.

There are many ways to conduct quality checks within the university system, checking its performance regarding for example financial efficiency and gender policies. There are also many parties that can perform such quality checks. The evaluations of the activities at a university can be made internally, for example by local student organisations, as well as externally, for example by governmental organisations. Although quality checks like these are important and interesting, the discussion below will concentrate on the internal scientific quality control of the research performed at the university.

The universities in Sweden are responsible for conducting education, research and for communicating new findings to society. Since university education is based on research the discussion in this chapter will mainly revolve around the issue of quality judgement of research activities. University education has many other qualities in addition to the purely scientific ones, like pedagogic aspects and the usefulness of knowledge in future careers, which will not be dealt with here.

The general discussion related to the quality of multidisciplinary research is twofold, it relates to the quality aspects of disciplinary research as well as to the quality of the synthesis between the constituting disciplinary parts. The disciplinary specific quality of research can in general be judged adequately within the normal disciplinary quality system. In addition, multidisciplinary research projects must however also be valued with regard to the multidisciplinary aspects, i.e. a quality check of the synthesis of the different disciplinary contributions. This part of the quality cannot be done only within the quality control of only one scientific field.

7.2 The System of Peer Review

The scientific control within the research community is based on the principle of peer review. This is a system where scientists with a great deal of experience in their field of research judge new material within that, and related, fields of science. Material that is to be published in scientific journals or in books are in general sent to a group of peers, who give their opinions on the piece of work. The system of peer review is based on the idea that successful scientists can judge what is good science. Seen in a historic perspective the tradition of educating new researchers has its roots in the Renaissance when the primary task of universities changed from being preservation of knowledge to production of knowledge. The most famous university promoting these new ideas was the Humbolt University in Prussia, which proclaimed that the main goal of the university was production of new knowledge, i.e. the performing of research. The quality control of the new production of knowledge was through the peer review system and this has remained the main process of quality control of the modern universities. One early Swedish example of an active peer transferring his new scientific findings to his students was Carl von Linné at the University of Uppsala who acted as a personal tutor for his students in the middle of the 1700’s.

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125 1 kap. 2§ in Högskolelagen (1992:1434).
The peer review system has been heavily criticised over the years. Scholars like, for example the philosopher von Wright, have accused this method of quality control for being conservative and hindering creativity.\textsuperscript{127} von Wright continues his critique stating that the peer review system is contributing to a negative streamlining of science.\textsuperscript{128} It can be argued that all sciences have prevailing ideas that can be called paradigms, using the terminology presented by Thomas Kuhn in his \textit{The Structure of Scientific Revolutions}.\textsuperscript{129} Paradigms are the, at that moment in time, prevailing set of theoretical framework and methodology within a group of researchers and/or the entire scientific community within a field of science. Paradigm shifts can occur only when the course of the traditional research, “normal science” in Kuhnian terminology, is changed through the emergence of complementary and radically different theories. The critics claim that the peer review system is hindering these shifts to occur since established scientists are not likely to applaud the abandonment of theories on which they have based their research and hence their entire scientific careers. Instead, it is rather likely that these scholars will refuse to incorporate new ideas that are somehow threatening their theories and research by judging such science unscientific. In addition, the more periphery topics within a specific area of research might not get adequate attention if the peers find it irrelevant and of low priority because of their own interest in other parts of the field of research.

Despite the imperfections of the peer review system it is hard to think of a system that would work better in judging the specialised scientific quality of research. In an article in \textit{New Scientist} (1990), “End of the Peer Show?” Tuney draws a parallel to democracy, as it is also a highly imperfect system but still better than the alternatives.

Despite the dominating peer review system for judging the quality of scientific research it can be argued that parallel systems of quality control have emerged over the years. One example is the move towards more of applied research and research within industry. This kind of research is different in that the results are applied in a more direct manner and the usefulness an applicability of the research are the most important criteria by which the research is evaluated. Regarding research within the university system it has also been increasingly influenced by societal demands for relevance and applicability of new knowledge. External quality criteria have become increasingly important for the scientific community today, as much of the financing to expensive research comes from these actors. A part of the discussion on the problems of scientific autonomy has changed its focus, from the negative consequences of steering from the part of the peer review system to concern for an epistemic drift of science due to these external quality demands.\textsuperscript{130} When external quality criteria becomes more important than the internal scientific ones, there is a risk that university research lose some of its characteristics and becomes more like the research performed at the research and development departments of large corporations. It is important to note that much of the new knowledge produced within the university system does not have an obvious application in society or in industry today. It is however this unrestrained search that has produced the most

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\item \textsuperscript{128} von Wright, 1987, p127.
\item \textsuperscript{129} Kuhn, T. 1992. \textit{De vetenskapliga revolutionernas struktur}. Thales, Stockholm, p18 ff.
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important and useful results historically. Demands from society for useful research therefore risk making research less useful in a long perspective.

Despite the increase in external demands on scientific research, the peer review system is still the prevailing and dominating manner of performing quality control within the university system. It is not only used in the review procedure before publication of research but also for judging the quality of project proposals when researchers are applying for funding and as an instrument in the external control of departments and research programmes in general. Another field where peer review is implemented is when vacant positions at the university are to be filled. Sverker Sörlin, a professor in environmental history, discusses this aspect of multidisciplinary research. Sörlin points out that although the peer review system has many advantages in judging scientific qualities, the negative effect of using it in the recruitment of, for example new professors, is that there is a tendency within the system to favour traditional disciplinary scientists. Disciplinary specialisation is promoted more frequently than multidisciplinary experience. A professorship is in general still coupled to a disciplinary field of research, for example applied biochemistry or psychology, and less frequently to areas of multidisciplinary research like gender issues and environmental science. In order for these fields of science to develop, the traditional structures might additional solutions in order to promote the growth of new fields of competence.

The organisational solution to promote multidisciplinary environmental activities at Lund University will be a sign of how the university board and the faculty boards view quality control of scientific work in general and multidisciplinary research in particular. The conclusion that the only organisational solution to the problem with quality control of the centre activities is to place the centre within a faculty is however a fallacy. The reason is that there will be no more competent peers judging the quality of the work at the CMCEI within a faculty organisation. The competence of controlling the scientific quality within a faculty is of course impressing, but the skills are primarily disciplinary specific. The activities as the centre will be multidisciplinary, and their scientific qualities should therefore not be judged within a specific scientific field. Multidisciplinary science is achieved through co-operation and the quality of such research should therefore be judged in a similar manner. Competent peers could be found within relevant departments at Lund University, as well as at universities elsewhere, just as it is normally done for disciplinary research. The only difference is that the search for competent peers is not restricted to the organisation or research community closest at hand, i.e. within the department or faculty, but enlarged to include organisational units that are not normally consulted for disciplinary quality control. It is even likely that if a scientific view within one faculty is allowed to steer the research through its quality control system, there will eventually be no real multidisciplinary science left.

8. Concluding Discussion

Modern science is largely a result of the belief that our understanding of a phenomenon increases if we study it in greater detail. Scientists are therefore often specialists within a quite limited area of research. The complexity of environmental problems requires analyses including many aspects, in order both to understand the relevant driving forces and to design solutions. Synthesising scientific knowledge about different aspects of a problem is hence a necessity. During the 1990's there has been recurring demands from society for more multidisciplinary environmental research. Policymakers and politicians seem incapable of making such syntheses and consequently they ask the scientific community to do the synthesising part of research as well as the traditional specialised disciplinary work.

The organisational setting of modern research at university is unfortunately not very well suited for making such syntheses. On the contrary, the organisational setting of university research is inadequate when it comes to promoting co-operation between different areas of research. At present disciplinary excellence is rewarded within the university system, not multidisciplinary co-operation. There are for example only a very limited number of professorships in multidisciplinary areas of research like environmental science.

Due to these inadequacies of traditional university organisation, additional structures within the universities are needed to promote multidisciplinary activities. Examples of such structures are centres for multidisciplinary environmental research. These centres are supposed to work across faculty boarders, promoting co-operation between sciences that are normally not involved in joint projects, for example social sciences and technology. Centres can be seen as horizontal structures within the university promoting knowledge production with a wider focus than traditional disciplinary science found within the traditional faculty based system. Increasing interest in multidisciplinary research from the part of society as well as from within the research community has resulted in the establishment of many such centres at universities all over Sweden.

The process of creating a centre for multidisciplinary co-operation on environmental issues at Lund University was studied as an example of the strategy of multidisciplinary research on these multifaceted societal problems. The centre formation process in Lund was however mainly studied as a case of the theoretical aspects of multidisciplinary environmental activities within the university system.

The strategy of having a centre to deal with multidisciplinary environmental activities at Lund University is not new. Already in 1969 an organisational unit called *Miljövårdsprogrammet* was established to deal with the emerging environmental discourse. This programme was organisationally placed under the Chancellor, outside of the system of faculties at the university. In 1988 *Miljövårdsprogrammet* was however transformed into a department at the Lund University Institute of Technology. It then changed its name to *Institutionen för Miljö- och Energisystem* (IMES). The reason for this change in organisational setting was that the activities at *Miljövårdsprogrammet* had transformed into somewhat more traditional department activities with research and a vast number of multidisciplinary courses. Because of its increasing activities the programme needed similar funding as a regular department and one solution to facilitate the administration of these activities was to place it within the organisational setting of a faculty.

In 1992, another organisational unit was created at the university to promote multidisciplinary environmental research and education. It was called *Miljövetenskapligt Centrum* (MVC). This unit was also initially organisationally placed directly under the Chancellor of the university and hence outside of the faculty system. MVC continued to be a separate unit from the faculties during the entire period it existed. In the end of 1996 this unit was however
terminated. The reason was a malfunctioning organisation and a weak support from the rest of the university.

It was somewhat surprising to find that the new centre for multidisciplinary co-operation on environmental issues at Lund University would not be based on either of these previous organisations. Instead a completely new organisation would be established. It was therefore surprising to realise that the proposed new centre is very similar to Miljövetenskapligt Centrum when it comes to goals, organisational structure and planned activities. Even more surprising was the fact that in no documents related to the future centre were there explicit references to the experiences or views of IMES, the organisational unit with 30 years of experience in multidisciplinary environmental activities within the university.

The motives underlying the strategy of starting from scratch with the new centre for multidisciplinary co-operation on environmental issues are not articulated in the documents regarding the centre formation process. Nor was it stated in the inventorying of environmental activities at Lund University or discussed explicitly at the meetings that I participated in, surrounding the process.

One reason to this strategy of starting from scratch with the organisation for the new centre might have been a desire to create a unit for these activities with legitimacy at all faculties at the university. This was not the case for the old malfunctioning Miljövetenskapligt Centrum and since it was never considered to extend the activities of IMES into a centre for multidisciplinary environmental activities for the entire university it could be argued that it has not been the case for IMES either. These two cases of previous attempts at creating such a unit within Lund University point to two different strategies from an organisational point of view regarding centres within the university organisation. Miljövetenskapligt Centrum was never incorporated into a faculty whereas IMES was transferred from being a unit separated from the faculty system into being a department at the Institute of Technology.

The theoretical aspects of these different strategies can be summarised into the issues of quality control within the university system and the related aspect of differing ideals of science between different disciplines. The influence these ideals excerpts on the theoretical framework and methodology involves views on what is considered to be “the environment”, including views on nature and society, as well as views on proper methods of examining issues and problems related to this environment.

According to the proposal from the planning committee, regarding the new centre for multidisciplinary co-operation on environmental issues, this centre would be placed organisationally separate from the faculties. The aspect of organisational setting of the centre was the most commented part of the proposal from the part of the faculty boards. Some boards were very positive to an autonomous structure of the centre. It was stated that the activities of the centre are to address researchers and teachers at all faculties, and that placing it outside of the faculties is therefore a good solution. There were however several faculty boards that were criticising this aspect of the future centre as well. The board of the faculty of Medicine and the board of the faculty of (Natural) Science were for example both very negative to such an organisational structure of the centre. Their critique was based on a concern for the scientific quality of the centre activities. The main argument against placing the centre outside of the scientific quality control of a faculty was that the quality of the centre activities would then not be checked in a satisfactory manner. These arguments point to the theoretical aspects of the quality control of scientific work within the university.

134 The board of the faculty of Law was positive towards a centre autonomous of the faculty system. Yttrande 1998-11-24. Dnr. I:A 29 195/98, Juridiska fakultetsstyrelsen
The system of peer review is still the main control system of science, with distinguished scientists judging what is good new science and what is not. There is no alternative to this system, despite the adverse effects it might have on the production of new and revolutionary knowledge. The scientific ideals of a science are to a large extent transferred through the system of peer review throughout the scientific community. What is regarded as good scientific work must of course follow the norms within that specific discipline. These ideals involve both theoretical framework and methodological approach in science. In the discussion on multidisciplinary science it is often claimed that these differences in scientific ideals and traditions make multidisciplinary co-operation impossible.

According to my experience from participating in many multidisciplinary courses at IMES, as well as attending the multidisciplinary Master’s programme LUMES, the main practical problems are not related to major differences in scientific ideals or traditions. The problems rather involve overcoming prejudice between different disciplines. There is seldom any substance in the critique of other sciences, since there is seldom a deep understanding of other sciences than one’s own. Prejudice between different sciences can furthermore be overcome in a positive atmosphere where there is no superior theory of science or methodology. Different sciences merely study, analyse and try to explain a phenomenon on different explanatory levels. Each explanatory level has theories and methods well suited for this kind of scientific work. The problems might arise when these different levels are to be transferred or translated into one another. This might even be impossible in some cases but in most cases it is nevertheless possible to merge different scientific approaches together, if there is an understanding of the different levels of complexity. One tool that has been very efficient in catalysing the work of synthesising different scientific analyses together, by clarifying different explanatory levels, is system analysis. Within the multidisciplinary Master’s Programme LUMES this method was used to analyse complex environmental problems and to produce multidisciplinary syntheses of many scientific explanations of these problems. A majority of the LUMES students, with a very varying academic as well as ethnic background, found system analysis to be a very helpful tool in making multidisciplinary analyses of environmental problems. It must however be stressed that the part of system analysis where a mathematical computer model is constructed is discriminating sciences with holistic and hermeneutic scientific ideals and traditions.

There is a multitude of explanatory levels and the mere awareness of this might facilitate the co-operation in making syntheses but it might however not hinder scientific controversies regarding what level is the most relevant when discussing an environmental problem. Such discussions are however highly relevant to include in a multidisciplinary synthesis, as scientific disagreements often point to the political side of environmental problems. Societal priorities should not be made by science, but by policymakers and politicians.

There is a risk of placing the centre activities within the quality control system of a faculty, i.e. by letting the collegial review of a faculty organisation judge the quality of the syntheses made by the multidisciplinary groups of researchers at the centre. The risk is that the scientific ideals found within that faculty are steering the work at the centre. It is not only the ideals of science that is transferred through the system of peer review, but also what is to be regarded as interesting and relevant issues for research. This process can lead to a monopolisation of environmental research from the part of only one scientific field. Such a development involves a steering of the views on what is to be regarded as environmental issues, i.e. what environmental research is dealing with. Then there is a risk of streamlining what is to be regarded as relevant projects for the centre. The enormous variety of environmental research at Lund University, which was shown in the inventorying of these activities in relation to the planning of the centre, point to very different manners of interpreting what environmental
research is. This is a potential problem if the centre is placed within the quality control system of only one faculty, as the problem definition might be extremely different between different sciences. A monopolisation of the environmental problems from the part of one science is likely to cause a loss in legitimacy within disciplines and sciences with other scientific ideals, traditions and hence other views on environmental problems. A loss in multidisciplinary analysis of these issues is therefore one risk with such a development. If there is an ambition to create a centre for environmental issues stretching across all faculties with environmentally related competence, then placing the centre within one of these faculties might result in less multidisciplinary centre activities and hence not a fulfilment of the original ambition.

Even if the centre is placed within the organisational structure of a faculty there might however still be chances of fulfilling the ambitions of providing the university organisation with a forum for synthesising many aspects of environmental research. Getting synergistic effects from the co-operation between different parts of the collective environmental competence at Lund University has been and is an important goal for the university. In order for this to work, such an organisational solution will however require a clear and carefully designed system of quality control. A monopolisation of the environmental issues from the part of one science can be avoided by creating a system of quality control not within one faculty only, but through a system of quality control within all relevant sciences, irrespective of faculty. The disciplinary quality control of the work done by individual researchers will be done as usual within each department. The judgement of individual contributions to the multidisciplinary analysis will consequently take place within the traditional quality control of the faculty system. The synthesises, i.e. the multidisciplinary pieces of work of the centre, should however instead be judged in a similar manner as it was produced, i.e. by the joint effort of many specialists within different areas of competence. The board of the centre will have a great responsibility in this respect, since it is important that these aspects of the centre activities are discussed thoroughly and that a functioning system of quality control is developed. Each representative of the different faculties could come up with competent scientists that could function as a board of peers to consult when judging the quality of multidisciplinary environmental projects performed at the centre.
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