Applying Systems Approach to Educational-Organizational Change

Improvement of an Interdisciplinary Program: Masters Program in Sustainable Development

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Abstract

After the introduction of the term, sustainable development, a variety of academicians from different disciplines tried to conceptualize it in their own way, drawing on these views, many different degrees but with similar titles have been established in many universities all around the world.

Masters program in Sustainable Development (MSD) at Uppsala University and the Swedish University of Agricultural Sciences (SLU) is one the most recent ones. Before starting this study, it was investigated that the expectations of the different actors in this program are not fulfilled completely. Presence of many different ideas and perspectives in addition to the high number of actors involved in the situation made the situation too complex to be fixed easily. Therefore, the Soft Systems Methodology (SSM), as an appropriate approach for improving complex problematic situations, is used to reform the organization of the MSD in coming years. The process of identifying the challenges of this program and then improving some of them in practice are described in this thesis. Alongside the action phase, the applications of Systems Approach in transformation of Education for Sustainable Development (ESD) are explored.

It is investigated that three levels of learning, i.e. basic, meta- and epistemic learning, and accordingly three levels of organizational change, i.e. the first, second and third order, need to be recognized, if an ESD program is to be different from the unsustainable trends of education.

Keywords: Education for Sustainable Development (ESD), Systems Approach, Soft Systems Methodology (SSM), Organizational Change, Learning Levels, Master’s Program in Sustainable Development (MSD).
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1. Introduction

The idea of doing this thesis arose from my personal experience studying in the Master’s Program in Sustainable Development at Uppsala University (MSD). To be admitted into this program was a milestone in my life, a milestone which made me awakened as well as puzzled. I had come from a purely technical field so I was supposed to focus mostly on the practical and technological aspects of SD but encountering a wide range of novel worldviews and emerging branches of knowledge made me doubtful about the adequacy of what I had learned previously.

Although sustainable development (SD) means different things to different professionals, a wide range of ambitions and visions about human well-being is supposed to be covered by this single term. In the MSD, the first cohort of the international students of which I was a member, was exposed to many of those different versions and persuaded to make our own version out of them that we would need to apply in our future careers. Meanwhile, we would come across some harsh critiques stating SD is nothing but an ‘impossible oxymoron’ that could be easily refuted by the notion of the adaptive cycle in systems ecology and the second law of thermodynamics in physics (Voinova and Farley, 2006). According to them, if sustaining means saving the system in its current situation and development is equal to growth in the outputs of the system, then having limited inputs i.e. resources and an open system, i.e. the planet seems like solving one equation with two unknown variables.

Nevertheless, SD was not always causing us despair, sometimes we had the chance to come across different interpretations of sustainability saying SD is possible to be achieved if we just revise the misleading definitions of it and put it in the context of creative destruction (Elkington, 2001). In that context, saving the system in its current situation is not the aim but rather by destroying much of today’s growth-driven economy and by releasing our creative energy we would be able to recreate the system that would not call for more growth.

Up to that point, the program was very successful in challenging my previous capabilities and ‘creatively destroying’ my small but secure home of mathematical and physical thoughts, yet it had not been able to build another solid base. A variety of hot topics in natural and social sciences, the critical pedagogical styles of some of the lecturers, a very modern academic environment besides the interaction with the students by diverse cultural backgrounds could be a source of confusion to anyone, let alone somebody who comes from a very traditional and monocultural system of academia. But, on the other hand, it could be a rich source of opportunities and choices. I took good advantage of this opportunity and examined as many as possible of the schools of thought, disciplines, courses and academic departments. That long and overwhelming process of trial and error gave me a chance to find a usage, not exactly for my previous knowledge but rather, for the mentality and the schemata of mind that I had obtained when studying in engineering. That point was the beginning of the phase that could be called: ‘the phase of epistemological shift’ (Ison, 2008). Namely I started to become aware of my own epistemological stand and restructure my mental models at a higher level of complexity. As Ison (2008) describes it as the process of going through an overwhelming phase of confusion and then making new mental models to embrace a higher level of complexity is a common experience of learners who seek to exploit more of
the potential capacity of their brains. Drawing on the Prigogine’s theory of the ‘dissipative structure’ (Prigogine and Stengers, 1994), Ison claims that:

Each learner goes through a period of chaos, confusion and being overwhelmed by complexity before new conceptual information brings about a spontaneous restructuring of mental models at a higher level of complexity, thereby allowing a learner to understand concepts that were formerly opaque. The shifts in understanding that concern Prigogine and Stengers require circumstances in which there is genuine openness to the situation rather than a commitment to the conservation of a theory, explanation or epistemological position (e.g. objectivity) which is abstracted from the situation. Above all it requires awareness that we each have an epistemology (or possibly multiple epistemologies) (Ison, 2008, p. 151).

And so the MSD program provided me with the opportunity of the ‘genuine openness’ but ‘restructuring of mental models at a higher level of complexity’ was mostly a result of a personal struggle and a bit of good fortune. The fortune arose out of knowing about the concept of ‘theoretical pluralism’ by Midgley (2000). According to him, each theory gives us a lens to see the world through, and by doing so it is inevitable that our seeing would be partial and to expand our view and to enrich understanding, we need to take advantage of more ‘lenses’ i.e. theories. The question however is how to balance between coherence and welcoming in a variety of theoretical perspectives (Midgley, 2000). He suggests an alternative approach that can help us to optimize flexibility and responsiveness when we need to gather a variety of theories and that is methodological pluralism. Applying this approach, however, requires admitting that pure subjectivity in science is neither possible nor desirable, but rather we have to be conscious that we always carry objective purposes influenced by our norms and values and by knowing that fact we are able to pick the methodologies required. Midgley believes:

Knowledge cannot be seen as cumulative (building into a more and more accurate picture of reality) so the theories should be seen as more or less useful in terms of the purposes of the intervention being pursued and there always an agent making choices amongst a plurality of options and we should talk in terms of locally relevant rather than universal standards for choice. At the methodological level respecting the fact that others might have useful insights that we may learn from in constructing our own methodological ideas and the level of methods we can draw upon methods originally produced within other methodologies (Midgley, 2000, p. 168).

Therefore, when it comes to complex situations where understanding them calls for knowing about variety of theories, methodological pluralism is helpful. In the case of SD, even if we take the very basic definition of Brundtland report about three constituents of SD, i.e. the economic, social and environmental pillars, we acknowledge that SD is a complex notion and thus theoretical pluralism is inherent in the education for it. Consequently, methodological pluralism has to be pursued in education.
for sustainable development. This means if somebody has a specific expertise in a natural science field but her/his knowledge on the ontological level is not directly applicable in the so-called different fields of SD, still there is a room for applying the methodologies on the epistemological level. Yet one issue needs to be dealt with is how to combine and utilize these methodologies and achieve an appropriate pluralistic level. The solution of Midgley is to follow a ‘cyclical development of methodology’ which is possible to achieve by going through periods of openness to new ideas following by periods of revision and consolidation. He suggests that sometimes revisions may link to theoretical research and sometimes they happen as a result of reflections on the personal practice (Midgley, 2000). In other words, if achieving an appropriate pluralistic level is a cyclic process, it cannot happen just on one occasion and must be continued and revised constantly and reflectively. To elevate the level of methodological pluralism, the learners should be conscious which phase of the learning cycle they are going through.

The importance of being aware of going through the different phases of the learning cycle was another gift I got from my journey in the highly interdisciplinary field of SD. For technical scholars the learning cycle almost certainly starts from a technical and quantitative standpoint, and then if they have the chance of going through productive learning cycles, they will be able to examine the social basis that have orientated the scholars to specific technical standpoints. I said that my initial standpoint was also technical and quantitative but I was so lucky to find out that about thirty years ago a professor at Lanchester University made a similar journey as mine and developed a new type of social research enquiry drawing on a technical perspective. The methodology was inspired by Systems Engineering but has application in different fields of social science and in fact the technical spirit of it has been vastly modified through many upgrades by the inventor of it Peter Checkland and many other practitioners. After some successful experiences in dealing with technical problems using the Systems Engineering approach, Checkland proved that managers can fruitfully take advantage of an analogous methodology in coping with the unfolding complexities of organizational life (Checkland, 1999). He made a great effort to make the fundamental thoughts of Systems Engineering function in human situations as well and established a new type of methodology fitting the doctrine of Systems thinking and called it Soft Systems Methodology (SSM). This methodology commits itself not only to describe a given situation but also to bring about a change into it and to advocate action via performing scientific research.

To me, knowing about this methodology, which will be explained in detail in coming chapters, was an opportunity to apply my engineering mentality in dealing with some of the organizational predicaments of SD. Moreover, it showed me how much the nature of SD (as a typical unfolding complex concept) is subject to Systems thinking. Systems thinking, as will be explained later, has many useful insights into theoretical and methodological pluralism and hence could make an educational basis for SD.

From being lost in the labyrinth of SD to building a home under the shelter of Systems thinking, a similar journey which I have gone through might occur to any student who comes to the MSD program (and the similar programs related to SD). Therefore, I decided to share the experiences of this epistemological breakthrough and, more than that, adopt a systemic view to design a better pattern for our program.

The MSD is one of the programs established in the Decade of Education for SD (DESD). This resolution was decided by the United Nations General Assembly in December 2002 emphasizing that education is ‘an indispensable element for achieving SD’ (United Nations University, Institute of Advanced Studies,
2009). After adopting the resolution, a general vision for education for sustainable development (ESD) is described by UNESCO as:

ESD equally addresses all three pillars of SD; society, environment and economy; with culture as an essential additional and underlying dimension. By embracing these elements in a holistic and integrated manner, ESD enables all individuals to fully develop the knowledge, perspectives, values and skills necessary to take part in decisions to improve the quality of life both locally and globally on terms which are most relevant to their daily lives (United Nations University, Institute of Advanced Studies, 2009).

Launching and pursuing these types of holistic and integrated study programs is regarded as a necessary step towards achieving SD globally, however as seen in my personal account, has not been an easy task whatever. Such study programs face many theoretical, educational and organizational challenges to come up with the best possible interdisciplinary curriculum, pedagogy styles, program structure, scope of cover, and above all the most acknowledged definition for SD. Each of these challenges could be a distinct topic for a master thesis, but the ambition of this work is to address all of them at once and look at them as interconnected parts of a bigger picture in order to transform the MSD to a good example of productive ESD in the Decade of Education for SD. Thus this study follows a set of objectives enlisted below.

- To identify the important problematic issues of the MSD by the participation of the key stakeholders in the program.
- To address some of those issues by applying SSM.
- To improve some problematic situations in the MSD with the contribution of the key stakeholders.
- To investigate the strengths and weaknesses of SSM as applied in this case.

This hopefully provides the current and the future decision-makers of the program with a comprehensive guidebook (with enough space for further improvements and modifications) and demonstrates some applications of Systems Approach in ESD.

1.1. Thesis Outline

Thus far I have described briefly my travel through two years of study at the MSD and how it is related to the objectives of this study. In the next chapter I elaborate more on SSM and the methods I use. Kolb’s learning cycle, as an umbrella to any kind of action-oriented methodology will also be explained in chapter two, but the roots and characteristics of SSM are shown in chapter three. In chapter three I also dig into some theories of Systems which later on will make a basis for building conceptual models. Besides useful pieces of Systems Approach, a summary of the different existing views on ESD are given. Since the essence of this thesis is to bring about change, at the end of chapter three I touch upon the different categories of change in organizations.
In chapter four, the reader can see an overall overview about the current situation of the MSD. Seven stages of SSM are followed in this chapter one by one and lastly a report of the actual changes and outcomes can be found.

Ending chapter of the essay is a summary of the whole work and some suggestions for anyone who would like to continue the unfinished jobs. There I discuss about the shortcomings of applying SSM in the MSD case and also the general lessons that we can get from this case for other cases of ESD. With sharing some of my personal experiences during carrying out the thesis I close that chapter.
2. The Methodology Used

2.1. A Different Type of Methodology

In the beginning of this work it was quiet obvious to me which methodology I am going to use but during my interviews, with some long-established academicians, they were wondering if my work is a true scientific thesis or just a plan for giving consultation. Thus I tried to make it clear to them that my work is essentially scientific and abductive but not necessarily positivistic. Action-oriented methodologies still have a long way to go to be welcome by all the scientists and academicians. In their terms now the process of scientific inquiry is quite straightforward and, although subjected to some variations, is generally consists of following steps: 1) selection and formulation of the research problem, which consists of selecting a topic for research, gathering enough knowledge on current theories and previous research, literature review, identifying and defining the variables and concepts and then characterization of them and finally formulating a hypothesis. 2) Developing of research method which includes choice of research design, description of the samples and sampling procedures. 3) Data collection. 4) Analysis of data: data processing and statistical analysis, etc. 5) Interpretation of results by reasoning (logical deduction) from the hypothesis or theory. 6) Conclusion and recommendation 7) Writing the research report (Less and Higson-Smith, 2000).

In this type of scientific inquiry however there is no suggestion for any ultimate scientific way of formulating the research question in complex situation. What would happen if the problem formulation appeared to be a problem itself? Or if formulating a hypothesis was very controversial and people just did not agree on the mere formulation of the hypothesis? What would happen if we just prove or refute a needless hypothesis? What is beneficial in formulating a certain problem and forget about the others? Could collecting more and more information by a researcher helps to come up with a better question?

Patokorpi and Ahvenainen (2009) believe in complex situations, collecting more and more information but keeping the research question fixed only adds to the confusion. To them complexity is characterised by nonlinearity, turbulence and existence of high numbers of interacting factors which create an indefinable and messy structure. Therefore, in complex situations the researcher might need to re-contextualize the phenomena at hand and redefine the research question many times (Patokorpi and Ahvenainen, 2009). These types of inquiry belong to the category of abduction-based methodologies and in fact SSM and other systemic inquiries in general, follow the same principles.

It was said that to reach the objectives stated in chapter 1 SSM is employed in this study for many reasons, therefore as other abduction-based methodologies formulation of the problem will be evolved during the research phase and the theories review is done in parallel with interpretation of results. That is why in the beginning of my inquiry, I skip to formulate the final research question but rather according to the stages of SSM when the situation explored completely, the questions are supposed to emerge out of analysing the situation together with other people involved in it, and that will be described in chapter 3.
2.2. Soft Systems Methodology in Action

Soft Systems Methodology is an approach for combining and optimizing different mental models of a problematic situation. Systems Thinkers believe everything we know about the world is just a ‘model’ (Meadows, 2009) and ‘all models are wrong but some are useful’ (Box, 1987, p.424). SSM proposes a way to make a useful model which results in a beneficiary action for all the people involved in the problem situation (the stakeholders). It is believed in SSM that in the complex situation there is no final solution to the problem, but rather there could be an improvement in the problematic situation. Redefining and reconceptualising the problematic situation also helps to develop and find the shortcomings of the methodology itself rather than applying a set of prescribed methods, or in other words it is a cyclic learning process both about the situation at hand and about the methodology used (Wilson and Morren, 1990).

2.2.1. Seven-Stage Process for Soft Systems Methodology

Peter Checkland is known as one of the main founder of Soft Systems Methodology. The methodology is based on the belief that ‘reality is not a given but socially constructed’ (Checkland, 1999). In other words what we define as reality is just our model from reality and the model is highly influenced by the social context that we live in. If as a rational being, our model from reality is a basis for our decisions, the more we expand the context and include more models, the more effective we could make decisions that come through with actual change. Drawing on this belief SSM is divided into two realms, realm of the abstract world and the realm of the real world. The practitioners of SSM, i.e. the facilitators of change have to travel between these two realms consciously and iteratively. In the real world a variety of perceptions and interpretations of the world outside are expressed and argued by the participants who ask for a change After exploring the real world through direct observations and experiences and enriching his/her mind with as many ideas as possible, then the practitioners of SSM sits in the abstract world analyse the rich findings on paper and then build some conceptual models from the reality. But again right after modelling s/he has to go back to the real world and scrutinize the models by putting them against the actual happenings. Facilitators of change might need to travel between these two worlds many times until they reach an applicable instruction for change. Yet the process would not be complete, if they don’t wait to see and examine the outcomes of the change that they have initiated. This examination might make the facilitator of change to pass through the entire cycle again and again. Figure 1 shows the entire cycle expanded on the two realms and the different stages of SSM. The stages are described by Checkland and Poulter (2006) and Wilson and Morren (1990) as comes next:

1. The Unstructured Problem Situation:

Everything about SSM starts with observing, direct experiencing and knowledge extracting from a situation. Researchers and/or practitioners who choose SSM as a way of knowledge extraction act as facilitators of brainstorming and initiators of social learning too.

In the first stage of SSM the situation, which is regarded problematic by the people connected to it i.e. the stakeholders, is scanned broadly by the facilitator. Although s/he might not be blank-minded about the situation but it is very essential for her/him to stay as open-minded as possible and gathers the
various perspectives of the stakeholders. Facilitator can also act as a conveyor of perspectives between different stakeholders and hence assists the process of learning among them.

The goal of this stage thus is not to comprehend or scrutinize the situation but rather to think divergently about it and to expand the border of seeing its complexity and richness as much as possible.

Figure 1: Seven stages of SSM

2. **The Problem Situation Expressed:**
After enough digging into the situation, the facilitator is able to express the problem situation in better terms. S/he puts all the information and different perspectives together to compile them in a big picture which demonstrates significances, connections, agreements and disagreements. The big picture therefore is a rich resource for assimilating the situation and making meaning out of its complexity. That’s why it is also called the *rich picture*. This will reveal the more important *themes* and *issues* to be selected for further work.

3. **Development of Root Definitions of Relevant Activity Systems**
Now it is time for the facilitator to distance himself from the real world, start thinking abstractly and pick some bolder themes of concern out of the rich picture by analysing the thoughts and express them in
systemic terms. The expression of the themes of concern makes a basis for conceptual modelling and in fact is a compact version of our understanding about the situation. For each of the themes and with having an ideal future in mind, the facilitator formulates a statement of human activities that can realize the ideal future and transform the current system. This statement is called root definition since it is meant to be the source for designing more detailed human activity systems and conceptual modelling. By discussing these root definitions with the stakeholders, the facilitator finds out what is desired by them as improvements to the system and what core transformation process should be the focus. This stage contains many iterations, corrections and modifications during discussions with stakeholders.

4. Development of Conceptual Models for Improving the Situation

Once a vision of an improved situation shaped, and the transformation processes required for improving the situation identified, the facilitator starts to build conceptual models of the activities that would be carried out to realize each of the transformation processes. It is very important to be clear about each of the human activities and express it with one main verb to spell out one concrete actions respectively rather than general recommendations. The models designed in this stage are not plans to be implemented, but they are bases for comparison with the real situation and encouraging further discussions among the stakeholders.

5. Comparison of Conceptual Models with Reality

Now we have conceptual models of human activities required for the realization of the core transformations towards ideal future. The facilitator must put the conceptual models against the real situation to discern differences between reality and abstract thinking. In order to do so there are certain questions that could be asked like which of the activities are currently being carried out and how, which of them are missing and why? How and for how long is the activity monitored and by whom?

6. Identification of Feasible and Desirable Changes

In this stage the nature, reason, means of bringing, obstacles and consequences of the change must be studied more carefully. By doing so it would be possible for the facilitator to identify which of the activities proposed in the last stage are mostly desirable within in the current politics and culture of the system and at the same time are feasible in terms of availability of resources and overcoming environmental constraints.

7. Action to Improve the Problem Situation

Now the change is going to happen by the implementation of the most feasible and desirable activities. The outcome of this stage thus would a plan consisted of concrete and implementable actions. Means of measurement of success and effectiveness as well as indictors of progress have to be included in the plan. Nonetheless it is not the end of process; any change in the systems creates another system which needs to be monitored and maintained. Some times the level of improvement is not enough, or the new situation could initiate a new sense of dissatisfaction and conflict. Therefore another cycle of the seven-stage SSM needs to be followed again. Improvement of a situation (unlike solving a problem) is a gradual and iterative process.
2.3. **Learning Cycle**

It is stated that going through cycles of SSM increases the knowledge of the facilitator and the stakeholders about the situation as well as their own connection with and role in it. Actually the effectiveness of SSM is coupled to the learning process that takes place during the iterations. In this section the coupling between SSM and learning process is explained. The idea of classification of different learning styles is borrowed from the experiential learning theory by an American educational theorist, David Kolb. Kolb believes that ‘learning is the process whereby knowledge is created through the transformation of experience’ (Kolb, 1984, p. 38). This process is called experiential learning and involves four distinct learning abilities namely concrete experience abilities (CE), reflective observation abilities (RO), abstract conceptualization abilities (AC), and active experimentation abilities (AE). Effective learning to Kolb means going through all of these four phases. A successful learner starts with involving himself/herself willingly in the new experiences and gaining as many as possible inputs from her/his environment (CE). S/he also must be able to reflect on the inputs gained and look at them from various perspectives (AC). To give meaning to the experiences and to connect them with his/her previous knowledge is another important phase that enables the learner to conceptualize, generalize and analyze the experiences. The last phase in a successful experiential learning cycle is to solve problems and come up with plans and concrete actions (AE). Learners however are different in terms of the learning abilities that they have developed and been educated for. Depending on which combination of the above-mentioned learning abilities s/he has, the learner belongs to one of these four categories: 1) Divergent (CE/RO) learners: Individuals with this style of learning seek new experiences rather than abstract concepts but they are able to identify concrete examples of a concept and see that from many perspectives. They are mostly interested in the question of what is happening. 2) Assimilative learners (RO/AC): These types of learners seek explanations, relations and logics behind the experiences in order to create theoretical models from their disparate observations. In other words they feel comfortable with inductive reasoning. They are mostly interested in the question of what does this all mean. 3) Convergent learners (AC/AE): They are learners with interest in deductive reasoning and finding solutions for problems out of general theories and thus converging to one given answer. They are mostly interested in the question of what could be done. 4) Accommodative learners (AE/CE): Their best ability is to get the things done by following instructions and plans. They are most interested in the question how can the actions be implemented?

SSM could be described as an action-oriented learning process compatible with Kolb’s model of experiential learning. A successful practitioner of SSM thus has to go through full cycle or cycles of experiential learning and persuade other stakeholders to do so to make sure that the maximum learning capacity of the system are utilized. Figure 2 and following descriptions show the compatibility between the methods used in the seven steps of SSM and four phases of the Kolb’s learning cycle.

- **What’s happening?**

This phase in the learning cycle focuses on experience and observation. The tools applied in this stage include methods such as unstructured, in depth or semi-structured interviews, formal or informal conversations, direct, planned or random observations, map studies and gathering of historical information, brainstorming and mind-mapping of individuals and composite mind-mapping of the
people involved in the situation in order to obtain a rich picture. Rich picturing is a technique to embrace and illustrate all the aspects of the situation. A rich picture in a non-verbal and non-linear visual expression that can contain pictorial symbols, cartoons, sketches keywords and any visual drawings that convey the thoughts and emotions about the situation (Checkland and Poulter, 2006). Creativity and freedom in illustration of thoughts is the essence of this technique. That’s why it calls for CE and RO abilities of the facilitator. The facilitator should not impose any structure or limitation on the picture. Both factual data and subjective information and emotion could be included in a rich picture (Checkland and Poulter, 2006).

Figure 2: Kolb’s Learning Cycle and SSM Tools

- **What does all this mean?**

To make sense out of the information collected, this phase focuses on tools that aid in understanding and assimilating the observations. Tools like Venn diagram, institutional interaction, cause-effect diagram, multiple-cause diagram, and influence diagram can be used to organize the disparate thoughts and orientate them towards identifiable themes of concerns and issues.

Venn diagram is a way of visually representing the interaction between the various stakeholders involved. Cause-effect diagram illustrates all factors affect a certain issue. The factors may directly affect the problem, or indirectly through other factors.
Influence diagram is a graphical representation of the outcomes of or dynamics influencing a certain decision.

○ What could be done?

This phase involves realizing solutions and converging on classified thoughts to figure out what might be done and by which agents. One or more transformation processes are identified and respective human activity systems, to make change happen in the current system, are modelled. Modelling of human activity systems starts with formulating a root definition and if the root definition to be well-informed that should be supplied by some elements called CATWOE (Checkland and Scholes, 1990). **CATWOE** is a mnemonic for:

- **Clients**: The potential beneficiaries or victims of the transformation.
- **Actors**: Those who have the possibility and power of implementing the transformation.
- **Transformation**: The activities that are required to convert the system from an old state into a new and hopefully improved state.
- **Worldviews**: The picture of the world that makes the transformation process preferred meaningful to each of the stakeholders.
- **Owners**: Those who have the authority to stop the transformation.
- **Environment**: The factors in the physical and social environment that affect the transformation and are not possible be changed.

Thorough investigation of CATWOE can make a solid ground for modelling the human activity systems with identifiable transformation and agents of change.

○ How can the actions be implemented?

This phase clarifies the details of each of the actions to be done. Thus following questions are relevant to be asked by the facilitator of change: Why is the activity necessary? How will the activity be done? When should the activity be completed? Who should implement the activity?

All of these four phases of experiential learning, which also take place in SSM, belongs to a stream of enquiry described as the *logic-based stream* by Checkland. Nonetheless according to him, this is not the only cycle that a systems practitioner has to go through. S/he has to analyse his/her own role in the situation as well as the other stakeholders’ position by going through a *stream of cultural analysis*. In the stream of cultural analysis, there are three main examinations of the problem situation:

○ Intervention analysis, i.e. analysing and reflecting upon the application of SSM to the problem situation.

○ Social system analysis, i.e. focusing on roles, norms and values in a problem situation.

○ Political system analysis, i.e. answering questions related to power distribution in the problem situation.

Drawing on the comparison results derived from the logical-based stream and the three analyses in the cultural stream, the analyst is able to discern changes that are systemically desirable and culturally feasible to implement (Checkland and Poulter, 2006).
I use the metaphor of computer programming to clarify these two streams of analysis. Let’s assume we want to write a computer program by means of specific software; first we have to be fairly aware of **what we do want to write**, this is a metaphor of logic-based analysis. But it is not the only analysis we need to do, we also have to make sure about the type of operating system of the computer, i.e. whether it is capable enough to execute or program or not. This step is more like intervention analysis. Then we have to think about the programming software we are going to use, i.e. whether it is compatible with the programming language we use and it could understand the codes we use or not. And finally, we need to know about the hardware of the computer, i.e. how much power does it use? What is the capacity of its memory and hard drive? These two last steps are social and political analysis accordingly.

### 2.4. The Implications of Systems Approach and Learning Theory in the MSD Case

The MSD is a large program in terms of the number of its students and the institutions involved in it. It is run by a combination of more than seven different academic departments at two big Swedish universities, the educators come from a variety of academic disciplines, the students are from five different continents and each of them carries a different view about SD. The multiplicity of the concept of SD in conjunction with the of the complexity of organizational structure in the MSD program produced a problematic situation, which figuratively referred to as a ‘mess’ in systems language, where the opportunities and difficulties interlock with each other and produce an indefinable sense of unease. It has stated before that the main application of SSM is to clarify and formulate the problems and opportunities arising from messy human situations. Thus it is obvious that SSM could be adopted for addressing the problems of the MSD. On the other hand according to the Kolb’s learning cycle, SSM is able to create an opportunity of knowledge production and experiential learning. Since the mission of the organization here is education, SSM with its particular emphasis on learning could have double usage.

I took advantage of the first usage widely to address the organizational issues and touch upon on the second usage to conceptualize ESD. Nevertheless, as the time span of this thesis is limited to six months, I did not have the chance of applying some of the very last stages of the methodology, such as monitoring the consequences of transformations and modifying the models.

Many issues about ESD at larger scales can be exemplified by looking into the MSD program; although it is not the primary aim of this thesis but I try to put forward those issues in my discussions too.

### 2.5. Plan of the Case Study

This work started with some discussions among the first cohort of the MSD students. They prepared a report, summarizing their concerns, to be delivered to higher decision-makers. The report got a very positive feedback but did not find the right actors to be implemented in reality. I started my work with reviewing that report, identifying the issues inside it, expanding its scope and finding out about the potential clients concerned about the situation. Then I realized that the rest of the work can be done according to the seven stages of SSM as below:

**Stage one:** From the various tools suggested by Wilson and Morren (1990) and I mentioned above, the following techniques were used to dig more into situation.
• Direct observation and full time participation in all the courses of the MSD and several similar courses in other masters program at SLU and Uppsala University.
• Collection and reading the official proposal, plan, and evaluation results of the MSD.
• Separate and group interviews with the stakeholders shown in Figure 4 (at least one member from each group was interviewed).
• Mind mapping of the students’ representatives.
• Reading through the outlines of some similar programs in the Swedish Universities like Masters Programme in Environmental Studies and Sustainability Science at Lund University\(^1\), Master’s in Strategic Leadership towards Sustainability at Blekinge Institution of Technology\(^2\), and Science for Sustainable Development Master’s Programme Linköping University\(^3\).

Although the general approach in the interviews is encouraging stakeholders to express their concerns in their own terms, asking some clarification questions can help in stimulating the discussions. The questions I asked during the first interviews were of arbitrary and unbiased nature, while after conducting some interviews I succeeded to structure them more and more while trying to sidestep my own opinion of the situation. Some questions were used in the later semi-structured interviews:

- What do you like/dislike most about the program?
- What is special about this program to you?
- What are differences between your tasks in this program and your previous similar works/studies?
- What makes you ardent/uncomfortable while you are working/studying at the program?
- Have you ever complained about your position? When was that and in which terms? What was the result of your complaints?
- How do you see your own role in the program?
- How do you manage your responsibilities in the program?
- When did you join the program? How long more are you going to stay with it?
- When did you start working with sustainability issues?
- Do you have any specific definition for SD?
- Which fields within SD are you interested most?
- Who makes decisions about you responsibilities in the program?
- Who administrates and evaluates your performance?
- Who would you like to be in contact with during your work/study in the program?

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\(^1\) [http://www.lumes.lu.se/index.aspx](http://www.lumes.lu.se/index.aspx)
\(^2\) [http://www.bth.se/ste/tmslm.nsf/pages/msls_home](http://www.bth.se/ste/tmslm.nsf/pages/msls_home)
Stage two: In this stage the rich picture of the MSD was analysed. To conduct the logic-based analysis, I dug into two main areas of program: organization and the curriculum. Then I based further analysis on some insights gained from Systems thinking. By doing so three layers of issues were identified and will be illustrated in section 4.2.1.

Stage three: After identifying two layers of issues, I took advantage of theories about organizational change, ESD and interdisciplinary team work and then envisioned an ideal situation for each layer.

Stage four: In order to develop conceptual models that could realize the ideal visions, I went back to the stakeholders and some of the models which made more sense to them were discussed and then the human activities derived from them.

Stage five: After examining feasibility and desirability of the activities proposed, I realized that the second layer of issues cannot be discussed furthermore; as my time and knowledge was limited besides the clients did not appreciate the situation envisioned. Therefore for those layers I stopped the SSM process in stage 5.

Stage six: For addressing layer 1 of issues, I progressed to stage six as I accessed to the correct actors within the boundary of the system under study (like the program heads, students and course leaders), but for layer 2, I did not have access to appropriate clients (higher decision-makers of the program at the faculty level) thus I stopped addressing the second level at stage 6.

Stage seven: With the contribution of the key actors in the MSD some of activities were modified and approved to be implemented. But within the bounds of existing rules of the two universities, it is not possible to apply structural changes in a Master program within a single academic year. A major part of the plan for changes proposed for the academic year 2010-2011 have not been implemented, and therefore, the actual impact of this study could not be truly judged in this study.
3. Theoretical Foundation

In this chapter the conceptions of systems thinking as the main foundation of SSM are elaborated. Not only because system thinking is the core logic of the methodology used in the study, but also because it could be an appropriate framework to design a productive ESD program. By describing some relevant models of ESD the connection is shown.

Organizational change and its particularities in the case of educational organizations are also explained at the end of the chapter to be used in conceptual modelling in chapter 5.

3.1. Systems Approach

_The truth was a mirror, once fell from the heaven and shattered. Anyone picks up a fragment, sees himself in it and believes the whole truth is before him (Rumi, 13th-century Persian poet)._ 

If we believe this saying of Rumi then we would approve that any individual is just able obtain only a piece or some pieces of the truth. This is the fundamental idea of systems thinking however as we will show in this chapter there actually exists a glue which can help us to connect more pieces of the shattered mirror and see a bigger picture of the truth in it. This glue is nothing but coming together and looking at the others mirrors. Systems thinking is a belief in existence of a ‘broken mirror’ and Soft Systems Methodology shows us how better we can bind the shattered pieces of it. The new image in the mirror would be a better explanation of the reality but we should admit it is not yet the whole truth. Therefore systems thinking, as it name implies is not an intellectual discipline, it is not defined by the subjects to which its rules can be applied but as Chapman (2002) believes systems thinking is more like history or philosophy. It is an attentive process of thinking that can apply to a wide range of human app

One way to understand systems thinking is to contrast it with the reductionist approach to tackling complexity. Reductionist thinking has been remarkably successful, particularly in developing successful theories and models of the inanimate world when combined with scientific procedures. The essential aspect of the reductionist approach is that complexity is simplified by dividing a problem into sub-problems or lesser components. The process of sub-division is continued until the resulting bits are simple enough to be analysed and understood. The operation of the original complex entity is then reconstructed from the operation of the components (Chapman, 2002).

The start point of systems thinking is not dividing and sub-dividing the problems into separate parts, and solve each part one by one. There are intrinsic and essential properties in the connections between the parts that would be denied in the process of dividing and systems thinkers are particularly interested in the properties that connections produce in a system.

Systems thinkers however, depending on the type of the problem situation to be addressed, take either of two main positions existing in the systems school. In systems language problem situations might be either _difficult_ or _messy_. The distinction between mess and difficulty depends on basic understanding of the people involved in the problem situations, and described by Ison (2008) as:
Difficulty is characterized by broad agreement on the nature of the problem and by some understanding of what a solution would look like, and it is bounded in terms of the time and resources required for its resolution. In contrast, messes are characterized by no clear agreement about exactly what the problem is and by uncertainty and ambiguity as to how improvements might be made, and they are unbounded in terms of the time and resources they could absorb, the scope of enquiry needed to understand and resolve them and the number of people that may need to be involved (Ison, 2008).

Table 1: Differences between Hard Systems Thinking and Soft Systems Thinking (Modified after Ison, 2008)

<table>
<thead>
<tr>
<th>Hard systems thinking</th>
<th>Soft systems thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal-oriented</td>
<td>Learning-oriented</td>
</tr>
<tr>
<td>Assumes the world contains system that can be engineered</td>
<td>Assumes that the world is problematical but can be explored by using systems models</td>
</tr>
<tr>
<td>complex-unitary: key issues are difficult to appreciate, but general agreement is perceived between those defined as involved and/or affected</td>
<td>complex-pluralist: key issues are difficult to appreciate, and disagreement is perceived between those defined as involved and/or affected</td>
</tr>
<tr>
<td>assumes system models to be models of the world (ontologies)</td>
<td>Assumes system models to be intellectual constructs (epistemologies)</td>
</tr>
<tr>
<td>Talks in the language of ‘problem’ and ‘solutions’</td>
<td>Talks in the language of ‘issues’ and ‘accommodations’</td>
</tr>
<tr>
<td><strong>Advantage:</strong> Allow the use of powerful techniques</td>
<td><strong>Advantage:</strong> Is available to all stakeholders including professional practitioner; keeps in touch with human content of problems situations</td>
</tr>
<tr>
<td><strong>Disadvantage:</strong> May lose touch with aspects beyond the logic of the problem situation</td>
<td><strong>Disadvantage:</strong> Does not produce the final answers; accepts that inquiry is never-ending</td>
</tr>
</tbody>
</table>

Dealing with difficulties is subject to a branch called hard systems thinking. While soft systems methodology has been particularly developed to address messy situations. Table 1 summarizes the differences between these two traditions. The difference is mostly in the epistemological stand of these branches. Epistemology is the study of the ‘containers’ and ‘carriers’ of knowledge i.e. the mental setting and the socio-cultural milieu within which our knowledge is shaped. Soft systems thinking revolves on the assumption that the truth about the system under study and our personal believes are mixed and not recognizable from each other, so when we want to make mental models for a given system i.e. ‘to know it’ in order to change it in a desired way, we have to be conscious about the setting of our knowing process and the possibility of designing many different mental models embedded in different believes. In hard systems thinking however the fundamental assumption is that models could be exact reproductions of systems if certain principles and systems concepts are investigated about them. Basic systems concepts are acknowledged both in hard and soft tradition of systems thinking, although in soft one the basic concepts are regarded as tools to organize our thoughts whereas in hard tradition, the systems concept are regarded as intrinsic facts. Some of these concepts, classified by
Chapman, (2002), Meadow (2009) and Ison (2008), are: systems boundary, systems order, communication, connectivity, emergent properties, resilience, self-organization, delays, feedback, hierarchy, nonlinearity, transformation, leverage points and systems trap.

Systems concepts have found their way into the discourse of sustainable development mostly in the form of hard systems thinking, for instance the belief that the world is consisted of three systems namely economic, social and ecological system and that those systems are connected and show emergent properties. In education for sustainable development on the other hand, systems thinking with its emphasis on epistemological awareness can play a more important role which will be explained in the next section.

3.2. Education for Sustainable Development

Most mainstream education sustains unsustainability-through uncritically reproducing norms, by fragmenting understanding, by sieving winners and losers, by recognizing only a narrow part of the spectrum of human ability and need, by an inability to explore alternatives, by rewarding dependency and conformity and by servicing the consumerist machine (Sterling, 2001, p. 14).

Sterling (2001) believes, within the current structure of our educational organizations, ESD is not achievable. If our approaches to education are supposed to be fixed and we just plan to append ‘science for sustainability’ to our current collection of sciences, then the current structure with few numbers of additions will be reproduced.

In fact the question of ESD is more about which kind of education could enable us to revise what we have done so far that led us to unsustainability. According to Sterling that type of education must not only increase our knowledge about the world outside but also rebuild the construct of our minds. Thus he distinguishes between three levels of learning in order to design appropriate objectives for ESD.

Basic Learning:

At the first level, educators teach and students learn how to respond to change in the system’s environment which in the ESD case is the consequences of unsustainability such as energy shortage, climate change, loss of biodiversity, environmental pollution etc. This level of learning is variously described as adaptive, basic or single-loop learning (Sterling, 2004). At this level the goal of learning is formulating questions and finding solutions by admitting the fundamentals of the current systems or as it described by Clark (1989, p. 206) the goal is to ‘change within changelessness’. For example at this level the energy shortage is formulated as ‘lack of fossil fuels’ and thus the solution would be proposed as ‘finding alternative energy sources’.

Meta Learning:

At the second level, however, the fundamentals, norms and values of the current systems are supposed to be questioned more critically. Therefore not only students but also educators learn to reexamine their thoughts and norms in order to reformulate given questions frequently. For example at this level the energy shortage may be reformulated as ‘irrational exploitation of energy resources’ or ‘unbounded demand for energy’ and thus the solution could be proposed as ‘rational use of energy’ or ‘decreasing
the demand for energy’. This level of learning is variously described as generative, meta- or double-loop learning (Streling, 2004).

Epistemic Learning:

At the third level, the reformulation process goes one step further and includes questioning and reexamining the total paradigm that the learning process occurs within. It calls for major change in cognitive abilities of students and educators. This level therefore, is described as third-level or epistemic learning (Streling, 2004). For example at this level the problem of energy shortage would be formulated as reconsidering the definition of shortage itself and thus the solution could be proposed as combating other types of shortages that make us dependent to energy.

The importance of epistemic learning for ESD is about enabling the minds of students for ‘restructuring of mental models at a higher level of complexity’ (Ison, 2008, p. 151) and making the necessary platform for achieving ‘methodological pluralism’ as proposed by Midgley (2000).

While basic learning could take place on an individual level, meta- and epistemic learning need a platform in which the learners have the possibility of coming across new norms and ideas more frequently or as (Ison, 2008, p. 151) puts it have the prospect of ‘genuine openness’. That means learning collaboratively and examining our thoughts with one another is a perquisite for the higher orders of learning. Collaborative learning is a specific process that begins with a comprehensive discussion of ideas and norms (Daniels and Walker 2001) and leads to agreement and production of collaborative knowledge about a specific issue.

Experiential learning, defined in the previous chapter is also indispensable not only for completing the cycle of learning and evaluating the practicality of our knowledge, but also to obtain the cognitive capability required for meta-learning.

Any fundamental change in ESD involves educational organizations that go beyond basic-learning, motivate meta- and epistemic learning and create an appropriate environment for collaborative learning. The right combination of all these learning processes prepares the learners to be ‘systemic’.

From experiences of educating Systems Thinkers it is concluded that Systems Thinking was only possible if individuals could be(come) systemic. They chose not to highlight a visionary state but to focus on the inclusive and holistic nature of processes that addressed the nexus between the epistemic development of critically self-reflexive ‘actors’ and material and social ‘acts of development’ (or improvement) under complex, often confrontational circumstances (Ison et al., 2007).

In the next section, the respective types of organizational change required for each order of learning are described.

3.3. Organizational Change

In a given system transformation occurs on the input to give a certain output. If the input is fixed but the output changes, then it is possible to conclude something within the system has changed. In another word if we want a different output from a same input, we have to change something inside the system. The definition of the input and output, however, depends on how we decide about the boundary of the system. Within the boundary of this study about the MSD, the input to the system is defined as the
knowledge of the students coming from different parts of the world as well as the knowledge of the educators at the two universities. The output then would be the type of knowledge and competence that both students and educators will obtain after the MSD program. Therefore anytime that I refer to change I am talking about a shift in the level of knowledge and competence. We have seen three types of possible knowledge transformation happening as a result of three different types of learning. An organizational change could be considered relevant to each of those transformations, respectively first order, second order and third order of organizational change.

First order organizational change is a change that reinforces and sustains the primary task of an organization. The primary task in SSM is equivalent to the basic nature of an organization, its reason for being, its main functions or its obvious roles (Wilson and Morren, 1990). In order to make this change happen the understandings about the nature, the structure and the mission of the organisation must be expressed clearly and then reinforced by the facilitator of change and the stakeholders.

Second order, evolutionary organizational change or reform as described by Burke (2008) is continuous improvement and alternations or modifications in existing system characteristics, such as substituting certain people and positions in the organization, eliminating a layer of management or administration in the organizational hierarchy, rather than a shift in the organizational mission. In order to make this change happen the individuals’ understandings about the mission of the organization have to be challenged, yet incremental changes in a systems’ parts will not alter the whole radically.

In revolutionary or third order change which mostly occurs in leaps and not in an incremental and linear manner, the total function of the organization is questioned and then transformed.

Organizational change cannot always occur since even in the case of dissatisfaction and having difficulties with the current situation, there might not be enough desire or clear vision for change. At least three factors must be present for a meaningful organizational change to take place. Change is possible to occur when the multiplication of dissatisfaction, vision and first concrete steps that can be taken towards the vision is greater than resistance (Beckhard, 1969). SSM, as a methodology claimed to be committed to bring about change, puts a great effort on designing each of the first steps carefully and also envisioning the desired future in a participative way to cure resistance that possibly occur during the implementation of change.

3.3.1. Academic Leadership for ESD

Planned organization change cannot take place without an appropriate leadership. Leadership is not the same with authority, and there are some differences between leadership and management. Burke (2008) believes leaders are the starters and motivators of change, while managers are the administrators and regulator of change. Leaders create opportunities for innovation, they persuade their followers to question assumptions and to be critical about the current situation. They enable people to adapt to, work with change rather than resist it, while managers try to keep the stability and persuade the followers to be pragmatic and cooperative. Management is a way of imposing regulation on the institution; it is a way of keeping the organization on time and on budget. It is about ‘doing things right’ and ‘path following’, about looking at present activities and ensuring they work consistently and well. Leadership is about directing change, about ‘doing the right thing’ and ‘path making’ (West-Burnham, 1999, p.3). Both roles are needed for implementing a successful first, second or third order change in an
organization. They are complementary to each other. Neither alone, excessive management nor excessive leadership can guarantee long-run success of an organization.

Excessive management produces compliance, passivity, and order for order’s sake; it discourages risk-taking and stifles creativity and long term vision. But excessive leadership without the compensating force of strong management produces inconsistent, delayed and off budget results, while emphasizing change for change’s sake (Scott et al., 2008).

The distinction between leadership and management is also identifiable in the case of academic organizations, however, as generally there is a lack of firm hierarchical structure in universities compared with other types of organization (Scott et al., 2008), academic organizations are more reluctant to have rooms for these two positions separately. In the case of ESD, as we will see in next section, it calls for the integration and cooperation of different persons from different disciplines and keeping a firm hierarchical structure in this case is very hard as well as disadvantageous, on the other hand both roles of proper leadership and management are needed.

Another feature of classic academic organizations is their commitment to produce objective knowledge; this feature makes them very different from private organizations which are more guided by considerations of maximizing shareholders value or from nongovernmental, community-based organizations that seek operational purposes (Scott et al., 2008). However strong commitment of academia to objectivity and knowledge production restrain them to be an appropriate type of organization for promotion of ESD since, as it will be explained in the next chapter, the action-oriented type of ESD cannot suffice to objective knowledge production.

Considering these features of academic and educational organization, besides the particularities of ESD, we have to reconsider and emphasize the role of leaders in the case of ESD. Mere management or classic leadership cannot respond to the needs of ESD. Leaders of ESD should have the ability to develop a collaborative and supportive culture and to provide opportunities to share knowledge between colleagues. Debowski and Blake (2004) also suggest more specific capabilities and competencies for academic leaders such as:

- a strong commitment to pedagogy, and an understanding that course design and curriculum development should be driven by a strong grasp of how learning occurs and the effects of different forms of teaching on student learning; a sound awareness of the university, faculty and school, and teaching and learning policies; knowledge of the curriculum areas and factors which need to be considered when designing relevant and effective curricula; the ability to evaluate and review courses and programs; the capacity to analyze and evaluate curriculum content for relevance, suitability, currency and uniqueness; an understanding of student needs and learning styles; and ongoing development of new teaching strategies (Debowski and Blake, 2004 p.3-4 ).
4. Applying SSM to the MSD

In this chapter, I start by investigating the characteristics of the situation. The overriding goal of the situation description phase is to think divergently about the situation and place it progressively in wider and wider contexts (Wilson and Morren, 1990). The central task is to identify the situation in all its richness and complexity rather than defining the problems, in order to do so enough information about the MSD from a variety of resources is given. Some of my resources are official and printed documents, some have come from the memory and the observations of people involved, and the rest are based on my personal observations, therefore it is not possible to judge how much of the description in this chapter is objective and neutral. However as stated earlier, in SSM, objectivity is not a requirement and the essential matter is the views of people about the situation.

After gathering the data, to have a more meaningful order of presentation, I divide them into three packages which are the organization of the program, the approach of it and finally the outline of the MSD program as it is stated in official documents. By organization here I mean the structure and the relationships between different nodes of decision-making within the program. Approach of the program is the direction according to it the students’ abilities are supposed to be developed during the learning process. The outline is the curriculum of the program, the objectives and the weight of the courses, their disciplines and different types of examinations. This information can help to draw a proper rich picture of integrated net of issues and then start with analysing the issues according to logic-based and cultural-based type of analysis proposed by Checkland.

4.1. Description of the Program

The program was launched in August 2007 followed by some planning of a joint council consisted of educators at both Uppsala University and the Swedish University of Agricultural Sciences (Sveriges lantbruksuniversitet-SLU). Uppsala University, founded in 1477, is known as the oldest institution of higher education in Scandinavia and has a good reputation for its scientific approach, critical thinking and professionalism, as well as collaboration and progression across different levels of study. In the year 2009, the university has about 40,000 students and about 2,000 doctoral students. It has a teaching staff of 4,000 out of a total of 6,000 employees (Uppsala University, 2009). SLU is very much younger, founded in 1977, and with having around 4000 students is much smaller than Uppsala University, however, its organization and mission is essentially focused on sustainability, natural resources and environmental issues such as climate and ecosystem change, sustainable production and urban and rural development (Sveriges lantbruksuniversitet, 2009). SLU has different campuses around Sweden but the main campus and the head office is situated in Ultuna which is an educational and agricultural neighbourhood in south of Uppsala city. The MSD program were meant to be a bridge between these two universities in order to exchange their experiences and capabilities in different disciplines related to SD. It seems that it has a great potential to do so since although there are some other joint programs between these two universities, but none of them covers so many common areas of activities at both universities. The joint council designed the primary curriculum and came to agreement about the primary description of the program:
Human activities affect and are affected by natural resources in many ways. The programme SD offers opportunities to learn more about SD in various disciplines. SD is an important political objective in Sweden and many other countries. The programme has an interdisciplinary basis and applies a holistic perspective using economic, social and ecological dimensions. Knowledge of how environmental and social aspects affect economic development is central to the programme. The programme offers a review of different approaches to SD in both the natural and social sciences. The students will be equipped with analytical and quantitative tools for assessing and managing SD. These are then applied to interdisciplinary case studies where the students will collaborate with a fellow student from another discipline. In addition, they may choose from a variety of optative courses within the profile of their Bachelor’s degree (SLU Programmes, 2009).

The scope of future career for the students is claimed to be very wide and, as it is stated in the description, the program also provides the students with enough capability to peruse higher degrees although it is not clear from the statement in which areas or disciplines:

The labour market for this educational programme includes different types of decision makers in the private and public sectors, e.g. educators and scientists. Examples of job opportunities within the private sector are the automotive, construction and IT sectors, various non-governmental organizations, and the travel and tourism market. The studies will also form an excellent basis for pursuing PhD studies and academic research (SLU Programmes, 2009).

The main requirement to be admitted to this program is having a Bachelor’s degree in any field of natural or social sciences and certain level of English language qualification (SLU Programmes, 2009), that literally opens the door of the program to anyone who has a certain level of academic studies, no matter in which discipline.

4.2. Organization of the Program

The MSD has been first introduced by Bo Sundqvist, a physicist and the former rector of Uppsala University and the Faculty of Science and Technology (TEKNAT) officially launched it in 2007 (Gemert B., 2009). At the time of this writing, the MSD program has been running for three years with the enrollment going up remarkably from twenty in 2007 to eighty in the third year of admission (2009). The Department of Earth Sciences at Uppsala University is its home, but many of the administrative tasks took place at another location, the Evolutionary Biology Centre (EBC). The collaborating university, SLU, assigned responsibility for the program to its Faculty of Natural Resources and Agricultural Sciences and within the Faculty, the Department of Economics and the Department of Urban and Rural Development (institutionen för stad och land-SOL) play important roles in the MSD. There is a strong natural science part within the program, but the long established Faculty of Social Sciences at Uppsala University has little influence on the program. The decision about the right academic location for SD, and its position as a subject of scientific research was a hard one, so running it jointly and cooperatively were proposed
by the initiators as the immediate solution. Still the pattern of cooperation is a matter of debate both at administrative and scientific levels.

In addition to the discipline-based departments, there are a number of interdisciplinary centers working on different areas of SD at both universities, such as the Uppsala Center for Sustainable Development (CSD), the Centre for Environment and Development Studies (CEMUS), the Baltic Sea University Program and the Swedish Environmental Impact Assessment Center at SLU (EIA). These centers has a share in running the MSD program, but a systematic coordination of these many actors is in fact beyond the normal responsibilities of the program head. The variety of the actors as well as their respective position is shown in Figure 3 and the mission of them with more explanations could be found in Appendix.

![Figure 3: Stakeholders in the MSD](image)

The program runs by two heads, one from Biology Department at Uppsala University and the other from Urban and Rural Development at SLU. Therefore it seems that the weight of courses in the natural sciences is more on the side of Uppsala University and the courses pertaining to social sciences need to be taught at SLU. When we look at the curriculum this is true to some extent but it is not clear whether this decision has to do with the specific capacities of the two universities or that was just one possible way of dividing the tasks between them. Nevertheless according to the official mission statement for the program heads both heads regardless of their home disciplines are assigned to a certain set of responsibilities that basically are:

- to participate in planning and development of the program
- to assist the program committee for formulating the proposal of economic planning
- to coordinate the draft curriculum and scheme of education
- to advise and support the students in the program
- to communicate the information about the program to students and promoting the program
- to prepare and provide advice on accreditation of courses

In this statement however, there is no information about any necessary qualifications of the program heads and it is not clear who is responsible to judge about the performance of them. Nonetheless, in the organizational chart (Figure 4) there is a program board consisted of the vice dean of the faculty of Science and Technology (TEKNAT) at Uppsala University, associate dean of the faculty of Natural Resources and Agricultural Sciences at SLU, and the two program heads. The program board makes the major decisions about the structure of the program and judges the performance of the course leaders.

The course leaders, depending on the different objectives of their course and within the scope of course budget, are free to hire appropriate lecturers from any other university. The course budget is proportional to the number of the students registered in the course. In the year 2009, most of the higher educations in Sweden, including the MSD program, were tuition-free for the Swedish and international students and the universities’ costs were subsidized by the Swedish government (Swedish Institute, 2009). The program budget has been also proportional to the number of students who successfully finish the program. However this scheme is going to be changed for the non-EU/EEA students from the academic year 2011 and the education won’t be free for them any longer. It has not been investigated in which ways this new policy of the Swedish government will affect the MSD and the similar programs, nonetheless it is predicted that the current arrangement of the program, probably with smaller number of students from non-EU/EEA countries, will continue to exist.
4.3. **Approach of the Program**

It has been said previously that SD has been too complex to be defined accurately, nevertheless in any plan that aims to be sustainable a kind of map indicating the start point, the approach and the target needs to be agreed upon by the decision makers. By the approach of the program I exactly mean this map. In an educational plan the start point of the map is equivalent to the basic knowledge of the students, the approach is how to invest on and develop that basic knowledge and the target is akin to the type of the students that will trained. Here I try to derive this map from the information given in the official documents of the program. According to these documents general map of the program in the years 2007, 2008, 2009 and 2010 can be illustrated as shown in Figure 5. It shows the intended direction of the program in the first year of studies which directs the students from gaining wide general knowledge of society and natural resources to learning about methods and tools and then to applying those tools to narrower case-specific practice. During this type of education, students accumulate basic knowledge from different disciplines, and then they are equipped with methodologies to integrate different disciplines and gain the tools and techniques they probably will need for their future career and action. They are also supposed to be given the opportunity of practicing their knowledge with some hypothetical projects. In this approach critical and more radical views are not ignored but they make a
narrower margin in parallel with the main direction; what has come in the description as ‘the power to appreciate and discuss sustainability discourses’ (Appendix) mostly belongs to the critical part. If the students succeed to pass the first year according to this figure, then they will be supposed to orient themselves and seek the applications of SD sciences in their own field of expertise in the second year of studies. In the outline of the program it is stated that:

Of central importance is the parallel training in oral and written presentation together with theoretical learning. The progression within the programme is characterized by later courses giving an increased depth within the subject, increased complexity, increased focus on analysis and synthesis, increased independence and responsibility for one’s own learning, increased responsibility for disciplinary development, and an increased ability to communicate disciplinary and transdisciplinary knowledge (Uppsala University, n.d.).

![Figure 5: Program Approach](image)

If we put this figure against the syllabus of the program (Appendix), some of the components of the description are easily realizable in the syllabus i.e. it is clear which of the courses are meant to cover which of these aims, but some other components are not direly connected to any particular course. It seems the intention was teaching and developing them during the whole process of education.

4.4. **Expression of the Problem Situation**

So far we have seen how the MSD is presented and meant to be on paper. Here in this section the facts that have not been seen in the documents but been experienced in reality are investigated. Practically in parallel with gathering information, the result of those investigations was gradually compiled in the rich picture shown in Figure 6. Therefore this rich picture is a comprehensive expression of what is really happening. Just to make the picture more readable most of the items on it are listed in Appendix and categorized in the composite mind map in Figure 7, without any prioritization or judgment. However it
must be noted that itemizing the issues is not aim of drawing the rich picture but rather seeing and being aware of their connections and sequences is of central importance. I would like to emphasize again they are ‘issues’ expressed by the stakeholders rather than real ‘problems’. Some of them might contain both positive and negative aspects, although most of them are the expressions of sense of unease and dissatisfaction among the different stakeholders.
Figure 6: Rich picture of the MSD situation
4.4.1. Issue Analysis

The scope of influence, boundary and time scale of the issues in the MSD are very wide. In order to reduce the messiness and enter the phase of assimilation, I took advantage of some systems concepts and drew boundaries around some of the issues and categorized them according to their influence on each other, and then two layers of issues emerged as a result. In the layer one, three themes of concerns are recognizable: issues related to the educators in the program, issues related to the students, and the issues related to the program heads.

Figure 7: Composite mind map of the MSD issues

The educators’ issues are more related to the nature of the program and the concept of SD itself, regardless of educational backgrounds or needs of the students, such as high number of topics required to be addressed in the courses, difficulties in keeping coherence among the courses, poor communication among the lecturer and lack of regular update. But the learners’ issues are those that students bring with themselves to the program, like coming from different academic traditions, disciplines and cultural backgrounds. There are some issues that are specific to the responsibilities and choices of the program head, they can be called issues of roles and power hierarchy. These are not educational concerns per se, but rather they have to do with the organization of the program like lack of appropriate and adaptive regulation for such interdisciplinary programs, no clear statements for the roles and authorities and difficulties with time and financial management. Figure 8 shows these three themes, their components and their influence on each other’s. As it is drawn in this diagram, a gap between what it is intended in program description and the current outcome is the direct result of these three themes. Referring to the concept of hierarchy in systems language, I call this diagram the first layer of issues or issues of the MSD. This layer, to a large extent, covers the current issues of the MSD as well as the interconnection among them.
After drawing the first layer, however, I went back to the discussions of chapter two and to the ideal vision of ESD and three orders of learning represented in section 3.2, then I realized some of the fundamental issues of ESD are not expressed explicitly by the current stakeholders within the MSD, however they are connected with the expressed ones and will probably emerge and come into consideration after happening some improvements in the first layer i.e. if we overcome or improve the current issues of the program, some other issues will probably be unveiled that belongs to a wider scope of education for sustainability and are not specific to the MSD. For instance after having an efficient communication between the educators and establishment of a strong team of educators, the problem of educator-oriented education will probably show itself more strongly. It does not mean that it is not a problem right now but rather it is hidden behind the problem of lack of communication between the educators. As it is stated by Wieck and Quinn ‘small contiguous adjustments created simultaneously across units, can cumulate and create substantial change’ (Burke, 2008). So I call this layer, second layer of issues or general issues of ESD (Figure 9), the issues that might be encountered in any type of higher education for sustainability.
Cultural-Based Analysis

Intervention Analysis (Processor Analysis):

The processor (refer to section 2.3) of the intervention in the layer one are the current stakeholders of the program, who mostly have been consulted during this study and shown in Figure 3. Except the facilitator of the intervention, other owners hold high academic degrees with many years of experiences in their own scientific disciplines. Some of them have relevant interdisciplinary experiences as well, but none of them holds a specific degree in SD.

Social Analysis (Software Analysis):

The values, norms and roles are compatible to of those cultural norms in the Swedish society. It needs some deeper cultural analysis; however, generally speaking the academic environment in Sweden is secular and encouraged by the values of liberal democracy. Participation, gender equality, freedom of expression and thought has great values in Swedish academia. Another value which has recently gained more attention is the significance of SD and the environmental responsibility of the both universities, especially in SLU where is an agriculture university. This tendency to realization of environmental values could be a potential to take the second layer of issues (Figure 9) into consideration, since thinking about them and considering them as ‘problematic’ issues needs to be critical about the values of modernity (such as objectivity, dualism between object and subject, reductionism and rationalization). Old universities like Uppsala University have been essentially established on those values and strong
commitment of universities in being positivist and objective makes them very reluctant to reconsider the values of modernity.

**Political Analysis (Hardware Analysis):**

Academic ranks are mostly the symbol of power in universities. But as stated in the characteristics of academic organization as well as in Figure 4, although there exists a hierarchy of responsibility in the MSD but it is not very firm and authoritative, so finding a specific leverage point in the power structure (place to intervene the system) is not easy, on the other hand, commitment to democratic values creates a good potential for being more cooperative. Organization charts in universities are normally based on separation between disciplines. That means your academic identity is mostly recognized by the department you belong to. There are some centres and forums at both universities to bring experts from different disciplines together, but they don’t attract academicians’ attention that much without being a formal academic department.

**4.5. Root Definitions and Relevant Activity Systems**

The general belief about the MSD is that it has not yet obtained its ultimate form as it is very young. It has been stated by the stakeholders in many occasions that the time for applying their original ideas have been too short and it takes some time to make sure that the program has reached its primary task and the outright form desired initially. For that reason the first system is envisioned as a foundation for other transformation processes and the outcome of this system envisioned to be accelerating the process of reaching a stable system i.e. a master’s program with a distinctive identity and compatible to the general standards of the Swedish universities. The original plan and prospectus designed in way to fulfil such standard therefore a system that bridges the gap between the original proposal and the existing outcome of the program would drive this phase. The approach of the program then would be compatible with the content of the initial outline drawn in Figure 5.

**Table 2: Three Layers of Change**

<table>
<thead>
<tr>
<th>Area of applicability</th>
<th>Time Scope for applying in the MSD program</th>
<th>Type of Organizational Change</th>
<th>Type of Educational Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSD</td>
<td>Short Term (2-3 years)</td>
<td>Primary Task-Stabilizing</td>
<td>Basic learning, Collaborative learning</td>
</tr>
<tr>
<td>ESD</td>
<td>Middle Term (3-5 years)</td>
<td>Evolutionary</td>
<td>Meta learning, Experiential learning</td>
</tr>
<tr>
<td>Systems Education</td>
<td>Long Term (5-8 years)</td>
<td>Revolutionary</td>
<td>Epistemic learning</td>
</tr>
</tbody>
</table>

The layer two, however, are more difficult to be addressed within the current boundary of the program. Therefore improving them is subject to second order organizational change, which means after overcoming the issues of layer one we still won’t have a radically transformed program. In order to
move towards that kind of radical transformation some other unspoken issues must be taken into consideration but actually these ones could not directly be addressed by SSM, as they have not been discussed in my interviews with the current stakeholders and essentially is beyond the current boundary of the program. However they have a good potential for opening the discussion about a revolutionary change. In my discussions with the stakeholders they estimated the time scale of applying the changes in each that could be found in Table 2.

4.5.1. First Order of Change

4.5.1.1. Students Preparation System

One of the themes of Figure 8 is the issues connected to the students’ background and diversity. The MSD is open to applicants from all parts of the world, with a certain level of previous studies but there is no particular requirement regarding the disciplines admitted. Most of the clients see this as an opportunity to fulfil the purpose of being thoroughly interdisciplinary and do not consider eliminating it to narrow down the scope of the program; on other hand a number of problems in the MSD is associated with this unmanageable diversity as could be seen in Figure 8, such as confusion of educators in selecting the level of the subjects they need to teach and destructive conflicts between the students while they are working in interdisciplinary and multicultural teams. Those problems could be put in the general category of lack of coherence. An improved situation therefore could be envisioned in a way when the diversity is kept to an optimal degree but managed to be less destructive. The system for realizing this vision has to create an interdisciplinary and multicultural climate among the students in the beginning of the program and to increase the knowledge of the educators about the students’ needs and differences. Some of the basic academic abilities required both in natural and social sciences at masters level have also to be taught in this phase to make sure that the students with natural science backgrounds are made aware of the basic methods and approaches of social sciences and vice versa. By doing so the need for repetition during advanced courses will be reduced and this creates more time for in-depth studies. Therefor the first relevant system and its root definition are formulated as below:

- **Root Definition**: A system organized by senior interested students and some of the educators which prepare the fresh students for starting the actual program. This creates an interdisciplinary and multicultural climate and makes the interaction among the students as well as their interaction with educators smoother and more cooperative and ensures that the students, disregarding their background, are familiar with the basic traditions and methodologies both in natural sciences and social sciences.

- **Input**: Passive and indifferent students with diverged backgrounds and conflicting views, hesitant and ill-equipped educators with little sense of belonging to the program.

- **Output**: Cooperative and active students aware of the program’s principles and cognizant about the differences in their class, receptive educators with appropriate information about the students and close attachment to the class.

- **CATWOE List**:
  - **Customers**: Newcomer students and the educators of the first year courses who need to adjust their course plan according to the needs and capabilities of the different students.
- **Actors:** The program council, the heads of the program, the course leaders of Interdisciplinary Methods and Case Study and volunteers from the senior cohorts.

- **Transformation:** Creation of Interdisciplinary and multicultural climate and levelling out the differences in the academic qualifications of the students.

- **Worldview:** Belief in the usefulness of collaborative learning among the students and belief in making the most of cultural and academic diversity.

- **Owner:** The program council, the heads of the program and the body in charge of the introduction phase.

- **Environmental constraints:** The standard length of an academic year (constraint of time) and the lack of appropriate communication among the educators during the summer holidays before the start of the introduction phase.

  - **Resources:** Budget for the class trip, a part of the budget of the Interdisciplinary Methods course, experiences of the senior students and the suggestions of the educators in the different courses.

  - **Measures of performance:** Students evaluation of the appropriateness of this phase and removal of the elementary parts in other courses that used to be taught because of uncertainty about the background of the students.

Conceptual modelling of the system is done according to the description of the stage 4 in SSM. The list of the activities proposed could be found in the first column of Table 3, while the data of other columns were gathered after going back to the real situation and discussing the activities with the stakeholders.
<table>
<thead>
<tr>
<th>Activity proposed</th>
<th>Present in reality?</th>
<th>How is it done now, if it is and if it is not what are the existing relevant activities?</th>
<th>Measure of Success</th>
<th>Justification for proposing the non-existent activity or improving the existing one</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Appoint an admission committee by the program council consisting of teachers with different disciplinary backgrounds and connection to SD issues.</td>
<td>No</td>
<td>General qualifications are judged by the Swedish National Admissions Office to Higher Education and specific requirements as well as the letter of intent is judged by one of the program heads.</td>
<td>Productive discussion in the program council and selection of the appropriate professors.</td>
<td>The program head belongs to a specific disciplinary tradition of science and it makes it difficult for her to judge the qualifications of all the applicants.</td>
</tr>
<tr>
<td>2 Make a comprehensive and clear instruction by the admission committee for qualifying the applicants.</td>
<td>No</td>
<td>Requirements are limited to a Bachelor degree in any field of social or natural science, an English language certificate and a letter of intent.</td>
<td>Having a written and agreed upon instruction.</td>
<td>To make it clear to all the participants in the program what kind of students and with which specific capabilities are accepted.</td>
</tr>
<tr>
<td>3 Insert a preparation phase with appropriate academic credits in the beginning of program.</td>
<td>No</td>
<td>There is just an optional introduction week before beginning of the actual program.</td>
<td>A change in the current syllabus of the program and publishing the change on the web-page.</td>
<td>To recognize the importance of the preparation phase as equal to other courses in the syllabus.</td>
</tr>
<tr>
<td>4 Give an overview and vision about the content and the structure of the program in the preparation phase.</td>
<td>No</td>
<td>The information is mostly given on general and practical guide about student life in Uppsala.</td>
<td>Having an explicit lecture on those matters.</td>
<td>To make it clear to the students what they will have ahead and make it easier for them to plan the elective part of their studies.</td>
</tr>
<tr>
<td>5 Prepare the students for better communication, dialogue and team work skills.</td>
<td>No</td>
<td>It takes place informally during the first year and mostly in the Interdisciplinary Case Study course which is situated in the end of the first year.</td>
<td>The satisfaction of the educators in each of the courses about the general skills of the students.</td>
<td>To avoid repetition during advanced courses and to create more time for in-depth studies in the rest of the year.</td>
</tr>
<tr>
<td>6 Shift some of the lectures of the Interdisciplinary Research Methods and Case studies course into this phase.</td>
<td>No</td>
<td>There are a few lectures in these two courses more connected to preparation for being interdisciplinary.</td>
<td>A change in the syllabus of the Interdisciplinary Research Methods and the Case study course.</td>
<td>To have enough time in those two courses to focus on advanced topics and to not defer the groundwork of being interdisciplinary.</td>
</tr>
</tbody>
</table>
By comparing this model with the existing situation and discussing with most of the stakeholders, it appeared that this model contained many activities that were feasible and desirable and could accommodate several interests of the stakeholders. The only activity that seemed to be less feasible due to lack of financial resources was the activity 1. This activity calls for assigning a new body in the program which were rejected by some of the stakeholders for the reason of avoiding adding more complexity to the MSD.

The creditability of the whole model also needs to be discussed with the newcomer students who were not available at the time of presenting the model, although they would be the main customer in the system. This would make the process to some extent incomplete. Therefore one more activity which is about monitoring and evaluating other activities needs to be discussed with them when they join the program.

4.5.1.2. Educational Leadership System

Another bold theme in Figure 8 is the issue of authority and leadership. As explained in section 3.2.3 in a young program of ESD, compared to deep-rooted disciplinary programs, a different kind of approach to administrating and leading is needed. Without recognizing that fact, leadership and administration jobs, that are supposed to be done on two different levels, would be mixed and thus would have poor quality. According to the previous arguments an improved situation could be envisioned in such a way that the mission statement of the program heads distinguishes between the administrative and educational leadership tasks. The limitations, responsibilities and the level of authority of the program heads are also clearly defined in the mission statement. Therefore the first relevant system and its root definition are formulated as below:

- **Root Definition**: A system by higher decision-makers of the program which makes a distinction between administrative tasks and educational leadership tasks of the program heads and defines realizable responsibilities and gives enough authority to carry out them.

- **Input**: Overwhelmed and confused program heads.

- **Output**: Creative leaders and well-ordered administrators.

- **CATWOE List**:
  - **Customers**: Program heads, the course leaders and the students.
  - **Actors**: Program board and the program heads.
  - **Transformation**: Mixed responsibilities and little authority to realizable responsibilities and more power to influence the program.
  - **Worldview**: Educational Leadership and administration are two different parts of coordinating the program.
  - **Owner**: Faculty of Science and Technology at Uppsala University and faculty of Natural Resources and Agricultural Sciences at SLU.
  - **Environmental constraint**: Lack of engagement of higher decision-maker in the faculties, lack of explicit regulations.
• **Resources:** Experiences of the current and previous program heads, the demands of the students, accountability of the program board and their commitment to improve the situation.

• **Measures of performance:** Clarity in the mission of statement, satisfaction of the program heads and execution of other changes proposed in this study.

Conceptual modelling of the system is done according to the description of the stage 4 in SSM. The list of the activities proposed could be found in the first column of Table 4 while the data of other columns were gathered after going back to the real situation and discussing the feasibility and desirability of the activities with the stakeholders.

The two constraints mentioned above i.e. lack of engagement of higher decision-maker in the faculties and lack of explicit regulations made most of the activities infeasible within the current structure of the faculties, however, the request of the program board might change the situation in the faculties. That change would be a subject of another subsystem which is not within the boundary of this study.
### Table 4: List of the activities for the system of Educational Leadership

<table>
<thead>
<tr>
<th>Activity proposed</th>
<th>Present in reality?</th>
<th>How is it done now, if it is and if it is not what are the existing relevant activities?</th>
<th>Measure of Success</th>
<th>Justification for proposing the non-existent activity or improving the existing one</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Make a request for change by the current program heads.</td>
<td>No</td>
<td>The sense of unease has been expressed by the heads but it has not stated as an official request for change.</td>
<td>Arising the issue in the program board and having a written proposal.</td>
<td>The program board must become aware of the need for change.</td>
</tr>
<tr>
<td>2 Revise the mission statement in term of a)Regulation b)Responsibilities</td>
<td>No</td>
<td>The current mission statement is short and imprecise.</td>
<td>Productive discussion about the items that must be included in the mission statement.</td>
<td>It must be made clear to the program heads what they have to do and what is beyond their obligations.</td>
</tr>
<tr>
<td>3 Make a new version of mission statement, with distinction between educational leadership tasks and administrative tasks.</td>
<td>No</td>
<td>The heads are responsible for all the tasks related to coordinating the course leaders and the students.</td>
<td>Production of a new statement with appropriate number of items and explanations.</td>
<td>It is to recognize the distinctive position of educational leadership.</td>
</tr>
<tr>
<td>4 Assign of a person with appropriate qualifications for each group of tasks.</td>
<td>No</td>
<td>The current heads are professors with significant achievement in their own scientific disciplines and some interests in SD.</td>
<td>Having a new body in the decision-making team.</td>
<td>Administration and leadership calls for different kinds of personal capabilities.</td>
</tr>
<tr>
<td>5 Ask for comments and revision of the new statement from the course leaders</td>
<td>No</td>
<td>The course leaders are normally consulted by the program heads for applying big changes.</td>
<td>Getting feedbacks from the course leaders.</td>
<td>It is to make sure that the process is participatory.</td>
</tr>
<tr>
<td>6 Announce the change to the faculties at two universities and convince them for implementing the change.</td>
<td>No</td>
<td>The faculties at both universities are generally responsive to the feedbacks and requests of the program board.</td>
<td>Approval of the faculties.</td>
<td>Without acceptance of the faculties the change is not operable.</td>
</tr>
<tr>
<td>7 Implement and announce the new regulations to the course leaders and students.</td>
<td>No</td>
<td>Students are not aware of the structure of the program and responsibilities of the program heads.</td>
<td>Publishing and distributing enough information about the change.</td>
<td>All the participants in the program should know what kind of expectations they can have from the heads and how far they can influence the decisions.</td>
</tr>
<tr>
<td>8 Monitor the competence of the leader and the administrator after one academic year.</td>
<td>No</td>
<td>Evaluations are done for assessing the whole program and not for measuring capabilities of specific persons.</td>
<td>Receiving the evaluation forms with comprehensive comments.</td>
<td>It is to make sure that the new body and the new mission statement function properly.</td>
</tr>
</tbody>
</table>
4.5.1.3. **Consolidation of the Subjects Taught and Collaborative Learning**

Lack of coherence in the MSD is not only related to the diverse backgrounds of the students but also it is a direct result of the requirements of education for SD. As characterized by Streling, ESD must be integrative by means of ‘breaking free of disciplinary perceptions and traditions’ (Streling, 1996). It is apparent from the description of the program as well as its structure that putting different disciplines together has been an important objective for the initiators. On the other hand Streling believes it is not the only step that must be taken. The more important task is to make a new theoretical ground for interdisciplinary work and create a basis for constant communication and collaboration between different disciplinary departments when it comes to ESD. Creating that basis is another transformation process suggested improving the problem of lack of coherence in the content of the MSD. In order to design the relevant system I take advantage of some hints in the personal account of Midgley when he describes his experience of building and communicating theoretical coherence. For him the transformation process is consisted of two main periods, consolidation period and openness period. When he is in a period of consolidation to build and communicate theoretical coherence, the new ideas and subjects are consciously refrained from integrating into the whole unless ignoring them seriously undermine some aspects of the total process. Then in the period of openness and revision he says that he starts to acquire new ideas to construct a basis for the next level of consolidation (Midgley, 2000).

Although this is a personal experience of an individual but it can helps in designing a bigger system of integration of knowledge when it comes to a group of different educators and course leaders with different worldviews and disciplinary backgrounds. Accordingly to run an optimal type of consolidation process the group must come together on a regular basis to share and revise their knowledge and pursue collaborative learning among the group. Then drawing on the ideas acquired from other educators, one has to consolidate the block that s/he in charge of with the whole. Therefore it is evident that in order to have a coherent program collaborative learning process must take place not only among the students but also among the educators. This process calls for a regular communication between the educators and an interdisciplinary climate among them. The conceptual model designed here is supposed to realize such a process.

- **Root Definition:** A system owned by the educational leader of the MSD, that creates a dynamic and interdisciplinary climate among the course leaders. This system increases the interaction between them in order to exchange their experiences regularly, realize their position in the whole program, learn for each other’s experiences, and give them enough inputs for improving and consolidating their own block.

- **Input:** Scattered, overlapping and shallow subjects to be taught and conflicting ideas about SD and ESD.

- **Output:** Coherent and integrated themes of study and optimal number of subjects to be taught.

- **CATWOE List:**
  - **Customers:** Students, lecturers, course leaders, educational leader(s) and future planners for ESD programs.
  - **Actors:** Educational leaders (yet to be appointed) or the program heads, course Leaders and the lecturers.
Transformation: Integration and optimization of the incoherent and numerous subjects of studies.

Worldview: Belief in interdisciplinarity and importance of collaborative learning.

Owner: Program council.

Environmental constraints: Lack of time for arranging regular meetings, part-time employment of the course leaders in the MS and lack of budget for employing new bodies for facilitating communication.

Resources: Previous official documents and evaluations of the courses done by the students, written and oral feedbacks of the students, consultation of other academic institutions involved in SD, and the information given in this research.

Measures of performance: Number of regular meetings and present persons in each of them, number of documents produced and satisfaction of the course leaders.

Conceptual modelling of the system is done according to the description of the stage 4 in SSM. The list of the activities proposed could be found in the first column of Table 5. The data of other columns were gathered after going back to the real situation and discussing the activities with the stakeholders.

By comparing this model with the existing situation and discussing with most of the stakeholders, it appeared that this model contains many activities that are feasible and desirable and can accommodate several interests of the stakeholders. The only activity that seemed to be less feasible due to lack of financial resources is the activity 1. This activity calls for assigning a new body for facilitating the communication between the different persons in the MSD. This was rejected by some of the stakeholders for the reason of avoiding adding more complexity to the MSD and lack of financial resources.

One shortcoming of the model is its dependence on the position of the educational leader, who does not exist at the moment and as it was said in the previous section, that position is hard to be made within the program, so either the model must be modified according to the existing roles or at least the role of the educational leader has to be transfer to another body in the program.
Table 5: List of the activities for the system of Consolidation of the Subjects Taught and Collaborative Learning

<table>
<thead>
<tr>
<th>Activity proposed</th>
<th>Present in reality?</th>
<th>How is it done now, if it is and if it is not what are the existing relevant activities?</th>
<th>Measure of Success</th>
<th>Justification for proposing the non-existent activity or improving the existing one</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Assign a body for facilitating communications between the course leaders and doing the documentations.</td>
<td>No</td>
<td>Mostly one of the program heads facilitates the meetings.</td>
<td>Having a new body in the program.</td>
<td>The heads are part-time employed professors so they lack time for being in constant contact with all the educators.</td>
</tr>
<tr>
<td>2 Make the regular meetings as an important part of the course leader’s mandates.</td>
<td>No</td>
<td>Currently the meetings are infrequent and optional.</td>
<td>Number of regular meetings and present persons in each of them.</td>
<td>The course leaders see the meeting as an optional and purposeless part of their job.</td>
</tr>
<tr>
<td>3 Discus to make a standard and understandable outline for the courses’ syllabuses.</td>
<td>No</td>
<td>Each course has its particular outline for syllabus and some of them are too brief to be understood by other educators.</td>
<td>Publishing new syllabuses on the homepage of the program</td>
<td>The communication among the educator needs a basis and if they understand the objectives of other courses, they would be more successful in the phase of consolidation.</td>
</tr>
<tr>
<td>4 Make standard and detailed outlines for evaluation of the courses.</td>
<td>No</td>
<td>Each course has different type of evaluation form and the questions are not designed carefully to encourage the students to respond them thoughtfully.</td>
<td>Number of feedbacks received from the students.</td>
<td>It is to encourage the students to take part more actively in improving the program and use their feedback as a resource in this process.</td>
</tr>
<tr>
<td>5 Ask for revising and giving feedbacks on the documents produced in 3 and 4 from the lecturers in each of the related courses.</td>
<td>No</td>
<td>The lecturers mostly have no actual effect on designing the syllabuses. They are just asked to teach a specific topic within a course.</td>
<td>Number of feedbacks received from the lecturers.</td>
<td>It is to make the process more participatory and help the lecturers to realize their connection with other parts of the program.</td>
</tr>
<tr>
<td>7 Report to the educational leader(s) (yet to be appointed) or the program heads.</td>
<td>No</td>
<td>Heads control the structural changes in the MSD but minor changes about the content of the courses are allowed to be done without their consultation.</td>
<td>Awareness of the educational leader about the contents of the courses.</td>
<td>The educational leader must have complete information about the content of the courses in order to lead any change.</td>
</tr>
<tr>
<td>8 Document the outcome of the meetings and set agenda for the next meeting.</td>
<td>No</td>
<td>The outcomes of the meetings are not documented.</td>
<td>Number of documents produced and published.</td>
<td>Documentation is supposed to make a basis for evaluating progress and to be used in the phase of consolidation.</td>
</tr>
<tr>
<td>9 Compare the objectives in the syllabuses with the results of the evaluations and make an update.</td>
<td>No</td>
<td>Syllabuses have been fixed since the launch of the program.</td>
<td></td>
<td>The process of learning and updating is supposed to be cyclic and continues.</td>
</tr>
</tbody>
</table>
4.5.2. Second Order Change

Three transformation processes have been modelled and discussed so far. They have been designed to stabilize and assure the stakeholders of thorough implementation of the initial proposal. Whereas, as argued previously, having the initial proposal implemented thoroughly, the issues of the layer 2 (Figure 9) will probably come to the scene more apparently and the need for change in the proposal itself will be arose. So in this section, the second order of organizational change, to tackle the issues of the layer 2, is considered. The core issue in that figure is the poor connection with the real world problems. Therefore the ideal future in the case is an educational system that connects the MSD to the real world cases and puts more efforts into meta-learning and is aware of the importance of epistemic learning. This phase goes beyond the current proposal and tries to change the current outline of the MSD. Back to the Kolb’s descriptions of experiential learning, a new outline for the program could be envisioned here that help the students in going through all four phases of the experiential learning cycle. Meta learning is regarded as one of the products of going through this cycle consciously and systematically.

**Root Definition:** A system runs by the program board which modifies the current outline of the program to be adaptable to the experiential learning cycle

- **Input:** The current outline.
- **Output:** A new outline compatible with the experiential learning cycle.
- **CATWOE List:**
  - **Customers:** The program board, future generations of students, lecturers, course leaders and the educational leaders.
  - **Actors:** The program board, the program council and the educational leaders (yet to be assigned).
  - **Transformation:** Change in the official description and the overall policy of the MSD program.
  - **Worldview:** Belief in the importance of higher levels of learning in ESD to understand higher orders of complexity.
  - **Owner:** TEKNAT at Uppsala University and the Faculty of Natural Resources and Agricultural Sciences at SLU.
  - **Environmental constrain:** Reluctant positivistic traditions of science and lack of connection with the real world problems.
- **Resources:** Experiences of other action-oriented projects both at Uppsala University and at SLU, local SD projects and the interests of local communities to be connected to the academic institutions.
- **Measures of performance:** Number of accomplished projects connected to the real world problems with the cooperation of local communities.
<table>
<thead>
<tr>
<th>Activity proposed</th>
<th>Present in reality?</th>
<th>How is it done now, if it is and if it is not what are the existing relevant activities?</th>
<th>Measure of Success</th>
<th>Justification for proposing the non-existent activity or improving the existing one</th>
</tr>
</thead>
<tbody>
<tr>
<td>Come to an agreement about the use of experiential learning in the program.</td>
<td>No</td>
<td>The current outline of the program has never been questioned by the program board.</td>
<td>Number of comments and critics on the current outline.</td>
<td>Discussing about the current outline can create the possibility of collaborative learning within the program board and urge the critical thinking on them.</td>
</tr>
<tr>
<td>Call on course leaders for a meeting with the program board.</td>
<td>Yes</td>
<td>The course leaders are in contact with the program board via program heads.</td>
<td>Information of the members of program board about the opinions of the course leaders.</td>
<td>The course leaders have valuable experiences of some years of coordinating the MSD courses and are more aware about the deficiencies of the current outline.</td>
</tr>
<tr>
<td>Incorporate new educators into the program board with some experiences in experiential and action-oriented learning.</td>
<td>No</td>
<td>Some of the current educators are involved in local research projects but their work on those projects is not a part of their job in the MSD.</td>
<td>Number of the educators with adequate experiences in experiential and action-oriented learning.</td>
<td>Experiential learning cannot be taught without having experienced it.</td>
</tr>
<tr>
<td>Change the outline according to the principles of experiential learning.</td>
<td>No</td>
<td>-</td>
<td>Number of modifications and correction in the outline.</td>
<td>An official document needs to be made to make an applicable directive for the program council.</td>
</tr>
<tr>
<td>Adjust the content of each of the courses to the new outline.</td>
<td>No</td>
<td>-</td>
<td>Number of relevant changes in the syllabuses of the courses.</td>
<td>The objectives of the new outline must be realized by the content of the courses, lectures, exercises and the project works.</td>
</tr>
<tr>
<td>Assign a new body for communication between the local communities and the MSD program.</td>
<td>No</td>
<td>There is a person in charge of connecting the students to the active companies in SD, and helping them in finding internships.</td>
<td>Creation of a distinctive position in the MSD program.</td>
<td>Effective and constant communication with the local communities can help in finding examples from the real world problems and increase academic accountability.</td>
</tr>
<tr>
<td>Search for appropriate cases among ongoing projects or existing problems in the different fields of SD.</td>
<td>No</td>
<td>-</td>
<td>Information of the course leaders about potential projects.</td>
<td>It must be investigated which type of the cases are appropriate to be worked on as academic projects at the master’s degree level.</td>
</tr>
<tr>
<td>Make connection between those cases and the content of each of the courses.</td>
<td>No</td>
<td>-</td>
<td>Number of productive projects in the MSD program</td>
<td></td>
</tr>
</tbody>
</table>
Conceptual modelling of the system is done according to the description of the stage 4 in the SSM. The list of the activities proposed could be found in the first column of Table 6. But the creditability of the whole model needs to be discussed after having the other three systems implemented, as it was said the input of this system is the current outline that yet to be fulfilled. So the meaningful comparison stage is postponed to a later time, when the primary task of the MSD is fully achieved.

4.6. Action Report

In parallel to the completion of this report, the systems, designed for the first order of change in the MSD, started to come to function. The communication sessions of the program council started to be held more regularly. The models proposed in this study were used put as a basis for discussions in the meetings of the program council. The outcome of the regular meeting was accepting some minor changes in the approach of the program in general and some of the courses. The leader of the Interdisciplinary Methods course started to apply extensive changes in that course, with the cooperation of one the program heads and a former student. They made a team with a clear agenda to coordinate the different modules of the course. Four main modules were designed for the course, i.e. normal lectures, two excursions that exemplify the content of the lectures, team work with the purpose of producing useful knowledge about a case of SD and individual exercises that examines the ability of students to evaluate their own performance in the course and in their team works. In that course, collaborative learning not only among the students but also among the course leader team was persuaded as a requirement for success of other modules.

Educational leadership has not been recognized as a distinct position by the program board yet. However, the program heads, due to their personal interests, put more time and resources to encourage the communication between the different members in the program, assist the transmission of knowledge and experiences, ask for more feedbacks from the course leaders and the students and involve them in modifying the content of the courses, and start to take part in a learning process for improving the MSD. Nevertheless, structural changes within the program, especially to implement the second order of organizational change, call for more active involvement of the higher authorities of the two universities.
5. **Discussion**

5.1. **MSD Case and ESD**

Master’s program in Sustainable Development at Uppsala and SLU University has been a big step towards incorporating sustainability into academic educations as a distinctive subject of study. The number of students in the program has been increasing significantly, which proves the popularity of the MSD and the recognition of the discourse of SD in academia. Thus SD is not just a political aim with no connection with scientific research but it could be regarded as a subject of research itself, although the researchers in this field have to be more committed to bring about change in society. The MSD yet needs to take some more steps to have noticeable influences. Observations show that the intentions of the founders, the outline of the MSD program and the attempts of the current actors create a suitable setting for development and improvement of the program. However if it is meant to be a successful pattern for ESD, it cannot be treated same as other old-established disciplines and it needs constant modification, update and monitoring. If it is meant to adopt more radical types of education, then higher orders of change also need to be thought about.

A package of feasible and desirable plans, designed by the help of SSM, proposed in this study. Some of the plans are specific to the MSD case and some others are applicable in similar programs of ESD. The first order change has been widely investigated in this study. Three transformation processes, connected to that change and as investigated in this study in the case of MSD, are 1) student preparation to create an interdisciplinary and multicultural climate, 2) consolidation of the subjects taught and collaborative learning to take full advantage of the diversity inherent in the program and 3) educational leadership to initiate and supervise the other transformation processes. These three systems together could assure the success of basic learning and prepare the settings for evolutionary change in the organization and meta-learning in the minds of the educators and students. But if we want to take one step further and generalize the results, we have to consider that any substantial change in ESD involves educational organizations that go beyond basic-learning, motivate meta- and epistemic learning and create an appropriate environment for collaborative learning. A package consists of all these abilities prepares the learners for understanding complexity because a new kind of mental capability is necessary to comprehend complex systems which are the subjects of study in SD. Therefore although deciding about the best type of ESD is not easy and straightforward, using systems approach and thinking in systems terms can aid in appreciating wholes in terms of an interrelated complex. Whether academic institutions are ready to persuade this kind of ability is a question that yet to be investigated. As this thesis was a limited project, it did not cover that question and skipped designing any system for realizing revolutionary organizational change. However this is a very urgent issue that must be studied in the case of MSD and other ESD programs that are committed to the ideas of sustainable development.

5.2. **Use and Limitation of Soft Systems Methodology in the MSD Case**

**Pragmatic Approach**

Although SSM has been proved to be a very useful methodology to address messy situations, it still shows some shortcomings that I have experienced in improving the MSD program. The first one is its little guidance for bringing about a revolutionary change as Bergvall-Kåreborn (2002) states SSM has a
tendency to result in conventional and regulatory, rather than radical change, mostly because it pragmatically tries to accommodate the desire of all the stakeholders involved. I claimed that ESD in general and the MSD in particular call for the high order and imminent type of change but SSM did not suggest any tools and techniques to persuade that in the program. Therefore as I did not have enough time to take other types of action-oriented methodology, I did not progress to the third order change.

**Outsiders are excluded**

In order to analyse the issues of the MSD, I took advantage of the views of many experts outside that specific situation like Midgely (2000), Ison (2008), Sterling (1996, 2001, 2004, 2005) and my supervisor, Sriskandarajah. That was because I realized that the two streams of analysis proposed by Checkland i.e. logic-based analysis and cultural-based analysis, were not enough in the MSD case. As in most of his methods, Chekland looks at the situation from inside. Too much emphasis on the context of the problem and the views of the stakeholders involved does not let the facilitator see all the possible aspects of the situation from outside. This can lead in restriction of modelling in stage 3 which is counterproductive compared to the emancipatory objectives of this stage. Knowing about the perspectives of the outsiders might be necessary for more comprehensive modelling. Bergvall-Kåreborn (2002) believes ‘participation of outsiders is an important issue both from an emancipative and democratic view but also because novel ideas often arise when we are able to view situations from new perspectives’ (Bergvall-Kåreborn, 2002, p.17).

**Dependence of SSM on the characters of the facilitator**

During this study I had to interview and challenge my professors and, in some occasions, several people who hold high rank at both universities. My personal considerations did not let me to be as open and inquisitive as it is required for a successful SSM. Due to my insignificant position in the situation, as a junior student with little ability of persuasive communication, the stakeholders at some points did not count on my facilitations.

SSM is highly dependent on the position of the facilitator in the situation and her/his relation with the other stakeholders, as well as his/her abilities to challenge their views and influence them (Bergvall-Kåreborn, 2002). Therefore genuine openmess as one of the requirement of SSM is not always guaranteed.

**Very slow for the systems with rapid dynamics**

The learning process in SSM requires adequate amount of time and patience to reach the final phase of accommodation and action. There is no formula to determine how fast a facilitator has to be to follow up the external changes which might come into the scene during the process. SSM is meant to accommodate different interests by imitating a learning process, but it does not consider that the worldviews of people might change not only because of learning but also as a result of other external events, which can make the models invalid even before reaching the end of the cycle. In the MSD case, the number of students was tripled after two years and that changed the structure and dynamism of the program as well as the views of the people involved. Therefore some of the central activities designed by SSM lost their feasibility and/or desirability before implementing.
5.3. Personal Reflections

In the beginning of this study, I had a very assimilative type of learning style, therefore getting used to the process of divergent thinking was very difficult to me. It was not just me but it was a general problem in the MSD case, since the stakeholders were educated, they acted very perceptive in the phases of assimilation and convergence. Their faith in democratic values made them open-minded enough to hear new ideas, but breaking free from the reality and making conceptual models was not a familiar activity to them. Most of the times I was not able to direct the interviews, and it was difficult to keep the divergence. Most of the interviewees sought to see the ultimate horizon from the beginning which seems to be a general tendency of academicians. At this point I experienced difficulties of acting as the facilitator of emancipation. Nevertheless it increased my patience in dealing with people who have different styles of learning. It also helped me to be a more attentive listener and restrain my own views when I am trying to understand the other views. It reduced the amount of time I used to spend on organizing my scattered thoughts. I also discovered some unknown areas of my thinking abilities, yet I need to train them more.

I believe after writing this thesis, I have acquired a better mental capability that brings me one step closer to understanding complexity, and thus now I am able to learn more about sustainable development.
References


Checkland, P. (1999). *Systems Thinking, Systems Practice: Includes a 30-Year Retrospective*. West Sussex: John Wiley and Sons Ltd.


Appendix

Program Syllabus

Description of the programme
The courses in the programme are given at the advanced level. Successful studies lead to a recognised Master of Science Degree in Sustainable Development. After one year the student may, if he or she wishes, finish with a “Magister” degree.

Comprehensive aims of the education
The studies form a basis for post-graduate studies towards sustainable development in a subject determined by the orientation of the student’s previous education. The studies also give the necessary knowledge for pursuing a career in many different sectors of society outside the academic world – both nationally and internationally.

Aims as expected results of the study
Knowledge and understanding
Within the frame of objectives stated in the Higher Education Ordinance (see chapter 2) graduated students should have

- an in-depth knowledge regarding the constraints and abilities (prerequisites) of society and natural resources in reaching a sustainable development, and
- a developed holistic view and in-depth knowledge in a specific field of central importance for sustainable development.

Skills and abilities
Within the frame of objectives stated in the Higher Education Ordinance (see chapter 2) graduated students should have the ability to:

- apply qualitative and quantitative methods for managing natural resources at different spatial and temporal scales, and
- apply specific tools to identify and analyse complex problems, and suggest methods and solutions within the limits of a sustainable development.

Ability to value and relate
Within the frame of objectives stated in the Higher Education Ordinance (see chapter 2) graduated students should have

- an awareness regarding global and long-term dimensions of sustainability and a capacity to identify sustainability issues at local, regional and global scales, and
- the power to appreciate and discuss sustainability discourses and their assumptions from different points of view.
Programme outline
The course schedule arrangement is outlined below. Of central importance is the parallel training in oral and written presentation together with theoretical learning. The progression within the programme is characterized by later courses giving an

- increased depth within the subject,
- increased complexity,
- increased focus on analysis and synthesis,
- increased independence and responsibility for one’s own learning,
- increased responsibility for disciplinary development, and an
- increased ability to communicate disciplinary and transdisciplinary knowledge.

Eligibility requirements
Bachelor's degree within the natural sciences, technology, the social sciences, jurisprudence, or the historical/philosophical subject areas.

Students who, outside the programme, have acquired equivalent qualifications corresponding to at least 15 hp on advanced level in addition to the degree at bachelor’s level, may apply to be accepted to a later part of the programme. The application deadline is for the autumn term May 1 and for the spring term December 1.

Grade and examination
Unless otherwise prescribed in the course syllabus, a grade is to be awarded on completion of a course. A student who has taken two examinations in a course or a part of a course without obtaining a pass grade is entitled to have another examiner appointed, unless there are special reasons to the contrary.

Courses together in a degree
Some courses cannot be considered in a degree together. Which courses this concern will be pointed out in each course syllabus.

Qualification and diploma
Upon request, a student who has received a pass grade in a course is to receive a course certificate from the higher education institution. Upon request, a student who meets the requirements for a qualification is to receive a diploma from the higher education institution.

A Degree of Master (One Year) is obtained after the student has completed course requirements of 60 higher education credits with a certain area of specialisation determined by each higher education institution itself, including at least 30 higher education credits with in-depth studies in Sustainable Development. For a Degree of Master (One Year) students must have completed an independent project (degree project) worth at least 15 higher education credits in Sustainable Development, within the framework of the course requirements.
A Degree of Master (Two Years) is obtained after the student has completed course requirements of 120 higher education credits with a certain area of specialisation determined by each higher education institution itself, including at least 60 higher education credits with in-depth studies in Sustainable Development. For a Degree of Master (Two Years) students must have completed an independent project (degree project) worth at least 30 higher education credits in Sustainable Development, within the framework of the course requirements. A degree of Master (Two Years) may, except for courses on advanced level, contain one or several courses on basic level comprising not more than 30 higher education credits.
## Departments and Academic Centres in the MSD Program

<table>
<thead>
<tr>
<th>Name</th>
<th>Educational Mission</th>
<th>Reference (Webpage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty of Technology and Science at Uppsala University <em>(TEKNAT)</em></td>
<td>Research at the Faculty of Science and Technology ranges from basic research to applied science with close connections to industry. This research encompasses biology, chemistry, earth sciences, engineering sciences, physics, mathematics, and computer science.</td>
<td><a href="http://www.teknat.uu.se">http://www.teknat.uu.se</a></td>
</tr>
<tr>
<td>Faculty of Natural Resources and Agricultural Sciences at SLU <em>(NL)</em></td>
<td>The mission of the faculty is to advance and impart knowledge that will lead to management of our natural resources in an ecologically, socially and economically sustainable manner.</td>
<td><a href="http://www.slu.se/sv/fakulteter/nl/">http://www.slu.se/sv/fakulteter/nl/</a></td>
</tr>
<tr>
<td>The Earth Science Department <em>(Geocentrum)</em></td>
<td>The education and research at Geocentrum cover virtually the entire Planet Earth, from the core to the atmosphere.</td>
<td><a href="http://www.geo.uu.se">http://www.geo.uu.se</a></td>
</tr>
<tr>
<td>The Uppsala Centre for SD <em>(CSD)</em></td>
<td>This is an interdisciplinary centre established at Uppsala University. The Centre is based on collaboration between Uppsala University and SLU. CSD aims to be a catalyst for research and education on SD at Uppsala’s two universities, as well as a place for students and researchers</td>
<td><a href="http://www.csduppsala.uu.se">http://www.csduppsala.uu.se</a></td>
</tr>
<tr>
<td>Centre for Environment and Development Studies <em>(CEMUS)</em></td>
<td>This is a forum for students, researchers and university educators with an interest in environment, development and other global issues. The aim of the centre is to give interdisciplinary courses and seminars, and to stimulate contacts between students, researchers, and society at large</td>
<td><a href="http://www.cemus.uu.se">http://www.cemus.uu.se</a></td>
</tr>
<tr>
<td>Department of Urban and Rural Development <em>(SOL)</em></td>
<td>They teach and carry out research in the fields of landscape architecture, environmental impact assessment, environmental communication, rural development and agroecology.</td>
<td><a href="http://www.sol.slu.se">http://www.sol.slu.se</a></td>
</tr>
<tr>
<td>Department of Economics <em>(Ekon)</em></td>
<td>The vision is to be a leading European institution in Economic, Historical and Applied Statistics Research, as well as in policy analysis and academic education within the agricultural, resource, and environmental sectors.</td>
<td><a href="http://www.ekon.slu.se">http://www.ekon.slu.se</a></td>
</tr>
<tr>
<td>Bioenergy Department of Energy and Technology <em>(ET)</em></td>
<td>They Conducts research and education within the disciplines of bioenergy, biometry, systems analysis, and technology. Mathematics and statistics, agricultural engineering, recycling technology, and transportation logistics are some of the issues addressed</td>
<td><a href="http://www.et.slu.se">http://www.et.slu.se</a></td>
</tr>
<tr>
<td>Course Title</td>
<td>Main Subjects</td>
<td>ECTS-credits</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Sustainable Development: Worldviews and Visions (a seminar series)</td>
<td>Environmental Philosophy, Theory of Science, Ethics, Critical Theory</td>
<td>7.5</td>
</tr>
<tr>
<td>Man, Society and the Environment</td>
<td>Macro-, Micro-, Environmental and Ecological Economics, Environmental Law, Business administration, Ethics and Project Work.</td>
<td>15</td>
</tr>
<tr>
<td>Systems Analysis for Sustainable Development</td>
<td>Principles of Systems Theory, Programming with Arena and PowerSim software</td>
<td>7.5</td>
</tr>
<tr>
<td>Interdisciplinary Methods</td>
<td>Sustainable City Planning (as an appropriate area for applying Interdisciplinary Methods), Urban and Rural Development, Interdisciplinary Project Work</td>
<td>15</td>
</tr>
<tr>
<td>Sustainable Development; Worldviews and Discourses (a seminar series)</td>
<td>Discourse Analysis, Tragedy of Commons, Human Behaviour, Anthropology</td>
<td>7.5</td>
</tr>
<tr>
<td>Interdisciplinary Case Study</td>
<td>Quantitative and Qualitative Research Methods, Team Work Abilities and Interdisciplinary Practice</td>
<td>15</td>
</tr>
<tr>
<td>Internship for Sustainable Development</td>
<td>(Optional)</td>
<td>22.5</td>
</tr>
<tr>
<td>Degree Project in Sustainable Development</td>
<td>-</td>
<td>45</td>
</tr>
<tr>
<td>Optional Course/s within Specialization</td>
<td>-</td>
<td>30</td>
</tr>
</tbody>
</table>
List of the MSD issues

- No agreement on the best type of ESD
- No agreement on the definition of SD
- A variety of views about the best direction of MSD
- Wide scale of SD applications from local and regional to national and global scale
- No standard and uniform interdisciplinary research method
- Little coherence of the subjects and topics within the courses
- Little coherence of the courses within the program
- Ambiguity of the courses’ titles
- Shallowness of the topics covered
- Overlapping of some of the subjects in different courses
- High diversity in the views of course leaders on SD and ESD
- High diversity in the views of the lecturers on SD and ESD
- Many different types of evaluation and feedback systems
- Different backgrounds of the students
- Different academic traditions of the students
- Level of study (Why do we have this education at a Master level?)
- High responsibility of the students to orient themselves
- Uncertainty about the specific prerequisites in the admission phase
- Little sense of group-belonging for the students and the educators
- Two universities with different academic traditions
- Many individuals with different expertise involved
- Ad hoc coordinators selection
- A gap between the initial proposal and the actual outcome
- Two part-time program heads (with little time for administrative tasks as well as educational leadership)
- Lack of resources (time, money, skilled interdisciplinary persons)
- Many physical locations (different class rooms, departments, libraries and computer labs)
- Little communication between the course leaders
- Little communication between the lecturers
- Little participation of the stakeholders in the process of planning and evaluation
- Little communication between the students in their team works
- Problematic timing of the courses (uneven burden)
- Unproductive type of the project works
- Little connection with other institutions and ESD programs
- Little connection with the real world problems
- Little connection with the job market
- Unproductive types of internship
- No clear criteria for selecting competent educators
- Lack of constant organizational training
- Little adjustment and regular updates
- High number of students
- Cultural conflicts between the students
- Retirement of the main founder and supporter (former vice-chancellor of Uppsala University)
- Unclear power hierarchy in the organization structure (many nodes of decision making)